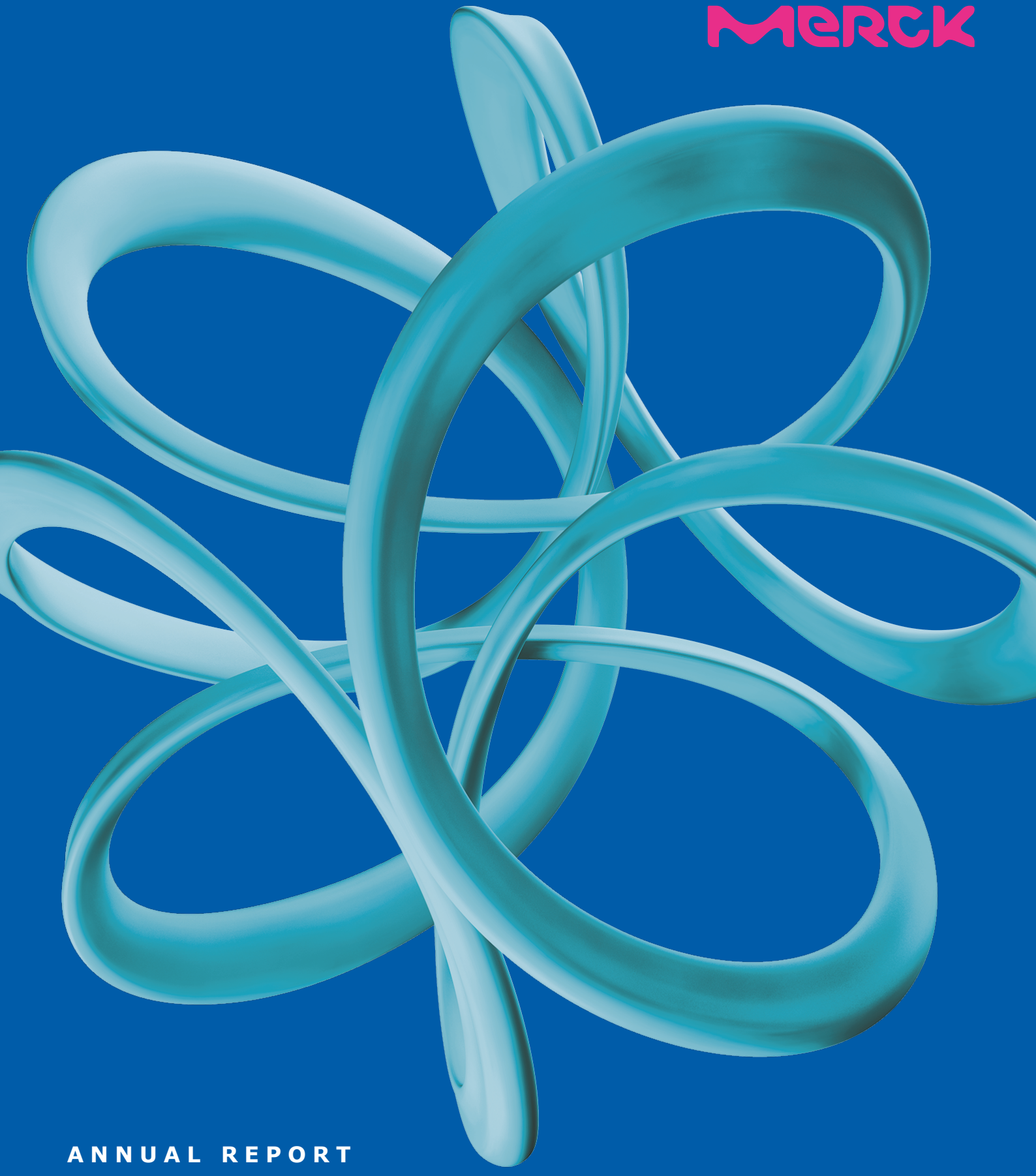
MERCK



ANNUAL REPORT

2019

Key Figures for 2019

MERCK GROUP

Key figures

			Change	
€ million	**2019**	2018	€ million	%
Net sales	16,152	14,836	1,315	8.9%
Operating result (EBIT)[1]	2,120	1,727	393	22.8%
Margin (% of net sales)[1]	13.1%	11.6%		
EBITDA[1]	4,066	3,528	539	15.3%
Margin (% of net sales)[1]	25.2%	23.8%		
EBITDA pre[1]	4,385	3,800	585	15.4%
Margin (% of net sales)[1]	27.1%	25.6%		
Profit after tax	1,324	3,396	-2,072	-61.0%
Earnings per share (in €)	3.04	7.76	-4.72	-60.8%
Earnings per share pre (€)[1]	5.56	5.10	0.46	9.0%
Business free cash flow[1]	2,732	2,508	224	8.9%

[1]Not defined by International Financial Reporting Standards (IFRSs).

MERCK GROUP

Net sales
€ million

MERCK GROUP

EBITDA pre[1]
€ million

[1]Not defined y International Financial Reporting Standards (IFRSs).

Owing to the altered expectations in terms of the impact of the Covid-19 pandemic, some chapters of this Annual Report were updated on May 12, 2020. The respective text passages are marked in magenta.

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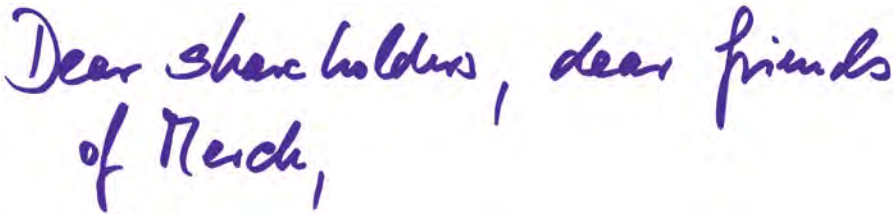
TO OUR SHAREHOLDERS



In this Annual Report, you will find all the relevant information about Merck and its performance in fiscal 2019. For the first time, we are publishing our Annual Report exclusively online and have streamlined it in comparison with previous years. As you can see, we are focusing on the essentials here, too.

From my perspective, the major topics of 2019 included the debate on the role of companies in society – in other words, their purpose. I am very pleased to note that while economic growth and profitability are and will always remain important and, of course, essential, more and more companies are realizing that these are not the only factors that matter. Companies must always create value for society as well. This is crucial to long-term success, and in my view, a pivotal element of good corporate citizenship.

We are curious minds dedicated to human progress. That is our purpose, and what drives us at Merck. And not only since the latest debates on the role of companies in society. Everything at Merck revolves around science. For 352 years, it has been at the heart of everything we do. Science enables us to develop new technologies needed, for instance, to treat serious diseases, to help researchers worldwide develop new therapies, and to shape the digital revolution.

We have therefore clearly articulated our ambition in our Group strategy: We want to become **the** vibrant science and technology company. In other words, we want to rank among the scientific and technological leaders in all three of our business sectors. We also aim to outperform our competitors in terms of both sales growth and margin growth so as to continue to generate sustainable value for our owners.

Our agenda is ambitious and challenging, but it is also feasible. In 2019, we reached many milestones, as the following examples show:

- By acquiring Versum Materials and Intermolecular, we are now well-positioned to become a leading supplier in the electronic materials market and to further drive future innovations in this field. It is clear that the global volume of data is going to grow exponentially in the coming years. In 2018, it amounted to around 33 zettabytes – in megabytes, that is a number with 15 zeros. By 2025, that figure could grow to 175 zettabytes. All these data must be generated, processed, transferred, and stored. This is a veritable technological challenge and a major opportunity for Merck: We produce leading-edge materials used in almost all the latest electronic devices.
- Our research results in Healthcare are very encouraging – and we have a promising pipeline. The U.S. Food and Drug Administration approved our medicine Mavenclad® in the United States for the treatment of certain forms of multiple sclerosis – a great achievement for Merck. Bavencio®, our immuno-oncology therapy, was approved in the United States, Europe, Japan and other markets for the treatment of patients with advanced renal cell carcinoma in combination with another drug. In addition, we formed a global strategic alliance with GlaxoSmithKline to further advance the development of our novel investigational therapy, bintrafusp alfa, in the fight against hard-to-treat forms of cancer. Moreover, we presented positive results for evobrutinib in relapsing multiple sclerosis (MS).
- We also made progress on our genome-editing technologies. Our portfolio for CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) genome scissors is used to understand the functions of individual genes and their interaction in a cell. Last year, we received further patents in this key area and now hold a total of 22 patents for CRISPR technology worldwide. In addition, we entered into an agreement with the Broad Institute of MIT and Harvard in the United States to offer non-exclusive licenses to CRISPR intellectual property under our respective control. Through this agreement, we are simplifying the path to licensing CRISPR technology in order to make it more widely available to the global research and discovery community.

Stefan Oschmann, Chairman of the Executive Board and CEO

As you can see, we made excellent progress in all three of our business sectors last year. And we grew profitably. At € 16.2 billion, Group sales rose by 8.9% in comparison with 2018. EBITDA pre, the most important financial indicator we use to steer our operating business, amounted to € 4.4 billion, a year-on-year increase of 15.4%. Earnings per share pre (EPS pre increased by 9% to € 5.56.

Our strong business development in 2019 was only possible thanks to the untiring engagement of our approximately 57,000 employees worldwide. On behalf of the entire Executive Board, I would like to warmly thank all our people for their tremendous commitment.

As shareholders, you are benefiting from our good business performance in 2019. Last year, the Merck share price rose by 17%. For fiscal 2019, we will propose to the Annual General Meeting the payment of a dividend of € 1.30 per share.

In 2020, we plan to build on the good development achieved in 2019 and to continue to grow profitably. We will move forward with our strategy of profitable growth while focusing, as we always do, on reducing our debt, which rose significantly owing to our most recent major acquisition of Versum Materials. As of the end of 2019, our net financial debt totaled € 12.4 billion. That is why we will now be setting our sights on growing organically and generating high cash flow. At the same time, we will work to sustainably strengthen a culture of cost awareness throughout Merck.

In our Healthcare business sector, we will continue to deliver profitable growth in our core business, especially in emerging markets, with a special focus on China. We want to fully leverage the potential of our new medicines Mavenclad® and Bavencio® and to forge ahead with our promising pipeline projects. In Life Science, we are aiming to expand our leading positions in bioprocessing and e-commerce. In addition, we will continue to unlock new growth opportunities through our Promise Ventures in gene editing and novel modalities, end-to-end bioprocessing solutions, and connected labs. Within Performance Materials, we will work to further reap the benefits of Bright Future, our five-year transformation program, as well as to successfully integrate Versum Materials and Intermolecular. We see particularly attractive long-term growth potential for Performance Materials in the businesses with materials and solutions for the semiconductor industry and OLEDs (organic light emitting diodes.

Overall, we are also keeping a close eye on the geopolitical and trade policy conflicts currently underway, as they are also likely to influence our businesses. Yet, irrespective of this, Merck can achieve great things in 2020 and beyond. Many of the technologies we are working on could help solve challenges facing humanity. I am thinking of novel cancer therapies, breakthrough technologies for scientific research, and of new materials that permit not only more powerful, but also smaller and – most importantly – more energy-efficient microchips and memory devices. This will be a major step forward, as data-based information technologies could account for up to 20% of global energy consumption in 2030. In addition, I am thinking of technologies such as clean meat, in other words the biotechnological production of real meat. Clean meat could help feed a growing population in an ecologically sustainable manner. Not to mention the many exciting future topics such as DNA data storage, which could emerge at the interface of biology and digital technologies.

All these examples show that science and technology are the key to progress that will benefit everyone: patients and customers, employees, society as a whole, and of course you, our shareholders. That is what we mean when we talk about unlocking the positive force of science and directing our actions toward human progress. I am convinced that our company has a strong future. As a leader in science and technology. Successful in business. And always instilled with a strong spirit of responsible entrepreneurship.

I truly appreciate your support and hope that you will continue to accompany us on our journey into the future.

Sincerely,

Dr. Stefan Oschmann
Chairman of the Executive Board and CEO

The Executive Board

The Executive Board of Merck KGaA:

Udit Batra (CEO Life Science)	**Marcus Kuhnert** (Chief Financial Officer)	**Stefan Oschmann** (Chairman of the Executive Board and CEO)	**Belén Garijo** (CEO Healthcare)	**Kai Beckmann** (CEO Performance Materials)

Short biographies

More information can be found at www.merckgroup.com
Company → Who We Are → Management

Merck Shares

At a glance

On the whole, the performance of Merck shares in 2019 was characterized by a strong increase in value. The shares started the year with an uptrend but came under pressure during the second quarter. The turnaround began in the second half of the year, when Merck shares caught up with the reference indices. However, at the end of the year, they fell short of these reference indices. Merck shares ended the year with a closing price of € 105.35 and thus appreciated by 17% compared with the prior year.

At the end of the year, the shares underperformed the relevant reference indices, which all reported a strong upturn during the same period. When compared with the DAX® reference index, which rose by around 25% during the overall period, the Merck shares performed just under 8 percentage points below. Compared with the relevant reference index for the chemical industry, which increased by 29% over the year, Merck shares were around 11 percentage points lower. The pharmaceutical industry index gained around 24% in 2019, thus outperforming Merck shares by 7 percentage points in the same period.

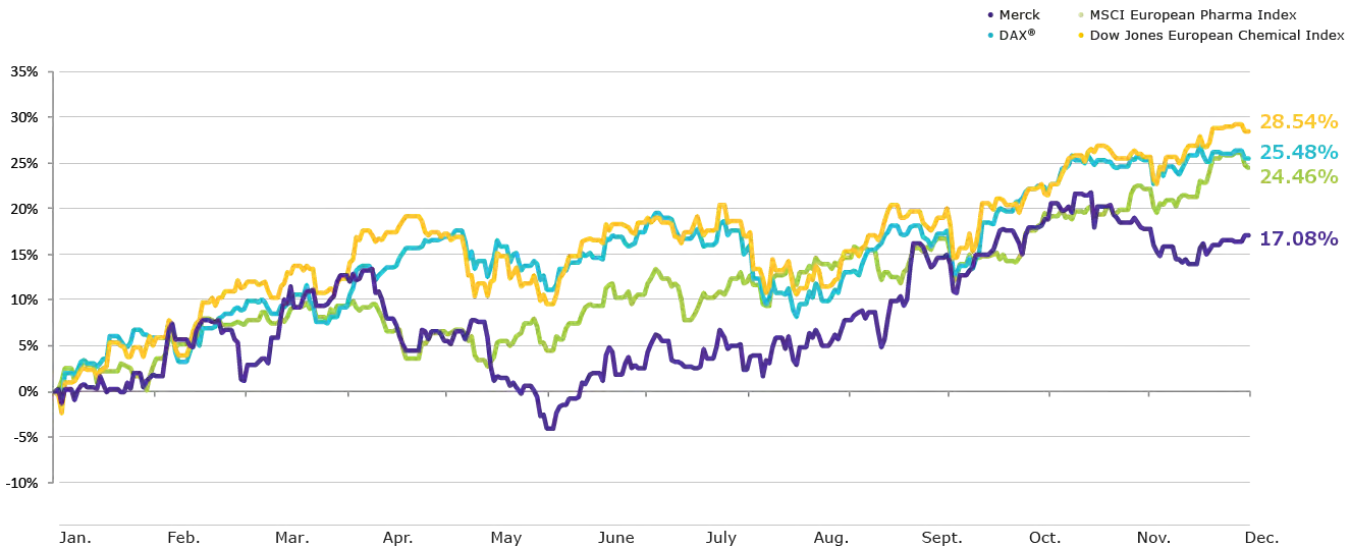
In 2019, the Merck Executive Board and the Investor Relations team gave in-depth briefings to more than 1,000 investors at investor conferences, as well as during roadshows and conference calls.

The average daily trading volume of our shares declined by around 13% year-on-year, from some 584,000 to a good 505,000 in 2019. North America's proportion of the free float remained the highest in 2019, although it fell to around 33% when compared to the prior year (2018: 36%). By investor type, growth investors and value investors dominated, as in the previous year. In 2019, the proportion of growth investors at Merck remained at last year's level of 34%. At the end of 2019, the top five investors held around 24% of the free float (2018: 28%).

MERCK SHARES

Share price development from January 1, 2019, to December 31, 2019

in %



Source: Bloomberg (closing rates).

MERCK SHARES

Key share price data[1]

		2019	2018
Dividend[2]	€	1.30	1.25
Share price high	€	109.75	99.82
Share price low	€	86.46	74.80
Year-end share price	€	105.35	89.98
Daily average number of Merck shares traded[3]	Number	504,934	583,653
Market capitalization[4] (at year-end)	€ million	45,804	39,121
Market value of authorized shares[5] (at year-end)	€ million	13,616	11,629

[1] Share price-relevant figures relate to the closing price in Xetra® trading on the Frankfurt Stock Exchange.
[2] 2019 dividend subject to approval by the Annual General Meeting.
[3] Based on the floor trading systems of all German exchanges and the regulated market on Xetra® .
[4] Based on the theoretical number of shares (434.8 million).
[5] Based on the number of shares in free float (129.2 million). Source: Bloomberg, Thomson Reuters.

IDENTIFIED INVESTORS BY REGION AS OF NOVEMBER 2019

Source: Nasdaq Shareholder Identification
Total Shares Outstanding: **129.2 million**

IDENTIFIED INVESTORS BY TYPE AS OF NOVEMBER 2019

Source: Nasdaq Shareholder Identification

COMBINED MANAGEMENT REPORT

* The management report for Merck KGaA has been combined with the Group management report and published in the 2019 Merck Annual Report as well as in the annual financial statements of Merck KGaA. The annual financial statements and the combined management report of the Merck Group and Merck KGaA for 2019 are filed with the electronic German Federal Gazette (elektronischer Bundesanzeiger) and are available on the website of the German company register.

This combined management report contains certain financial indicators such as operating result (EBIT), EBITDA, EBITDA pre, business free cash flow (BFCF), free cash flow, net financial debt and earnings per share pre, which are not defined by International Financial Reporting Standards (IFRSs). These financial indicators should not be taken into account in order to assess the performance of Merck in isolation or used as an alternative to the financial indicators presented in the consolidated financial statements and determined in accordance with IFRSs.

The figures presented in this combined management report have been rounded. This may lead to individual values not adding up to the totals presented.

The separate, combined non-financial (Group) report of Merck KGaA, which we issue pursuant to sections 289b–289e and 315b–315c HGB, is available as online version on our website as of April 14, 2020 at www.merckgroup.com/en/cr-report/2019/. It is integrated into the 2019 Corporate Responsibility Report in accordance with DRS 20 subsection 252 (b). We have prepared an overview of the information contained in the combined non-financial (Group) declaration at www.merckgroup.com/nfr19.

For reasons of better readability, we do not use gender-specific formulations in this annual report. The chosen male form represents all genders.

Fundamental Information about the Group

Merck

We are Merck, a vibrant science and technology company. Science is at the heart of everything we do. It drives the discoveries we make and the technologies we create. We make a positive difference in the lives of millions of people every day.

In Healthcare, we discover unique ways to treat some of the most challenging diseases, such as multiple sclerosis (MS) and cancer. Our Life Science experts develop tools and solutions, which are aimed at enabling scientists achieve breakthroughs even faster. And in Performance Materials, we develop science that sits inside technologies and changes the way we access and display information.

Everything we do is fueled by our belief in science and technology as a force for good. A belief that has driven our work since 1668, and will continue to inspire us to find more joyful and sustainable ways to live. We are curious minds dedicated to human progress.

We hold the global rights to the Merck name and brand. The only exceptions are Canada and the United States. In these countries, we operate as EMD Serono in the biopharmaceutical business, as MilliporeSigma in the life science business, and as EMD Performance Materials in the high-tech materials business.

Apart from our three business sectors, our financial reporting presents five regions: Europe, North America, Asia-Pacific, Latin America, and the Middle East and Africa. As of December 31, 2019, we had 57,071 employees worldwide[1], which compares with 51,749 employees on December 31, 2018.

Healthcare

Our Healthcare business sector comprises the two businesses Biopharma and Allergopharma. In 2019, Healthcare generated 42%of Group sales and 40% of EBITDA pre (excluding Corporate and Other). Europe and North America generated 55% of Healthcare's net sales in 2019. In recent years, we have steadily expanded our presence in growth markets. In 2019, Asia-Pacific and Latin America accounted for 38% of sales.

Biopharma*

Our Biopharma business discovers, develops, manufactures and markets innovative pharmaceutical and biological prescription drugs to treat cancer, MS, infertility, growth disorders, and certain cardiovascular and metabolic diseases. Biopharma is the larger of our Healthcare businesses and operates in four franchises: Oncology, Neurology & Immunology, Fertility, and General Medicine & Endocrinology. Our R&D pipeline positions us with a clear focus on becoming a global specialty innovator in oncology, immuno-oncology, and immunology including multiple sclerosis (MS).

At the end of March 2019, Mavenclad® (cladribine tablets) was approved in the United States, the market with the greatest number of people living with MS. Mavenclad® was approved for the treatment of adults with relapsing-remitting MS (RRMS) and active secondary progressive MS (SPMS). Our cladribine tablets have been approved by the FDA as a treatment for RRMS and SPMS that provides two years of proven efficacy, with a maximum of 20 days of oral treatment during a two-year period. With U.S. approval, Mavenclad® is now approved in more than 70 countries, including those of the European Union, Australia, Canada, and Switzerland.

[1] Merck also has employees at sites that are not fully consolidated subsidiaries. These figures refer to all people directly employed by Merck and therefore may deviate from figures in the financial section of this report.

* The contents of this chapter or section are voluntary and therefore not audited. However, our auditor has read the text critically.

We view Mavenclad® as a complementary oral treatment option in our MS product portfolio. Rebif® (interferon beta-1a), a disease-modifying drug used to treat relapsing forms of MS (RMS), is and remains a well-established therapy. Rebif® is registered in more than 90 countries worldwide. Interferon beta-1a has been proven to delay the progression of disability, reduce the frequency of relapses, and reduce magnetic resonance imaging (MRI) lesion activity and area.

In September, we initiated two global pivotal Phase III trials of evobrutinib, an oral, highly selective Bruton's tyrosine kinase (BTK) inhibitor in adult patients with RMS. Evobrutinib was developed within our own laboratories and further demonstrates our commitment to improving the lives of people with MS and other chronic progressive diseases (for further details see "Research & Development").

Erbitux® (cetuximab) remains the second best-selling drug in terms of revenue in the portfolio of our Biopharma business and is our flagship product in oncology. Treating more than 900,000 patients since authorization, the product is a standard of care for patients with epidermal growth factor receptor (EGFR)-expressing, RAS wildtype metastatic colorectal cancer (mCRC), as well as both recurrent and/or metastatic and locally advanced squamous cell carcinoma of the head and neck (SCCHN). We continue to invest in cetuximab and are committed to making it available to those patients it will benefit most. In September, Erbitux® obtained the approval of the National Medical Products Administration of China in mCRC.

Together with Pfizer Inc., we are developing much-needed new treatment options for patients with hard-to-treat cancers. We have made key progress in this area, with regulatory approvals in more than 50 countries for our anti-PD-L1 antibody avelumab under the brand name Bavencio®. In May, we and our alliance partner Pfizer announced that the FDA had approved Bavencio® in combination with axitinib for the first-line treatment of patients with advanced renal cell carcinoma (RCC). In October, we and Pfizer reported that the European Commission (EC) had also approved Bavencio® in combination with axitinib for the first-line treatment of adult patients with advanced RCC.

Bavencio® was initially granted two approvals in 2017 by the FDA for the treatment of adults and pediatric patients 12 years and older with metastatic Merkel cell carcinoma (mMCC) and previously treated patients with locally advanced or metastatic urothelial carcinoma (UC). These indications were granted accelerated approval based on tumor response rate and duration of response. Continued approval for these indications may be contingent upon verification and description of clinical benefit in confirmatory trials. The prognosis for both patient groups is very poor, so avelumab may represent a welcome new treatment option.

The Bavencio® approvals were based on data from our comprehensive clinical development program JAVELIN, which currently involves at least 30 clinical programs and more than 10,000 patients evaluated across more than 15 different tumor types.

We are continuing to explore all potential options and have entered into a number of strategic collaborations to evaluate avelumab in combination with a range of complementary oncology medicines (for further details see "Research & Development"). Key data from the JAVELIN program was presented at major medical congresses in 2019, including the European Society for Medical Oncology Congress (ESMO), where we shared new results from the Phase III JAVELIN Renal 101 study evaluating the efficacy of first-line treatment with avelumab in combination with axitinib compared with sunitinib in two clinically relevant subgroups of patients with advanced RCC.

Other highlights from our development pipeline included the presentation of new data for our investigational oral MET inhibitor, tepotinib, in advanced solid tumors. In September, we shared important milestones for two combination studies of tepotinib in locally advanced or metastatic non-small cell lung cancer (NSCLC) with epidermal growth factor receptor (EGFR) mutation and select MET dysregulations. In September, we announced that the FDA granted Breakthrough Therapy Designation (BTD) for tepotinib in patients with metastatic NSCLC harboring MET exon 14 skipping alterations who progressed following platinum-based cancer therapy. In November, we reported that the Japanese Ministry of Health, Labour and Welfare (MHLW) granted orphan drug designation (ODD) for tepotinib for patients with NSCLC-harboring MET gene alterations.

In February 2019, we entered a global strategic alliance with GlaxoSmithKline (GSK) to jointly develop and commercialize the investigational bifunctional fusion protein immunotherapy bintrafusp alfa, discovered as a result of our own research. In 2019, we achieved our alliance objective of eight trials ongoing or with protocol under development, including our most recent clinical trial initiations in October in 1L biliary tract cancer (BTC) (for further details see "Research & Development").

Being the global market leader in fertility drugs and treatments, with a unique and broad portfolio from therapeutics to lab technologies, our Fertility franchise is an important growth driver for our Biopharma business. Infertility represents an increasing challenge globally due to demographic changes and growing lifestyle adjustments like delayed childbearing. In this highly

specialized market, the focus lies on quality, standardization, outcome improvements, and patient convenience. With our portfolio, we are well equipped to be the Fertility partner of choice for our customers and to further improve assisted reproductive technologies (ART) through innovative solutions across therapeutics, lab technologies, services, and digital health solutions.

The Pergoveris® Pen is the first product with a combination of recombinant follicle-stimulating hormone (FSH) and recombinant luteinizing hormone (LH) in a ready-to-use liquid version, eliminating the need for mixing. It thus provides an improved and convenient treatment option for women with severe deficiency of both FSH and LH, a group of patients that is difficult to treat. Launches will continue. The Pergoveris® Pen has now been launched in 23 countries and we will continue to provide patients with access to this innovative therapeutic.

On the occasion of the annual meeting of the European Society of Human Reproduction and Embryology (ESHRE), we launched the Medical Innovation Program (MIP) for human reproduction. This initiative strives to support early stage innovation in key areas highlighting our continued commitment to open innovation. The MIP will support collaboration and co-development, bringing together internal and external expertise, and serves as a platform for interdisciplinary, conceptual, and methodological debate on how to provide new solutions to boost innovation in human reproduction.

Every day, more than 72 million patients around the world use our trusted general medicine and endocrinology (GM&E) medications. Concor®, Euthyrox®, Glucophage®, and Saizen® are highly valued brands and market leaders in many key markets worldwide. As a result, GM&E is the largest business franchise of the Healthcare business sector in terms of sales, with strong growth in all major therapeutic areas of focus, contributing significantly to the overall profitability of Biopharma and Merck. Although no longer patent-protected, the brand equity of our products, built up over decades, makes them cornerstones for the treatment of chronic cardiovascular, metabolic, and endocrine diseases.

Concor®, containing bisoprolol, is the leading beta-blocker for chronic cardiovascular diseases such as hypertension, coronary artery disease, and chronic heart failure. Euthyrox®, with the active ingredient levothyroxine, is the worldwide market leader with a market share of 28% in volume for the treatment of hypothyroidism, a disease with high prevalence but still low diagnosis rates in most emerging markets. Glucophage®, containing the active ingredient metformin, is the drug of choice for first-line treatment of type 2 diabetes. During 2019, multiple health authorities worldwide continued to approve Glucophage® in prediabetes when intensive lifestyle changes have failed. This indication for Glucophage® is now registered in 53 countries. Overall, considering the high prevalence of prediabetes and diabetes, we see great potential for Glucophage®.

We help to raise awareness and education in the areas we operate in, such as thyroid diseases and diabetes. This is well demonstrated by our active role in International Thyroid Awareness Week and our partnership with the International Diabetes Federation (IDF), which serves as a basis for implementation of education and communication activities that emphasize the importance of type 2 diabetes prevention.

Saizen®, with its active ingredient somatropin, is our main endocrinology product and is indicated for the treatment of growth hormone deficiency in children and adults. Saizen® is delivered with the Easypod® electromechanical injection device, the only growth hormone injection device of its kind. Easypod® is able to wirelessly transfer data such as injection times, dates, and doses to the web-based software system Easypod® connect, making it easier for healthcare practitioners and patients to ensure adherence and reach their treatment goals.

In endocrinology, we differentiate ourselves from competitors through leadership in the eHealth space, both by building evidence and by expanding our offerings with new services for patient engagement, partnership with healthcare practitioners, and better payer value proposition. In 2019, Aluetta® (the new Saizen® pen) was launched with the objective of expanding the reach of Saizen® by tapping strategic segments and expanding our devices portfolio.

Allergopharma*

Our allergy business Allergopharma is a leading company in the field of allergy immunotherapy (AIT) in Europe. In 2019, we celebrated our 50th anniversary. For high-precision, effective allergy therapy, we offer comprehensive diagnosis solutions as a basis for individual treatment concepts. Our AIT products concentrate on causal treatment of type 1 allergies such as allergic rhinitis and allergic asthma to meet patients' needs. For AIT, strong evidence of efficacy and an acceptable safety profile have been well-documented in allergy-induced allergic rhino-conjunctivitis in numerous clinical trials. Furthermore, there is a potential positive effect on the long-term course of the allergic disease. AIT is designed to induce tolerance in the immune system of the allergy patient to the allergy-triggering allergen, thus potentially inducing an immune modification.

* The contents of this chapter or section are voluntary and therefore not audited. However, our auditor has read the text critically.

We offer high dosage, hypoallergenic, standardized preparations for allergen-specific immunotherapy for pollen and house dust mite allergies, as well as a wide range of diagnostic allergy tests. Based on long-standing expertise, scientific excellence, and entrepreneurial responsibility, we provide physicians with first-class therapy options and help people with allergies lead more fulfilled lives. Products of Allergopharma are available in more than a dozen countries worldwide.

Life Science

Our purpose is to solve the toughest challenges in the life science industry in collaboration with the global scientific community. With our Research Solutions, Process Solutions, and Applied Solutions business units, we are a leading worldwide supplier of tools, high-grade chemicals, and equipment for academic labs, biotech, and biopharmaceutical manufacturers, as well as the industrial sector. Research Solutions provides our academic customers with the chemicals and tools needed to make scientific discovery easier and faster. Process Solutions provides drug manufacturers with process development expertise and technologies, such as continuous bioprocessing. Applied Solutions offers both testing kits and services to ensure that our food is safe to eat and our water is clean to drink.

Since acquiring the chemical and technology company Sigma-Aldrich in 2015, our strategy includes strengthening our core business by delivering a broad and relevant portfolio as well as establishing new pillars of growth in scientific areas, such as cell and gene therapy and continuous bioprocessing. As determined by sales, the Life Science business sector of Merck has achieved a top-three ranking in the global life science industry.

In 2019, the Life Science business sector generated 42% of Group sales as well as 44% of EBITDA pre (excluding Corporate and Other).

Portfolio at a glance*

Our portfolio comprises more than 300,000 products, ranging from lab water systems to genome-editing tools, antibodies, and cell lines, as well as end-to-end bioprocessing systems to support the manufacturing needs of both emerging biotech and large pharma companies. For example, our ZooMAb® recombinant antibodies bring the next generation of polyclonal and monoclonal antibody technology and production to the industry, specifically engineered for greater specificity, higher consistency, and maximum stability.

Our e-commerce platform, www.sigmaaldrich.com, continues to grow and connect customers globally with the products needed to advance their research, development, and production efforts. To expand our e-commerce reach, in 2019, Life Science became the first in the industry to launch an official flagship store on Alibaba's 1688.com in China, providing easy access to high-quality products and solutions for our customers in that country. The launch reinforced our commitment to the scientific community in China and to enhancing e-commerce capabilities.

Another example is our BioReliance® End-to-End Solutions, a service offering for process development and manufacturing for emerging biotech companies. In 2019, Life Science agreed to provide Phanes Therapeutics Inc. of China with this full suite of products and services to accelerate the development and manufacturing of a bispecific antibody for the treatment of solid tumors. Responding to an increased demand for these process solutions, this collaboration represents our dedication to delivering innovative advancements for global clinical drug development and scaling processes. We also launched the new integrated Plug & Play Upstream Development Service to help emerging biotech and start-up companies optimize the cost and speed of advancing their molecules to the clinical stage.

Additionally, our Life Science business sector has built the expertise to further develop BrightLab™, our digital ecosystem for complete lab management.

In February 2019, Life Science made the first of several announcements regarding our CRISPR intellectual property portfolio for genome editing. CRISPR functions as a core competency for our business sector and we support research with genome editing under careful consideration of ethical and legal standards. In February, we received our first United States patent for proxy-CRISPR technology. This specific technique makes CRISPR more efficient, flexible, and specific by opening the genome for modification of DNA.

* The contents of this chapter or section are voluntary and therefore not audited. However, our auditor has read the text critically.

Our portfolio now includes 22 patents for CRISPR technology granted worldwide, including 10 additions throughout 2019 in Canada, Europe, Israel, South Korea, the United Kingdom, Japan, and Singapore.

In July, we simplified the path to licensing CRISPR technology for commercial research and product development through an agreement with the Broad Institute of MIT and Harvard in Massachusetts, United States. With this unique offering, Life Science collaborates to ease navigation of the complex intellectual property landscape of CRISPR patents, encouraging participation and innovation in this area. Additionally, in November, we licensed our foundational CRISPR intellectual property to Evotec SE, an international biotechnology company headquartered in Hamburg, Germany, again demonstrating our promise to accelerate discovery and research that may lead to new therapies.

Our CRISPR Core Partnership Program continues to add more members each year. The program, which started in 2014, accelerates collaboration on cutting-edge, gene-editing techniques with diverse and advanced CRISPR workflow solutions. In March, we announced the addition of China's Zhejiang University to our Core Partnership Program, which will utilize our Arrayed CRISPR Library to assist in discovering the relevance of specific genes in biological functions. With more than 80 core partners in our global network, this addition demonstrates our dedicated collaboration to promote ethical scientific exploration in genome editing.

In March, we took a further step with regard to our Life Science expansion plans by opening a new M Lab™ Collaboration Center in Molsheim, France, to serve customers in Europe, the Middle East, and Africa. With 4,000 square meters of space, this M Lab™ Collaboration Center is the first in Europe — representing a € 10 million investment in the region — and ninth worldwide. It includes non-GMP pilot and bench scale labs. This allows our customers to engage in process development support, troubleshooting, demonstrations, and hands-on training to explore new ways of increasing productivity, improving processes, and mitigating risks.

We announced continued expansion in May with our approximately € 3.1 million (£ 2.7 million) investment in our biopharmaceutical production facility in Irvine, United Kingdom. The is our only location where we manufacture both liquid and powder cell culture media. As a result of its expansion, we will be able to supply an additional two million liters of specialized medicine to the global healthcare industry. Additionally, in November, we announced the completion of a 5,250-square meter expansion to our site in Gillingham, United Kingdom, which serves as the primary distribution center for the region in our global supply chain. The addition, valued at approximately € 10.5 million (£ 9 million), supplies the pharmaceutical industry, biotechnology companies, research institutes, and academic centers with biochemical and chemical reagents, laboratory supplies, and testing services. Both expansions demonstrate our commitment to the United Kingdom and to growing our global presence while providing employment opportunities.

In addition to the new expansion of these facilities, Life Science announced new product platforms for our biopharmaceutical customers in 2019. In April, we launched the BioContinuum™ Buffer Delivery Platform. A building block of our BioContinuum™ Platform, which addresses intensified bioprocessing and continuous manufacturing, this integrated solution is tailored to provide the highest levels of accuracy and precision in buffer preparation and management. The configurable platform supplies process buffers at a fraction of the resources and facility space, resulting in a more streamlined buffer suite and a more efficient manufacturing process. Its launch marked a key step in our strategy to deliver "contiguous" bioprocessing, which goes beyond connecting the individual unit operations to include the orchestration and management of all the processing steps — materials, production, testing, and analytics — with an industry-leading, streamlined, and optimized approach. Pilot studies suggest that conversion to such a manufacturing method may reduce manufacturing costs by up to 50%.

In August, we acquired all ownership rights to the ProcessPad™ platform from Simplyfeye Softwares Private Limited. Adding to our biopharmaceutical product portfolio, the web-based platform provides easy, on-demand access to data for aggregation, analysis, visualization, and management. It advances our BioContinuum™ Platform by adding a building block that connects across functions and with suppliers to deliver continuous manufacturing.

A key goal for our Life Science business sector is to help our customers that manufacture drugs, from small to large innovator companies, bring life-enhancing medicines and therapies to market — and to patients — faster. To facilitate reaching this target, in October, we became the first to make acoustic technology available for cell therapy manufacturing with the acquisition of FloDesign Sonics of Massachusetts, United States. The unique acoustic cell processing platform will industrialize the manufacturing of autologous cell therapy and provide revolutionary cancer treatment by way of chimeric antigen receptor T (CAR-T) cell therapies. A strategic fit with our goal of advancing cell-based therapies to patients, the acquisition will allow further advancement toward potentially life-saving treatments.

In October, we launched our ADC Express™ services to accelerate pre-clinical conjugation candidate selection. The portfolio addition uses established platform technology to reliably scale target molecules, providing rapid production of antibody drug conjugates

(ADCs). Aligning with our goal to accelerate access to health, this innovation reduces time to clinic through comprehensive services spanning pre-clinical to commercial from a single source.

Working toward that same goal, we aim to optimize digitalization across Life Science to increase lab productivity, efficiency, and safety. In March, we announced the Milli-Q® Connect online service portal as a cloud-based, remote lab water service and monitoring capability. Available on all Milli-Q® CLX 7000 clinical water purification systems, this technology streamlines quality report production, allowing increased productivity, maximal uptime, easier data traceability, and saved time.

In August, we announced the acquisition of BSSN Software, a Darmstadt, Germany-based laboratory informatics company. The acquisition continues the acceleration of customers' digital transformation in the lab by giving scientists better, more efficient access to their lab data. We remain committed to building this ecosystem based on the AnIML standard and Standardization in Lab Automation, which the acquisition promotes by boosting our digital lab productivity business and commercial growth for Life Science.

Earlier this year, we completed the divesture of our flow cytometry business to Luminex Corporation of Texas, United States. A process begun in 2018, this included the portfolio's combined stock, asset, and inventory purchases.

Collaboration remains an important focus for Life Science as we work to drive innovation and solve the industry's toughest problems. While developing our own portfolio and capabilities, we also seek to unite with other key players in the industry to work toward our shared goal of bettering and increasing access to health globally. To extend the reach and accessibility of our work, we developed a fully-equipped Center for Microbiological Analysis Training (C-MAT) in Ghaziabad, India, and, in April, announced its handover to the Food Safety and Standards Authority of India (FSSAI). The C-MAT lab provides training to food safety scientists from government and FSSAI-ratified private laboratories on the latest technology in microbiological testing.

In November, we announced our intent to participate in a consortium comprised of academic healthcare, biotech, and biopharma industry leaders across Massachusetts, United States, that will come together and establish a new center for advanced biological innovation and manufacturing. Pooling our resources with industry partners like Harvard University and Massachusetts Institute of Technology (MIT), among others, the central facility will develop next-generation medicines and regenerative therapies. The purpose of the US$ 50 million investment is to explore and cultivate innovations in cell and gene therapy, advance biologic innovation and manufacturing, as well as advance developments in immunotherapy, cell therapies, gene editing, and other technologies. It is expected that the center will operate as an independent, non-profit organization. By fostering collaboration, this center holds the promise of speeding innovation and broadening the universe of patients that can be served by these emerging therapies.

Since 2018, 63% of drugs in the pipeline were being developed by biotech start-ups focused on innovative therapies, including those intended to treat niche diseases with small patient populations. Our global health commitment focuses on these companies and supports bringing their drugs to market through our grant programs. Grants provide selected companies with access to Merck products and services to help accelerate market entry for new therapies. Through our Advance Biotech Grant Program, which we run in North America, Europe, and Asia, we announced 12 grant recipients for 2019, selected based on the scientific and societal merit of their respective therapies in development, as well as process challenges and expertise gaps.

In addition to these grants, in May, we announced three winners of our new Retrosynthetic Reaction Prediction Contest. Retrosynthetic analysis plays a critical role in the development of new drugs, and its application has broad prospects in accelerating the speed of drug research and development, improving efficiency, and reducing costs. The contest, open to anyone in China, included a free training camp, online knowledge sharing, workshops, lab tours, and mentorship for participants. It attracted 1,150 contestants, including students, researchers, and practitioners from leading institutions.

Along with promoting scientific engagement and STEM disciplines within schools and universities, our business sector extends to the wider community through SPARK, our global volunteer program. In 2019, through this initiative, just under 2,300 employees volunteered nearly 19,400 hours to host thousands of events in 20 countries and engaged some 66,500 young minds. For the third year, our Curiosity Cube™ mobile science lab toured North America, celebrating the 150th anniversary of the Periodic Table of Elements and igniting youth interest in science. In 2019, the mobile lab traveled 48,000 kilometers (30,000 miles) and engaged with students at schools and city centers in 99 communities. 94% of the schools visited were classified as Title 1, indicating under-resourced areas.

Related to our work in the Asia-Pacific region, in June, Life Science held a national campus tour of our new mobile lab to promote protein research across China. Proteins are the fundamental building block in our research, and revealing the structure and function of thousands of proteins in organisms remains one of the industry's most challenging areas. The tour offered engaging learning experiences and scientific discovery through product displays, live demonstrations, speeches, online games, and digital interaction. It covered 20 colleges and biotech campuses in 13 cities across China.

Performance Materials

Our Performance Materials business sector comprises the specialty chemicals business of Merck and consits of three business units: Semiconductor Solutions, Display Solutions, and Surface Solutions. Comparing Performance Materials with a smartphone, Display Solutions represents the user interface, Semiconductor Solutions the intelligence, and Surface Solutions the aesthetics. In Performance Materials, we offer innovative solutions especially for the electronics industry — for microchips and displays — and for surfaces of every kind.

We are well on track in the execution of our five-year Bright Future transformation program announced in 2018, with which we are adapting to new market realities and customer requirements. Bright Future lays the foundation for returning to sustainable growth, attractive margins, and remaining competitive. Throughout 2019, we further streamlined our cost-base and processes. This included the reallocation of R&D resources. In this context, we closed our main R&D site in Chilworth, United Kingdom, in September 2019. The closure of our Atsugi site in Japan will follow by mid-2021. In addition, as announced in 2018, we will downsize by 400 positions in Germany by 2022.

With the completion of the acquisition of Intermolecular on September 20, 2019, and Versum Materials on October 7, 2019, we reached two major milestones on our Bright Future journey to transform Performance Materials into a strong solutions provider and leading player in the electronic materials market. Intermolecular has application-specific materials expertise and platforms for accelerated learning and experimentation with a powerful analytical infrastructure, all of which perfectly complement our portfolio. Together, we are well-positioned to deliver next-generation digital devices for a smarter, safer, and more connected world. Versum Materials is a leading global provider of innovative, high-purity process chemicals, gases, and equipment for semiconductor manufacturing. The merger should transform Merck into a leading provider of electronic materials for the semiconductor and display industries. The Intermolecular and Versum Materials businesses are being integrated into the Semiconductor Solutions business unit. We are making good progress with the integration, ensuring a seamless transition and business continuity.

Performance Materials accounted for 16% of Group sales in 2019 and its share of EBITDA pre (excluding Corporate and Other) was 16%. The EBITDA pre margin was 31.2% of net sales.

Semiconductor Solutions*

With the acquisition of Versum Materials and Intermolecular, Semiconductor Solutions is now the largest business unit within Performance Materials. It consists of two dedicated units: Semiconductor Materials and Delivery Systems & Services. Our Semiconductor Materials unit supplies products for every major step in the wafer manufacturing process, including doping, lithography, patterning, deposition, planarization, etching, and cleaning. Specialty cleaners and conductive pastes for semiconductor packaging round off the portfolio. The Delivery Systems & Services (DS&S) business enables the safe and responsible handling of gases and liquid chemicals for electronic manufacturers. It focuses on the development and deployment of safe and reliable delivery equipment. This allows our materials to be handled with the highest quality and safety standards for our customers.

In the area of deposition materials, we are continuously looking for both new organosilanes and organometallic materials as well as liquid phase silicon formulations for processes with low resistance and various dielectric characteristics for faster and better processors, as well as higher data storage density. Our photoresists business is growing rapidly; throughout the year we have developed new photoresists to address the needs of the markets, for example, for 3D NAND memory, sensors, and radio frequency (RF) filters. Furthermore, interest in Directed Self Assembly (DSA) technology continues among our customers. Our advances in DSA technology have enabled customers to begin planning high volume manufacturing (HVM) qualifications. We have responded by developing exceedingly pure, high volume synthesis capabilities, which are key to meeting our customers performance and quality targets. In the 5G space, our transient liquid phase sintering (TLPS) conductive pastes are enabling highly efficient production of modern antenna applications. Our mid- to back-end photolithography resist materials used in electronic packaging applications continue to drive miniaturization and heterogeneous integration for small form factor devices.

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Display Solutions*

Our Display Solutions business unit comprises the liquid crystals, OLED (organic light-emitting diodes), photoresists, and liquid crystal windows businesses. Even though competition continues to intensify, we defended our position as the global market and technology leader in the display materials business in 2019. Modern, energy-efficient technologies such as UB-FFS (ultra-brightness fringe-field-switching) have further established themselves on the market. With our XtraBright™, XtraBrilliant™, and XtraBoost™ products, we secured new projects for large-area displays as well as high-resolution mobile devices. The OLED business continued to develop favorably and experience a high demand due to the increased production capacities of display customers. Our constantly enhanced OLED material portfolio secured successful qualifications in a number of upcoming technical devices. For liquid crystal window modules, four projects are in the installation phase. These innovative solar shading solution projects demonstrate superior design aesthetics. The ramp up of commercial manufacturing at our Veldhoven site is running as planned, with the integration of a new lamination unit further optimizing overall production yield. Our photoresists business for displays continued to perform well, thanks to proven technical success in high-performance product lines. This is evidenced by a strong position in new display production lines in the growing Chinese market.

Surface Solutions*

In the Surface Solutions business unit, we provide our customers with solutions that help them to create innovative surfaces of all kinds. Our materials enable more beautiful, more resistant, and more effective products. Our pearlescent pigments allow striking automotive coatings, fascinating cosmetics, extraordinary packaging, innovative product design, and even unique food creations. With a broad portfolio of active ingredients, we enable cosmetics manufacturers to enrich their skin care products with moisturizing, protecting, or anti-aging effects. Moreover, with our functional solutions we serve a large number of innovative applications, from dirt-repellent and easy-care surfaces to laser markings of plastic parts and cables. We continue to invest in our pigment production capabilities. In August 2019, we celebrated the topping-out ceremony for new production facilities for silica flakes in Gernsheim, Germany. This investment will significantly increase production capacities for this special substrate, which is the basis for a whole range of unique effect pigments. In February 2019, we implemented a new structure as announced in October 2018 to align even more closely with the needs of our customers. We strengthened our key account approach as well as our regional setup to even better serve the diverse needs of our regional markets. Furthermore, we are implementing measures to stabilize our business in a market environment that has become challenging, mainly due to weaker demand from the automotive industry.

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Strategy*

Purpose and Values

We are Merck, a vibrant science and technology company. Science is at the heart of everything we do. It drives the discoveries we make and the technologies we create. Our work makes a positive difference to millions of people's lives every day.

In Healthcare, we discover unique ways to treat the most challenging diseases such as multiple sclerosis and cancer. Our Life Science experts empower scientists by developing tools and solutions that help them to deliver breakthroughs more quickly. And the science of our Performance Materials business sector sits inside technologies that are changing the way we access and display information.

Everything we do is fueled by a belief in science and technology as a force for good. A belief that has driven our work since 1668, and will continue to inspire us to find more joyful and sustainable ways to live.

We are curious minds dedicated to human progress. We believe that scientific exploration and responsible entrepreneurship are key to technological advances that benefit us all. Our values – courage, achievement, responsibility, respect, integrity and transparency – guide us in every step we take and in every decision we make.

Strategy Fundamentals

As a company, we have a strong foundation. These fundamentals have been defined by the Merck Family. We always take them into consideration when discussing and deciding on our Group strategy.

- We follow a risk diversification strategy with three distinct business sectors, and we avoid overexposure to any single customer, industry, or geography.
- With our science and technology focus, we want to be leaders in our fields of expertise and markets, always pushing the boundaries to find new solutions and drive innovation.
- We continue to operate under our current ownership with the Merck Family as majority owner.
- We continue to deliver sustainable value, and we want to maintain an attractive financial profile (for example, a strong credit rating).
- Mergers and acquisitions (M&A) are an important driver of our long-term value creation strategy with a focus on innovation-driven technology.

Group Strategy

Our transformational journey since 2007

Over the past years, Merck has grown significantly through a series of strategic moves that have enabled us to develop into a vibrant science and technology company. We have systematically and continuously strengthened and focused our portfolio of innovative science and technology throughout our business sectors.

In Healthcare, we divested our Generics business in 2007 to focus on highly specialized products and acquired Serono, also in 2007, to expand our pipeline. This focused approach has continued with the divestments of our Biosimilars business in 2017 and our Consumer Health business in 2018. We are now focusing our R&D efforts on the fields of oncology, immuno-oncology, and immunology (including multiple sclerosis).

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Within Life Science, we have significantly transformed to become a diversified industry leader through the acquisition of Millipore in 2010 and Sigma-Aldrich in 2015. We continue to leverage our e-commerce platform to expand our reach and leadership in the industry as well as invest in strategic initiatives, such as Gene Editing & Novel Modalities, BioReliance® End-to-End Solutions, and BrightLab™, our digital solution for lab management.

Performance Materials has delivered profitable growth and a significant cash contribution over many years, strongly driven by liquid crystals. Over the past several years, we evolved this business sector into new areas such as semiconductor materials, for example through the acquisition of AZ Electronic Materials in 2014. Performance Materials is currently undergoing a major transformation by repositioning its overall business toward the highly attractive electronic materials market. With the acquisitions of Versum Materials and Intermolecular, both in 2019, we are expected to achieve a leading position in this market, with a focus on the electronics market.

Our ambition for 2022

With our Group strategy, we want to become **the** vibrant science and technology company. By 2022, we aim to have strong, innovative science- and technology-focused business sectors with leadership positions in our areas. We want to be a top-tier company in relation to our peers in terms of sales and margin growth and we aim to continue to deliver sustainable returns to our owners.

We are now in the growth and expansion phase of our strategy and are well on track. Following the closing of the Versum Materials acquisition on October 7, 2019, we are putting special emphasis on generating cash in order to quickly lower our post-acquisition debt. Going forward, we aim to deliver profitable growth while focusing on ensuring a high degree of cost discipline. In 2020, we expect all three business sectors to drive earnings growth and support the growth and expansion phase of our strategy.

In Healthcare, we intend to fully leverage our pipeline's potential. Our new product launches, Mavenclad® and Bavencio® , are increasingly contributing to earnings. We expect our core business with our established products to at least remain organically stable for the mid-term. By 2022, we aim to achieve additional annual sales of at least € 2 billion with new medicines.

Life Science growth is driven by our strong product portfolio, our e-commerce platform – www.sigmaaldrich.com, which generates more than € 1.5 billion in sales – and our strong track record of service and innovation excellence. The business sector plans to deliver annual growth of 5% to 8% per year in the mid-term, thus continuing to outpace market growth. Our high-growth Process Solutions business unit and our e-commerce platform are expected to remain meaningful drivers of this growth.

Performance Materials has made significant progress with the implementation of its Bright Future transformation program, which was initially announced in 2018. With the acquisition of Versum Materials and Intermolecular, we reached key milestones in our transformation journey to become a leading player in the electronic materials market. Performance Materials aims to benefit from sustainable growth trends, particularly from the trend toward increasing data volumes worldwide.

To achieve our strategic ambition of becoming **the** vibrant science and technology company, we focus on our three Group-wide priorities: Performance, People, and Technology.

Performance

Our priority Performance focuses on the financial aspects of our activities. It provides a clear definition and tangible targets of financial success. As we focus on organic growth, we aim to sustainably increase our profitability with a focus on cash generation, and on implementing strict financial discipline.

In Healthcare, a successful year 2019 included further launches of our innovative products Bavencio® and Mavenclad® . Our Healthcare business has grown consistently for many quarters, and we continue to diligently develop and manage our pipeline of innovative medicines. The scientific data we presented at various congresses in 2019 underscored the overall attractiveness of our pipeline with its highly innovative assets in key indications and various stages of the clinical development process.

Life Science continued along the path of science and technology leadership through our sustained investment and focus on our strategic initiatives. Those include Gene Editing & Novel Modalities, BioReliance® End-to-End Solutions for Bioprocessing, and BrightLab™, our digital solution for complete lab management. Additionally, we maintained our focus on our leading e-commerce platform, www.sigmaaldrich.com.

In Performance Materials we are well on track with the execution of our five-year Bright Future transformation program, which we are using to adapt to new market realities and customer requirements. Bright Future forms the foundation for returning to sustainable growth, ensuring attractive margins. In 2019, we further streamlined our cost-base and our processes. With the completion of the acquisition of Versum Materials and Intermolecular, we achieved major milestones of our Bright Future program to transform Performance Materials into a strong solutions provider and leading player in the electronic materials market.

People

To become the vibrant science and technology company, we need to focus on our people – their talent, their performance, their ideas. Merck's People strategy aims at building the capabilities we need to shape the future by attracting and retaining the right people as well as creating the right culture for them to collaborate and perform at their best. It addresses how we as a science and technology company can create a working environment that meets our employees' individual needs and allows curiosity to unfold. Our growth strategy calls for people with diverse experiences and backgrounds who work together on the basis of shared values to innovate new solutions and respond flexibly to changing demands.

It is crucial to be perceived as an attractive employer in the market in order to continue to capture the interest of potential employees. The fact that we rank among the world's best employers was also confirmed by our distinction as a "Global Top Employer 2019" by the Dutch Top Employers Institute. In addition, we were ranked fourth among employers worldwide in the field of biotechnology and pharmaceutics by Science Magazine, an international scientific publication.

Our leaders play a decisive role in our People strategy. We aim to place leaders who will develop employees for future requirements – not just current needs – and foster the unique strengths of diverse individuals within the organization. At the same time, we want the leadership style of our managers to enable strategic innovation. The right leaders will help us promote curious talents who can solve complex problems and are passionate about the work they do. We will also strengthen results-driven teams as well as networks that value collaboration and provide flexible frameworks within which teams and individuals can drive our business forward.

We want to make data-driven people decisions – both when hiring new members of staff as well as in the personal development of employees. Another element of this strategy is to promote diversity, with a special focus on women and talent in Asia, and to create the inclusive environment that enable these groups – and all employees – to bring in their unique strengths and understanding of key customers and markets. We need to value different perspectives and encourage constructive discussions.

We place great importance on continuous advanced training and further development of our managers. This is essential to address the diverse needs of team members and the changing requirements of the businesses, especially in the area of digitalization. Our leaders are responsible for pushing our strategy ahead by building up the right competencies, thereby fostering innovation. As part of this, they take calculated risks, give clear and inspiring direction to their employees, and provide the requisite structures and resources to achieve our goals. Based on our competency model, we have identified six leadership behaviors that define how we expect our leaders to act (for further details see People at Merck). Those leadership behaviors are being implemented into our existing processes and tools (for example, selection, assessment and feedback tools, leadership programs, etc.).

In the context of the People strategy, we also want to look at new forms of cooperation and experiment with methods that result in better decision-making. For example, pilot initiatives focus on further expanding the Merck Science Network. Through this project, we are promoting the scientific community within the company to accelerate the exchange of innovative ideas and improve collaboration between all employees in the Research and Development sector.

Technology

Our approach to technology paves the way for discovering and scaling the most exciting technologies. The majority of our innovations come from within our existing business sectors, with approximately 7,800 scientists and researchers working for our company. These innovations include everything from incremental innovations to disruptive opportunities in the fields of Healthcare, Life Science, and Performance Materials.

Complementary to the business sectors, we are also looking into innovations that fall between our business sectors or beyond our company's current scope. With our Innovation Center in Darmstadt, Germany, and our Innovation Hubs in Menlo Park, California, United States, in Shanghai, China, and in Guangzhou, China, we are discovering new ideas and technologies, then scaling them up to build new businesses. We are focusing on our activities within three core innovation fields of interest: Liquid Biopsy, Clean Meat, and Biosensing & Interfaces. With liquid biopsies, a variety of diseases can be diagnosed through the detection of biomarkers in body fluids. This could be a key technology for early disease detection and expanding delivery of precision medicine to more patients. The innovation field Clean Meat comprises technological innovations to meet the world's growing demand for protein- and nutrient-dense foods made by means of ethical, eco-friendly methods. The innovation field of Biosensing & Interfaces focuses on the integration of electronics with the human body to create a digital human/biological interface. This could enable faster, more accurate (remote) health monitoring and treatment.

In addition to these global innovation fields, we have also introduced a China-focused innovation field through our China Innovation Hub: AI-enabled health solutions. Our focus within this field is the exploration of new AI-based technologies, products, and services that could impact the medical and healthcare industries across the value chain by, for example, increasing efficiency, saving costs, and improving customer experiences.

While our Innovation Center is operating on a global scale, the China Innovation Hub, with offices in Shanghai, China, and Guangzhou, China, will accelerate our innovation development by tapping into the China innovation ecosystem. Our objective is to advance innovation in China, for China and beyond – together with local partners, such as technology companies, start-ups, universities, and research institutes.

Through our Silicon Valley Innovation Hub in Menlo Park, California, United States, we aim to uncover new technological opportunities and establish partnerships and projects within our three global innovation fields, with a strong focus on Clean Meat.

Additionally, we focus on disruptive external innovation in emerging fields adjacent to, in between, and beyond our established business sectors. We strive for successful external innovation by transforming groundbreaking scientific ideas into businesses with the potential to improve patients' lives, disrupt industries, and transform the way we live. This includes M Ventures, the strategic corporate venture capital fund of Merck, with a total volume of € 300 million distributed across its Healthcare, Life Science, Performance Materials, and New Businesses evergreen funds. Since inception, M Ventures has invested in over 60 promising start-ups and companies that could impact Merck's core business areas, while at the same time providing Merck with strategic and financial returns, such as the successful IPO of Progyny (on October 19, 2019). In addition to company creation initiatives and its incubator activities in Israel, M Ventures has set up a China seed fund worth RMB 100 million (€ 13 million) to further foster innovation in this market with strategic importance for us.

A major focus of our innovation efforts is digitalization. We are leveraging related opportunities through our Digital Organization in order to create value for patients, customers, and business associates. To us, digitalization means the digital integration of our entire value chain, the digitalization of our products, services, and communication interfaces to customers, as well as the development of new digital business models. All this is supported by state-of the-art methods to collect and analyze vast amounts of data. Syntropy, our planned joint venture with Palantir technologies to advance cancer research, has been evolving throughout 2019 as we continue to grow our pipeline of potential customers and collaborators who share our vision of creating a step change in oncology.

We are strengthening Merck as a vibrant science and technology company. In this context, Darmstadt plays an important role as our headquarters and largest location, where all three business sectors are represented with their entire value chains and where we have invested around € 1 billion since 2015. At Merck, we are in a phase of accelerated growth and will continue to make targeted investments in Darmstadt as one of our centers for science and technology. For instance, in 2020 we will open a new research and development facility for Performance Materials that is currently under construction. And with projects such as a production site for Life Science's membrane business and a new training center, we plan to invest another € 1 billion in Darmstadt by 2025. The physical proximity of the business sectors in Darmstadt promotes cross-sector cooperation. By developing a state-of-the-art digital infrastructure and digital solution approaches, such as those pursued in our Innovation Center, we support profitable growth and new innovation fields.

Business Strategies

Healthcare

Our Healthcare business sector specializes in key franchises and specific diseases. Global megatrends – such as a rising prevalence of chronic diseases and the increase in average life expectancy – continue to drive the demand for our products. To meet these demands and respond appropriately to the dynamics of our markets, we have significantly transformed our Healthcare business sector in recent years.

Following on from the successes over the past three years, we continue to drive pipeline projects with the aims of bringing groundbreaking medicines to patients, maximizing our existing portfolio and continuing our expansion in growth markets. Our ambition is to become a global specialty innovator, operating in franchises with significant unmet medical needs and bringing high value to patients. Therefore, we continue to invest in research and development to discover new treatment options and improve existing ones. Together with our stakeholders and partners, we want to ensure that people can access the medicines they need to stay healthy and live longer.

The first pillar of our strategy is to reinforce our global footprint, bringing the innovation of our pipeline to patients and growing our presence – in the United States and in China, for example. The emerging markets and China are expected to be the largest growth drivers for many of our established products in the future. Managing the balance between delivering innovative new medicines while expanding our reach and ensuring the profitable growth of the existing business will be one of the strategic challenges. Fertility and endocrinology offer significant opportunities to bring value to patients, given their high profitability and growth potential. Maximizing the commercial potential of these areas will remain important.

The second pillar of our strategy is the focus on specialty medicine franchises. Here, we expect the oncology, immuno-oncology, and immunology markets to remain highly attractive in terms of size, growth prospects, and profitability. Within each specialty franchise, our approach is to develop deep internal expertise and insight, from internal research to commercialization, augmented by external talent sourcing, strategic partnering, and asset acquisitions.

The third strategic pillar is innovation: We aim to develop high-quality, first-to-market, and best-in-class therapies and to build a portfolio in each of our franchises. We have streamlined our pipeline and expanded our innovation capabilities with strong investigational drug candidates and technologies. In order to maximize the output of our R&D investments and increase our chances of success in discovering and developing new therapies, we focus our expertise on specific franchises and are exploiting synergies in disease mechanisms and biological pathways. We are investing in digital technologies as well as personalized and translational medicine in order to drive continued pipeline success.

In this context, strategic collaborations are an integral part of delivering on our commitment to transform the lives of patients living with serious unmet medical needs. We recognize the value of collaboration in the research and development of breakthrough therapies, as well as in strengthening our current portfolio. Here, we focus on balancing the right blend of internal capabilities and external partnerships (for example, with Pfizer and GlaxoSmithKline) and on building strong collaborations with other leaders in the industry.

Life Science

Life Science continues to deliver on our strategic agenda by increasing profitability due to strong organic growth. In 2019, we maintained our status as a top-three player in the industry. Our organic sales growth exceeded that of the industry and has remained the highest among integrated peers - as it has since the acquisition of Sigma-Aldrich in November 2015.

To sustain our leadership into the future, Life Science has established a strategy based on three key pillars:

1. Ensure operational excellence by focusing on building our base business, creating value in a strong organization and implementing consistent processes
2. Strengthen the core organization by expanding our leadership in bioprocessing and e-commerce as well as advancing our robust offering of testing kits and services to ensure food and beverage safety and quality
3. Establish new growth pillars through our three strategic initiatives: Gene Editing & Novel Modalities, BioReliance® End-to-End Solutions, and BrightLab™.

We have completed the integration of Sigma-Aldrich, the largest in our history and of the industry, during which we consistently outperformed the market. Work toward harmonizing our Enterprise Resource Planning (ERP) systems continues. Our aspiration remains to reinforce our leadership position as an innovation-driven tools supplier and collaborator dedicated to solving the toughest problems in life science.

Looking ahead, we expect our strategy to continue delivering net sales growth ahead of the market and further expand our market-leading EBITDA pre margin. For 2020, we will prioritize the continued support of new growth pillars with our Gene Editing & Novel Modalities offerings as well as differentiated gene editing tools, drug safety systems and models, and clinical viral vector manufacturing. In addition, we will further develop our BioReliance® End-to-End Solutions, a service offering for process development and manufacturing for emerging biotech companies, alongside our BioContinuum™ Platform, which addresses intensified bioprocessing and continuous manufacturing. We will also focus on expanding the use of BrightLab™, our digital solution for lab management, as well as our food and beverage testing kits and services.

Performance Materials

Performance Materials is currently undergoing a major transformation by repositioning its overall business toward the electronic materials market. This market is very attractive due to its long-term growth potential. The electronic content of any product is increasing; electronics are now part of nearly every product, and diversification is securing the market's long-term stability. Megatrends like the Internet of things (IoT), AI (artificial intelligence), and autonomous driving lead to high innovation pressure and drive the growth of data from every side. The global data volume grows exponentially with more than 30% annually; the "data explosion" will transform electronics far beyond what today's systems can handle. Data needs to be generated, transferred, processed, stored, and made comprehensible for humans through smart interfaces. Our strategy is to cover all aspects of this data handling and to enable processes by providing customized solutions for the production of innovative electronic components. We are the company behind the companies advancing digital living. Performance Materials targets the electronic materials market with a focus on the semiconductor and display industries in order to participate in the growth of data-driven electronics.

The Bright Future program ensures the successful transformation of Performance Materials by driving the realization of our strategy. Main outcomes are the shift of our portfolio into growing electronics segments, safeguarding our margin ambition, and changes in the culture within Performance Materials. The absolute growth of Semiconductor Solutions and the ongoing growth in OLED are expected to outweigh the decline in liquid crystal sales. We assume to stabilize the EBITDA pre margins at around 30% in the long term, well above the industry average. From 2020 onward, Performance Materials expects to be back to organic growth. With Versum Materials and Intermolecular, we are able to obtain a leading position in the electronic materials market. Overall, strategy realization within the electronics market is well on track, and we are working on measures in Surface Solutions to stabilize the business.

Our strategic priorities going forward:

- Drive top-line growth especially in Semiconductor Solutions and OLED
- Transform into a leading enabler for data driven electronics with best-in-class capabilities and portfolio
- Accelerate the realization of our growth ambitions through the successful integration of both Versum Materials and Intermolecular

Strategic finance and dividend policy

We are pursuing a conservative financial policy characterized by the following:

Financial flexibility and a conservative funding strategy

We ensure that we meet our obligations at all times and adhere to a conservative and proactive funding strategy that involves the use of various financial instruments. Our diversified and profitable businesses form the basis for our strong and sustainable cash flow generation capacity. Moreover, we have several funding resources in place. A € 2 billion syndicated loan facility, renewed in 2018, is in place until 2024 to cover any unexpected cash needs. The facility is a pure backup credit facility and has not been drawn on so far. In addition, we have a commercial paper program with a volume of € 2 billion at our disposal. Within the scope of this program, we can issue short-term commercial paper with a maturity of up to one year. Furthermore, in 2019, we used bilateral bank loan agreements with first-class banks to optimize our funding structure and cost. For the acquisition of Versum Materials, Merck also agreed on a US$ 6.3 billion acquisition loan with Merck's relationship banks, consisting of a US$ 4.0 billion bridge facility (which was never drawn and was canceled before the closing of the acquisition) and a US$ 2.3 billion term loan, which is partially drawn.

Additionally, as a general rule, the bond market represents a key element. The most recent bond issues took place in 2019 in connection with the acquisition of Versum Materials. Hybrid bonds (totaling € 1.5 billion) and euro bonds (totaling € 2.0 billion) were issued. The use of various instruments provides a broad financing basis and addresses different investor groups.

Maintaining sustainable and reliable business relations with a core group of banks

We mainly work with a well-diversified, financially stable and reliable group of banks. Due to Merck's long-term-oriented business approach, bank relationships typically last for many years and are characterized by professionalism and trust. The banking group consists of banks with strong capabilities and expertise in various products and geographic regions. We regard these banks as strategic partners. Accordingly, we involve them in important financing transactions.

Strong investment grade rating

The rating of our creditworthiness by external rating agencies is an important indicator of the company's financial stability. A strong investment grade rating is an important cornerstone of Merck's financial policy, as it safeguards access to capital markets at attractive financial conditions. Merck currently has a Baa1 rating from Moody's, an A rating from Standard & Poor's (S&P), and an A– rating from Scope, each with a stable outlook. Continuing to reduce our debt after the Versum Materials acquisition is of utmost importance to us.

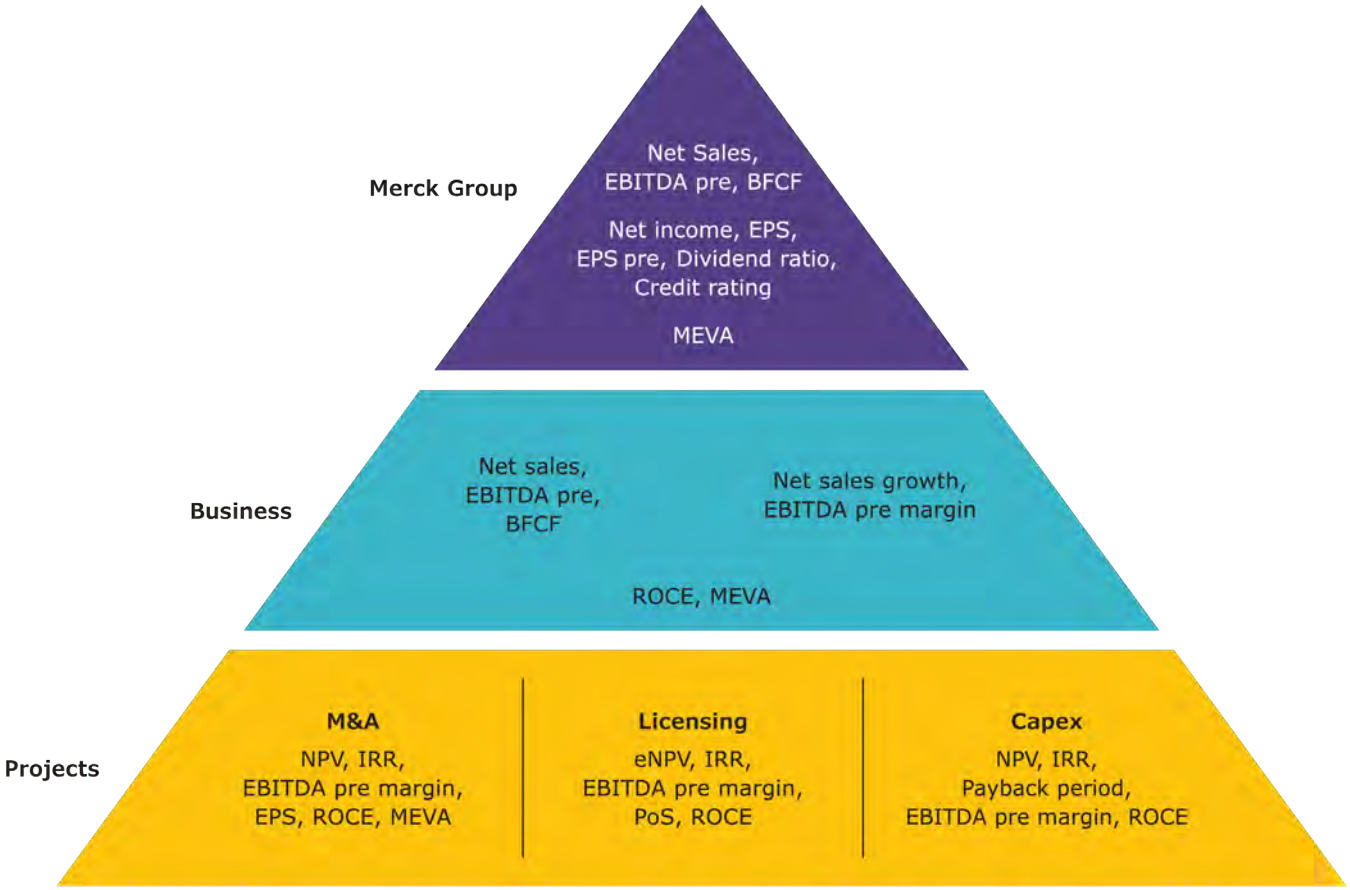
Sustainable dividend policy

We are pursuing a sustainable dividend policy. Provided the economic environment develops in a stable manner, the current dividend represents the minimum level for future dividend proposals. Our dividend policy will follow the business development and earnings increases over the coming years. However, dividend growth could deviate, for example, within the scope of restructuring or in the event of significant global economic developments. We aim for a target corridor of 20 – 25% of earnings per share pre.

Internal Management System

As a global company with a diverse portfolio of products and services, we use a comprehensive framework of indicators to manage performance. The most important key performance indicator (KPI) to measure performance is EBITDA pre[1].

The Value Creation and Financial KPI Pyramid, which summarizes the important financial performance measures of the Group, reflects the comprehensive framework of financial KPIs to steer the businesses and prioritize the allocation of cash resources. It consists of three managerial dimensions: Merck Group, Business, and Projects, each of which require the use of different indicators.



Abbreviations
EBITDA pre[1] = earnings before interest, income tax, depreciation and amortization, as well as adjustments
EPS = earnings per share.
EPS pre[1] = earnings per share before adjustments.
MEVA[1] = Merck value added.
BFCF[1] = business free cash flow.
ROCE[1] = return on capital employed.
NPV[1] = net present value.
IRR[1] = internal rate of return.
eNPV[1] = expected net present value.
PoS[1] = probability of success.
M&A = mergers and acquisitions.
[1] Not defined by International Financial Reporting Standards (IFRSs).

Key performance indicators of the Group and its businesses

The three key performance indicators of net sales, EBITDA pre, and business free cash flow are the most important factors for assessing operational performance. Therefore, we refer to these KPIs in the Report on Economic Position, the Report on Risks and Opportunities, and the Report on Expected Developments. As the most important indicators of financial business performance, the KPIs are key elements of our performance management system.

Net sales

Net sales are defined as the revenues from the sale of goods, services rendered to external customers, commission income and profit-sharing from collaborations, net of value added tax, and after sales deductions such as rebates or discounts. Net sales are the main indicator of our business growth and therefore an important parameter of external as well as internal performance measurement. In addition, organic sales growth is used for internal performance management. Organic sales growth shows the percentage change in net sales versus a comparative period, adjusted for exchange rate and portfolio effects. Exchange rate effects may arise as a result of foreign exchange fluctuation between the functional non-euro currency of a consolidated company and the reporting currency (euro). By contrast, portfolio effects reflect sales changes due to acquisitions and divestments of consolidated companies or businesses.

MERCK GROUP

Net sales

			Change	
€ million	**2019**	2018	€ million	%
Net sales	**16,152**	**14,836**	**1,315**	**8.9**

EBITDA pre

EBITDA pre is the main performance indicator measuring ongoing operational profitability and is used internally and externally. To provide an alternative understanding of the underlying operational performance, it excludes from the operating result depreciation and amortization, impairment losses and reversals of impairment losses, as well as adjustments. These adjustments are restricted to the following categories: integration expenses, IT expenses for selected projects, restructuring expenses, gains/losses on the divestment of businesses, acquisition expenses, and other adjustments. The classification of specific income and expenses as adjustments follows clear rules and underlies strict governance at Group level. Within the scope of internal performance management, EBITDA pre allows for necessary changes or restructuring without penalizing the performance of the operating business. The following table shows the composition of EBITDA pre in fiscal 2019 compared to the previous year. These figures were adjusted in accordance with IFRSs by the adjustments included in the functional costs.

MERCK GROUP

Reconciliation EBITDA pre[1]

€ million	2019 IFRSs	2019 Elimination of adjustments	2019 Pre[1]	2018[2] IFRSs	2018[2] Elimination of adjustments	2018[2] Pre[1]	Change Pre[1]
Net sales	**16,152**	**–**	**16,152**	**14,836**	**–**	**14,836**	**8.9%**
Cost of sales	-6,006	56	-5,950	-5,382	45	-5,337	11.5%
Gross profit	**10,145**	**56**	**10,202**	**9,454**	**45**	**9,499**	**7.4%**
Marketing and selling expenses	-4,576	10	-4,566	-4,396	13	-4,384	4.2%
Administration expenses	-1,154	109	-1,045	-1,183	190	-993	5.2%
Research and development costs	-2,268	29	-2,239	-2,227	2	-2,225	0.7%
Impairment losses and reversal of impairment losses on financial assets (net)	-8	–	-8	27	–	27	> 100.0%
Other operating income and expenses	-19	123	104	52	78	129	19.6%
Operating result (EBIT)[1]	**2,120**			**1,727**			
Depreciation/amortization/impairment losses/reversals of impairment losses	1,946	-9	1,937	1,801	-55	1,746	11.0%
EBITDA[1]	**4,066**			**3,528**			
Restructuring expenses	120	-120	–	46	-46	–	
Integration expenses/IT expenses	95	-95	–	142	-142	–	
Gains (-)/losses (+) on the divestment of businesses	6	-6	–	25	-25	–	
Acquisition-related adjustments	84	-84	–	2	-2	–	
Other adjustments	13	-13	–	58	-58	–	
EBITDA pre[1]	**4,385**	**–**	**4,385**	**3,800**	**–**	**3,800**	**15.4%**
thereof: organic growth[1]							11.3%
thereof: exchange rate effects							2.5%
thereof: acquisitions/divestments							1.6%

[1] Not defined by International Financial Reporting Standard (IFRSs).

[2] Previous year's figures have been adjusted, see Note "Effects from new accounting standards and other presentation changes" in the Notes to the Consolidated Financial Statements.

Business free cash flow (BFCF)

Business free cash flow comprises the major cash-relevant items that the operating businesses can influence and that are under their full control. It comprises EBITDA pre less investments in property, plant, equipment, software, advance payments for intangible assets, changes in inventories, trade accounts receivable, and receivables from royalties and licenses. To manage working capital on a regional and local level, the businesses use the two indicators "days sales outstanding" and "days in inventory".

MERCK GROUP

Business free cash flow[1]

€ million	2019	2018	Change € million	Change %
EBITDA pre[1]	**4,385**	**3,800**	**585**	**15.4%**
Investments in property, plant, equipment and software, as well as advance payments for intangible assets	-1,026	-932	-94	10.1%
Changes in inventories	-577	-214	-363	> 100.0%
Changes in trade accounts receivable as well as receivables from royalties and licenses	-259	-145	-114	78.6%
Lease payments[2]	-136			
Elimination of first-time consolidations	346			
Business free cash flow[1]	**2,732**	**2,508**	**224**	**8.9%**

[1] Not defined by International Financial Reporting Standard (IFRSs).
[2] Excluding payments for low-value leases and interest components included in lease payments.

Investments and value management

Sustainable value creation is essential to secure the long-term success of the company. To optimize the allocation of financial resources, we use a defined set of parameters as criteria for the prioritization of investment opportunities and portfolio decisions.

Net present value (NPV)

The main criterion for the prioritization of investment opportunities is the net present value. It is based on the discounted cash flow method and is calculated as the sum of the discounted free cash flows over the projection period of a project. The weighted average cost of capital (WACC), representing the weighted average of the cost of equity and cost of debt, is used as the discount rate. Depending on the type and location of a project, different markups are applied to the WACC.

Internal rate of return (IRR)

The internal rate of return is a further important criterion for the assessment of acquisition projects and investments in property, plant, and equipment, as well as intangible assets. It is the discount rate that makes the present value of all future free cash flows equal to the initial investment or the purchase price of an acquisition. A project adds value if the internal rate of return is higher than the weighted cost of capital including markups.

Return on capital employed (ROCE)

In addition to NPV and IRR, when looking at individual accounting periods, return on capital employed is an important metric for the assessment of investment projects. It is calculated as the adjusted operating result (EBIT) pre divided by the sum of property, plant, equipment, intangible assets, trade accounts receivable, trade accounts payable, and inventories.

Payback period

An additional parameter to prioritize investments in property, plant, equipment, and intangible assets is the payback period, which indicates the time in years after which an investment will generate positive net cash flow.

Merck value added (MEVA)

Merck value added gives information about the financial value created in a period. Value is created when the return on capital employed (ROCE) of the company or the business is higher than the weighted average cost of capital (WACC). MEVA metrics provide us with a powerful tool to weigh investment and spending decisions against capital requirements and investors' expectations.

Capital market-related parameters

Net income, earnings per share (EPS), and earnings per share pre (EPS pre)

Earnings per share are calculated by dividing profit after tax attributable to the shareholders of Merck KGaA (net income) by the weighted average number of theoretical shares outstanding. The use of a theoretical number of shares takes into account the fact that the general partner's capital is not represented by shares. To provide an alternative view, we also report earnings per share pre, in other words, after the elimination of the effects of integration expenses, IT expenses for selected projects, restructuring expenses, gains/losses on the divestment of businesses, acquisition expenses, and other adjustments. Moreover, amortization of acquired intangible assets as well as impairment losses on property, plant, equipment, and intangible assets are eliminated. The adjustment excludes impairment losses on intangible assets for acquired research and development (R&D) projects below a threshold value of € 50 million. Income tax is calculated on the basis of the company's underlying tax rate. The following table presents the reconciliation of net income to net income pre for the calculation of EPS pre.

MERCK GROUP

Reconciliation of net income to net income pre[1]

			Change	
€ million	**2019**	2018	€ million	%
Net income	1,320	3,374	-2,053	-60.9%
Non-controlling interests	3	22	-19	-85.1%
Profit after tax from discontinued operation	-28	-2,303	2,275	-98.8%
Income tax	440	368	72	19.7%
Amortization of acquired intangible assets	1,119	1,175	-55	-4.7%
Adjustments[1]	369	327	42	12.7%
Income taxes on the basis of the underlying tax rate[1]	-807	-741	-66	8.9%
Non-controlling interests to be adjusted		-3	3	100.0%
Net income pre[1]	2,417	2,219	198	8.9%
Earnings per share pre[1] (€)	5.56	5.10	0.46	9.0%

[1] Not defined by International Financial Reporting Standards (IFRSs).

Credit rating

The rating of our creditworthiness by external agencies is an important indicator with respect to our ability to raise debt capital at attractive market conditions. The capital market makes use of the assessments published by independent rating agencies in order to assist debt providers in estimating the risks associated with a financial instrument. We are currently assessed by Moody's, Standard & Poor's, and Scope. The most important factor for the credit rating is the ability to repay debt, which is determined in particular by the ratio of operating cash flow to net financial debt.

Dividend ratio

With the aim of ensuring an attractive return for our shareholders, we are pursuing a reliable dividend policy with a target payout ratio based on EPS pre (see definition above).

Other relevant/non-financial performance measures

Apart from the indicators of the financial performance of the businesses, non-financial measures also play an important role in furthering the success of the company. From a Group perspective, innovations in the businesses as well as the promotion of a diverse workforce, especially at the leadership level, and sustained planning for the filling of company-critical positions, are of particular importance.

Innovation

Innovations are the foundation of our business and will also be the prerequisite for future success in changing markets. We are continuously working to develop new products and service innovations for patients and customers. Indicators for the degree of innovation are defined individually depending on the specifics of the respective businesses.

Sustained employee development

We believe that a diverse workforce strengthens our ability to innovate. We actively promote diversity among our leaders to create an integrative culture that reflects our values and enables every employee to fulfill their potential. We ensure that our ambitious corporate goals can be realized through strategic succession planning for company-critical positions. To gauge the success of the related measures, we have introduced these two focus issues as non-financial indicators.

Corporate Responsibility*

We take responsibility every day – and have been doing so for over 350 years. This commitment is codified in our corporate strategy and values. Responsible conduct with respect to employees, products, the environment, and society is a fundamental prerequisite for our business success.

Strategy and management

Our corporate responsibility (CR) activities are steered by our CR Committee, which consists of representatives from our business sectors and relevant Group functions, such as Environment, Human Resources, Compliance, and Procurement. The Chairman of the Executive Board is responsible for the Committee, which is chaired by the head of the Group Corporate Responsibility unit.

Humankind is being confronted with global societal challenges such as climate change, resource scarcity, an increasing global population, rising life expectancy, and insufficient access to healthcare in low and middle-income countries. Responsible governance can help solve these global issues. We believe that in pursuing this approach, we can also strengthen our financial performance. In 2019, we continued the realignment of our CR strategy begun in 2018. We are increasingly pursuing a shared value approach and are working to make the value we create measurable for the company and for society. We have defined three strategic spheres of activity as the center of our CR strategy: Global Health, Sustainable Solutions, and Broad Minds. We focus our resources on those areas where we can have the greatest impact. Needless to say, we respect the interests of our employees, customers, investors, and communities in which we operate, and we work to minimize ethical, economic, and social risks, thereby sustainably contributing to our long-term corporate success.

* The contents of this chapter or section are voluntary and th refore not audited. However, our auditor has read the text critically.

Global Health: We are developing and producing medicine and intelligent devices that contribute to comprehensive healthcare. Awareness plays a key role in our approach to improving access to healthcare, which is why we regularly conduct campaigns to raise awareness of various diseases across the globe. We focus on those diseases that align with our core competencies, expertise and experience along the health value chain. In collaboration with our partners, we also support people in low and middle-income countries, for example by donating praziquantel tablets for the treatment of schistosomiasis. Through our Global Health Institute, we are developing diagnostics, therapies, and preventive solutions to fight malaria, schistosomiasis, and other infectious and tropical diseases.

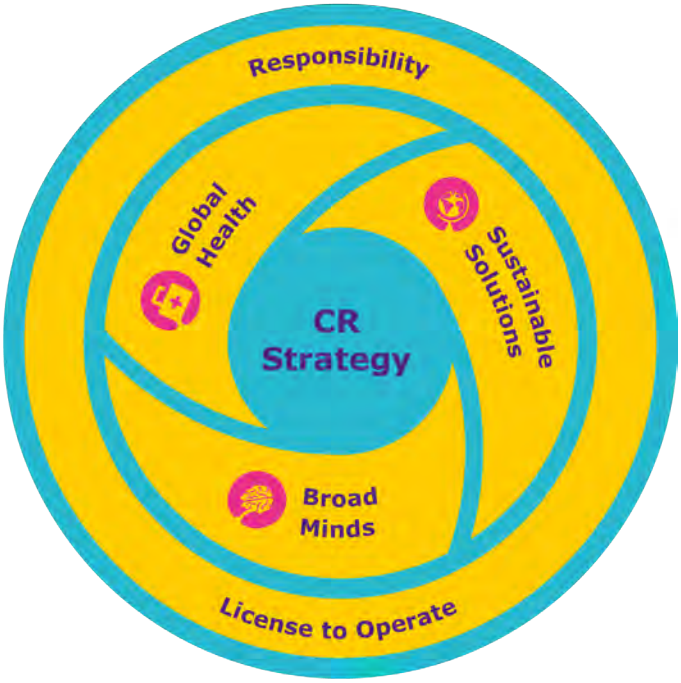
Sustainable Solutions: We are constantly working to improve the sustainability footprint of our products – even during their use phase – which also helps our customers achieve their own sustainability goals. For example, with our Design for Sustainability program in the Life Science business sector, we have developed a systematic approach for product development. This approach allows us to review the sustainability of products during the development process. This is achieved, for instance, by product developers using product lifecycle analyses.

Broad Minds: As a science and technology company, we endeavor to excite people about science, inspire curiosity, and help creativity to soar. Our goal is to strengthen our reputation in the field of science, especially in those areas where we have particular expertise. We not only support educational programs for schools, but also back pioneering research at universities. Reflecting the way that music and literature inspire people, we promote a range of cultural initiatives worldwide. Creativity and curiosity are the bedrock of science, culture, and art, and they also underpin our holistic approach.

Our corporate responsibility efforts are aligned with the United Nations (UN) Sustainable Development Goals (SDGs), and we are working to help achieve this ambitious agenda by 2030. However, our contribution toward achieving the SDGs does not limit itself to the strategic spheres of activity established in our Corporate Responsibility strategy. We report on which specific sub-goals of relevant SDGs we support through our management approaches, products, and projects, and we identify material goals based on these SDGs.

In addition to promoting the SDGs, we also support relevant responsible governance initiatives. Through our membership in the UN Global Compact, we are committed to upholding the Compact's principles on human rights, labor standards, environmental protection, and anticorruption. We ensure that we live our own corporate responsibility principles by following the guidelines of the Responsible Care Global Charter, which is an initiative of the International Council of Chemical Associations (ICCA). Responsible Care aims to help the chemical industry enhance its environmental, health, and safety performance. We are also a member of the Chemie^3 initiative in Germany, a collaboration between the German Chemical Industry Association (VCI), the German Employers' Federation of the Chemical Industry (BAVC), and the German Mining, Chemical, and Energy Industrial Union (IG BCE). This globally unique alliance seeks to make sustainability a core part of the chemical industry's guiding principles and to drive the sector's position within the German economy as a key contributor to sustainable development.

To us, corporate responsibility means listening and taking action, and so we place great importance on dialogue with our various stakeholders. These stakeholders include employees, business associates, the Merck family, investors, regulatory agencies, industry associations, and non-governmental organizations (NGOs). This continuous exchange creates transparency and clearly demonstrates how we live our values.



In recognition of our dedication to responsible and sustainable business practices, we were able to maintain our good position in sustainability evaluations in 2019 and are listed on numerous indices. We are included in the FTSE4Good index, the STOXX Global ESG Leaders index, the Euronext Vigeo Eurozone 120 index, and the Ethibel Sustainability Index (ESI) Excellence Europe. In early 2019, the independent rating agency EcoVadis granted us Gold status for our sustainability engagement. EcoVadis examines around 60,000 suppliers from 155 countries across four categories: environment, social affairs, ethics, and sustainable procurement.

Strategic sphere of activity: Global Health

Our aim is to create a healthier future for all, including individuals, communities, and countries. We want to use innovation in science and technology to improve the health of underserved populations in low and middle-income countries. To achieve this, we are leveraging our expertise from all business sectors and collaborating closely with a wide range of partners. We also participate in industry-wide initiatives and work closely with other businesses to develop new approaches.

Our Global Health strategy is designed to overcome access barriers for underserved populations and communities in low and middle-income countries in an economically viable and sustainable manner to create shared value for our business and for society. We want to develop a business model that increases the value and competitiveness of our company while solving unmet health needs and strengthening health systems. We want to be instrumental in curbing schistosomiasis and fighting malaria and other infectious diseases while helping to build local capacity across the value chain. In the Access to Medicine Index, which is published every two years, Merck continued to rank fourth in 2018. This index assesses the world's leading pharmaceutical companies on activities and initiatives they have implemented to promote access to medicine in low and middle-income countries.

Strengthening the availability of healthcare solutions

We research, develop and refine healthcare solutions that address unmet needs, tailoring them to local environments. With our Global Health Institute, we have defined a comprehensive portfolio of R&D projects to develop integrated health solutions. This includes treatments, diagnostics, preventive measures against infections, and approaches to strengthen health systems — targeting schistosomiasis, malaria, and bacterial infections. For schistosomiasis, the portfolio also includes the development of a new pediatric formulation of praziquantel to treat the worm disease schistosomiasis in children under the age of six, through the Pediatric Praziquantel Consortium, a public-private partnership. We started a Phase III study in September 2019 and expect the product to be ready to launch in the first affected countries in Africa in 2022.

As part of our One Merck for Malaria program, we completed a Phase I/Ib clinical trial of our anti-malarial compound M5717. In the upcoming next phase of the program, we will examine options for developing the substance in combination with other anti-malarial compounds for single administration in combination therapy to treat or prevent malaria.

In the drug discovery area, our strategic collaboration with the University of Cape Town in South Africa and the Medicines for Malaria Venture has continued the screening of our almost 100,000 proprietary substances with the aim of identifying new drug candidates for treatment of malaria, while also expanding our research capacity in and for Africa. This program is co-funded by the German Federal Ministry of Education and Research.

Additionally, we are working toward making IR3535® available as a malaria prevention method in Africa. This insect repellent is already used for complementary prevention from vector-borne diseases such as dengue fever and ZIKA. Products containing this active ingredient stand out due to their particularly good tolerance in young children and pregnant women.

In 2019, we continued our collaboration to support the National Malaria Control Program in Ghana. Alongside an integrated approach of prevention and diagnosis of the disease, we aim to expand local research competencies.

Addressing affordability challenges

Through intellectual property initiatives and equitable pricing strategies, we can assist those people who are unable to pay for the health solutions they need. We refrain from filing or enforcing patents in many low and middle-income countries and use a publicly available database to be transparent about our patents and patent applications.

Through our Open Innovation Initiative, we are addressing affordability challenges around intellectual property (IP) with an initial focus on neglected disease areas where we do not have portfolio competencies or expertise. Under this platform, we are a member of WIPO Re:Search, an open innovation platform sponsored by the World Intellectual Property Organization (WIPO) to accelerate early discovery of active ingredients for compounds through the sharing of IP and know-how. Our newest collaboration is with the University of Yaoundé I in Cameroon, at which our compound library is being screened for a potential cure for Buruli ulcer. We are also a member of the Drugs for Neglected Diseases initiative (DNDi) NTD Drug Discovery Booster, which simultaneously searches the compound libraries of the eight partnering companies.

In 2019, we continued our long-term partnership with the World Health Organization (WHO), under which we undertake to donate praziquantel tablets every year. The tablets are distributed in 47 affected countries in Africa for the treatment of school children. In 2019, we donated over 233 million tablets for distribution in 35 countries. Since 2007 we have supplied more than one billion tablets free of charge, which is equivalent to the treatment of around 400 million school children. Latest numbers from WHO show that in 2017, 72% of all school-aged children in need of treatment in sub-Saharan Africa were treated. As a founding member of the Global Schistosomiasis Alliance, we are at the forefront of the campaign to eliminate schistosomiasis worldwide.

Raising awareness

Through access to the appropriate tools, knowledge, and skills, we help health professionals, communities, and patients make informed decisions about prevention, diagnostics, treatment, and care. Our regular campaigns help increase awareness of certain diseases globally, with a focus on those diseases where we have extensive expertise, such as cancer, thyroid disorders, diabetes, multiple sclerosis, and infertility. In addition, Merck has championed World Malaria Day with awareness campaigns and through engagement around the One Merck for Malaria program.

Together with the NALA Foundation, we have been involved in a schistosomiasis health education project in rural southwestern Ethiopia since late 2017. The project helps to promote the long-term behavioral change that is needed to eliminate schistosomiasis. In 2019, we extended the project to two additional districts and reached around 188,000 people, of which nearly 40% were school children. In a survey, we learned that 58% of children had never heard of intestinal parasites. This demonstrates the importance of further health education.

Furthermore, Embracing Carers is a global initiative that we lead in collaboration with prominent caregiving organizations around the world. Embracing Carers is designed to heighten awareness of the often-overlooked needs of caring relatives and care staff as well as stimulating a public debate about this issue and any relevant measures. We believe that care in today’s healthcare policy is the issue that receives the least attention. In 2019, Embracing Carers backed up words with action and launched the global Time Counts campaign. The campaign calls for the support of caring relatives through gestures large and small and the offer of time.

Promoting accessibility and improving supply chains

We promote initiatives to strengthen supply chains and to develop localized health solutions in order to deliver and reach out efficiently at the point of care. We are a founding member of the Accessibility Platform, an informal, private-sector initiative that is working on a comprehensive approach to meeting supply chain and distribution challenges in countries with low or medium income. In a collective action, we are engaging in an Access Delivery mentorship program. A pilot was successfully launched and implemented in Tanzania with Bahari, a local private wholesaler, in collaboration with Business for Health Solutions (BHS).

NTDeliver is our digital information tool for improving transparency in medicine donation supply chains created through public-private partnerships. Deliveries from companies running donation programs are clearly displayed — from purchase orders made by WHO through delivery to the first warehouse in the destination country. This improves coordination and provides a more transparent overview of the in-country inventory. In Kenya, where schistosomiasis poses a significant risk to schoolchildren, we are collaborating with around 12,000 teachers across the country to support the de-worming program running with WHO. We deploy our NTDeliver tool to monitor volumes of medicines reaching schools, particularly "last mile" deliveries to remote, rural locations. In 2019, we further improved the tool and firmly established it as an essential part of the program. Building on this experience, we are reviewing the best way to retrieve unused medicines from the field and store them centrally for upcoming de-worming campaigns.

To realize our vision of achieving basic medical care everywhere and for everyone, we want to help eliminate inequality in access to healthcare in emerging economies. Our CURAFA™ stations serve as points of care for integrated primary healthcare. In these communities, local pharmacists and nurses provide pharmaceutical and clinical services, medicine, digital health solutions, health education, and insurance and financing schemes. In Kenya we have five facilities running that in 2019 served a total of more than 2,000 patients a month.

Falsified medicines pose a threat to millions of people. Latest figures refer to around one million deaths per year due to the use of ineffective or toxic products. Merck is fighting against falsified medicines — for instance through the Global Pharma Health Fund (GPHF), a non-profit organization funded by our company. Its mission is to combat falsified and poor-quality medicines in low and middle-income countries. The GPHF Minilab™ fits into a tropics-resistant flight case and enables scientists and clinical staff to verify some 100 active pharmaceutical ingredients in medicines for authenticity. More than 850 Minilabs are currently in use. 21 Minilabs were delivered in 2019. Of these, 15 went to the Philippines and the remaining six to Bangladesh, the Democratic Republic of the Congo, India, and Mongolia. Furthermore, we are collaborating with Boston University to explore new technologies against falsified medicines, particularly for antimalarials and antimicrobials. The objective is to test, validate, and optimize a new user-friendly technology to qualitatively and quantitatively assess the validity of drugs.

Strategic sphere of activity: Sustainable Solutions

Through our products, we are helping our customers reduce the impact of their own activities on sustainability and achieve their own sustainability goals.

Life Science: reducing environmental impact throughout the product life cycle

We aim to continuously improve the environmental impact of our products. This applies to the entire life cycle — from production and use through to the disposal of our products. To lower the environmental impact of our devices and instruments during use by customers, we apply our Design for Sustainability (DfS) program. This comprehensive approach keeps sustainability criteria in the foreground during product development or re-engineering and documents them in a scorecard. When developing a new product, our aim is to improve as many of these criteria scores as possible. Beginning with the concept stage, product teams identify potential environmental impacts and opportunities to make improvements. By the end of 2019, 32% of these product development projects met at least three or more sustainability criteria.

In addition, our researchers are developing innovative solutions in line with the 12 Principles of Green Chemistry developed by chemists Paul T. Anastas and John C. Warner. The objective is to enable research that is as environmentally conscious as possible and to minimize adverse effects on human health. More than 830 greener alternatives to conventional products are available so far. With DOZN®, we have developed a web-based quantitative Green Chemistry analysis tool. To date, we have used this matrix to assess and improve more than 45 products. In 2019, we launched a version of the tool for our customers. DOZN® 2.0 brings new

possibilities for sustainable product design to our customers and empowers them with data to make more environmentally friendly choices in their development processes.

We are expanding our portfolio to include greener alternatives, such as the new bio-based solvent Cyrene™, which is derived from waste cellulose and is employed as an alternative to widely used solvents that are subject to increasing regulatory restrictions due to their associated toxicity. Cyrene™ was named Environmental Product of the Year at the Environmental Leader Awards in 2019.

The application of single-use products, many of which pose a challenge to recycle in the current infrastructure, is growing as life science markets are expanding and adopting new technologies. We have developed innovative recycling programs that led to the recycling of almost 4,200 metric tons of our customers' products from 2015 to 2019. The figure for 2019 alone was 1,500 metric tons, which means our target of recycling a total of 5,000 metric tons by 2020 is easily achievable.

In 2019, we launched a sustainable packaging strategy for Life Science called SMASH Packaging. The strategy is built on three pillars: optimizing resources, using more sustainable materials, and designing for a circular economy. We set specific 2022 targets, such as reducing air space in distribution packaging by 20%, demonstrating that our packaging materials do not contribute to deforestation, and reducing our use of expanded polystyrene (EPS) by 20%.

Performance Materials: increasing the sustainability of end products

Windows that can be darkened in a matter of seconds are now a reality, thanks to our liquid crystal window (LCW) technology. These darkened windows regulate the heat generated by direct sunlight. Based on initial estimates, this technology is capable of lowering the energy consumption caused by air conditioning in buildings, as well as replacing conventional sun protection systems. This helps save materials and costs during construction. The LC material is commercialized under our licrivision® and eyrise™ brands.

In the cosmetics industry, we are addressing the continuing trend towards ingredients that meet stringent sustainability criteria. Our portfolio of fillers eliminates the need for microplastic particles that are heavily criticized for polluting waters and damaging marine life. Our cosmetic formulations comply with strict criteria. By the end of 2019, 73 of our cosmetic pigments and active ingredients were certified according to Ecocert's COSMOS standard for organic and natural cosmetics. We also obtained halal certificates for our Eusolex T and UV-Titan product ranges.

Strategic sphere of activity: Broad Minds

The promotion of science, education, and culture in an integrated manner constitutes one of the central concerns of our engagement in society. In this way, we champion characteristics that are indispensable for our activities as a science and technology company: creativity, passion for new discoveries and curiosity, and the courage to transcend boundaries.

Boosting scientific education

We view education as a key component of culture — and vice versa. Education can help us understand culture. But culture can also build a bridge to education by stimulating curiosity and creativity. We therefore support educational projects at many of our sites. For instance, we grant scholarships and help to create interesting science classes in school through employee volunteering. We want to spark interest in science, particularly among young people. This is why we have been supporting the "Jugend forscht" (Young Researchers) competition for more than 35 years. Since 1996, we have been organizing the state-level competition for the German Federal State of Hesse. 72 future young scientists took part in the 2019 competition. In the reporting year, we awarded the Julius Adolph Stöckhardt prize for the first time. This award recognizes committed chemistry teachers who conduct innovative experiments to impart chemistry to students in captivating ways.

Through our Junior Labs, we want young people to enjoy conducting experiments. These learning labs at the Technical University of Darmstadt combine classroom instruction with trending topics and modern research methods. In 2019, around 2,500 school students used the chemistry laboratory and around 1,500 school students experimented in the biology laboratory.

As part of SPARK, our global volunteer program, employees from our Life Science business sector share their skills and experience with students and support our local communities. The program is intended to spark curiosity in science and inspire students to consider a STEM[1]-related career. In 2019, more than 2,300 employees invested more than 19,400 hours in the program, reaching

[1] Science, Technology, Engineering, and Mathematics

over 66,500 young people. As part of SPARK, in 2019, we once again sent our Curiosity Cube™ on a journey through the United States and Canada. This is a freight container that has been transformed into a mobile laboratory and is equipped with state-of-the-art technology. Directed by our employees, school students can use it to carry out scientific experiments. In 2019, the Cube traveled approximately 48,000 kilometers across the United States and engaged students in 99 communities. 94% of schools visited fall under the Title 1 category, where students mainly come from low-income backgrounds.

The Deutsche Philharmonie Merck

The Deutsche Philharmonie Merck is our musical ambassador. We consider classical music to be the universal language that brings people together; as such, it is an important part of our culture. The concerts of this professional ensemble represent an integral part of cultural life in the vicinity of our Group headquarters in Darmstadt and remain highly popular, with around 21,000 people having attended these concerts in 2019. In the orchestra workshop, children and teenagers gained their first experience in a professional orchestra. We also fostered enthusiasm for classical music among young people through cushion concerts for children aged four years and above, as well as through youth concerts. In addition, the orchestra again toured internationally. In 2019, one concert took place in Moscow.

Promoting literature

Like music, literature is an important mediator between cultures. That is why we support five literary prizes in Germany, India, Italy, Japan, and Russia. The awards primarily recognize those authors who build bridges between cultures as well as between literature and science. We awarded two of the prizes in 2019: The Johann Heinrich Merck Award for Literary Critique and Essay in Germany went to author Daniela Strigl, and the winner of the Merck-Tagore Literature Award in India was Kris Manjapra.

Responsibility for our products

The safety of our products is at the core of our corporate responsibility. When used properly, they must pose no risk to customers, patients, consumers, or the environment. Our goal is to ensure a positive benefit/risk profile for our products, which is why we regularly examine safety across their entire life cycle and continuously take steps to minimize risks. We provide patients, consumers, and customers with extensive informational material so they can use our products in a safe, responsible, and proper manner.

In our pharmaceutical marketing activities, the focus is always on the health and well-being of patients because we want them to receive effective and high-quality treatment. All guidelines pertaining to marketing and advertising are part of our Group-wide compliance program, which is complemented by our internal guidelines and various voluntary commitments that, in many cases, far exceed the applicable statutory regulations.

Safety of our chemical products

Numerous regulations are in place to ensure that chemicals pose no risk to humans or the environment. Compliance with these regulatory requirements is an important part of our work. Our Group-wide Regulatory Affairs Governance Policy governs the processes with which we implement and manage product safety as well as the corresponding management structures. We incorporate all relevant national and international chemical regulations into our policies and guidelines. This includes the EU chemicals regulation REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) and CLP (Classification, Labelling and Packaging of Substances and Mixtures, EU GHS). We issue all chemicals classified as hazardous with safety data sheets, which contain information on the physicochemical, toxicological, and ecotoxicological properties of the agent and reflect the relevant regulatory requirements of the countries in which they are published. We have standardized and automated the majority of our Group-wide hazard communication processes. In the course of integrating the companies we acquired, Versum Materials and Intermolecular, we are examining compliance with the applicable regulatory requirements and our internal standards and making any necessary adjustments to the underlying processes.

Safety of our Healthcare products

Patient safety has a top priority in everything we do. During the entire life cycle of our medicines, we provide patients and physicians with up-to-date risk-benefit evaluations. To this end, company experts process safety-relevant information from various sources such as clinical trials, adverse reaction reports, and medical/scientific literature. Our Global Patient Safety unit continuously monitors and evaluates the safety and risk-benefit ratio of our pharmaceutical products worldwide (pharmacovigilance). Presided over by our Global Chief Medical Officer, our Medical Safety and Ethics Board examines and assesses, where necessary, significant medical safety risks and questions regarding risk-benefit evaluations. For products in our Allergopharma business, we have also developed comprehensive clinical efficacy and safety profiles that we continuously update. For the safety of patients, we have established a global pharmacovigilance system that we are always working to enhance.

Quality of our products

Our goal is to provide customers and patients with high-quality products at all times. Through our quality vision – "Quality is embedded in everything we do!" – we remind our employees of their responsibility across all business sectors, all Group functions, and all levels of the company.

Supplier management

We procure many raw materials, packaging materials, technical products, components, and services worldwide. We aim to promote supply chain stability while providing our customers with high-quality products and services. Our supplier management focuses on compliance with fundamental environmental and social standards in addition to high-quality, delivery reliability, and competitive prices. They are set out in our Responsible Sourcing Principles and primarily derived from the core labor standards of the ILO (International Labour Organisation) and the UN Global Compact.

Due to the global focus of our procurement, we are continuously working to ensure adherence to our supply chain standards. As a member of the industry initiative Together for Sustainability (TfS), we are able to use the supplier self-assessments and audit results shared among all member companies, who in turn abide by all restrictions stipulated within competition law.

In the course of integrating Versum Materials and Intermolecular, we are examining conformance with our policies and processes and will make any necessary adjustments.

Responsibility for our employees

Our employees contribute to groundbreaking progress in science and technology across the world. They are the basis of our success and therefore play a central role in the success of our business. In accordance with the Merck values, we live a culture of mutual esteem and respect. To remain successful in the future, we want to attract people to our company who contribute their curiosity, courage, and spirit of invention. We therefore place a strategic focus on employee development, leadership, and performance management. Furthermore, we strive to foster diversity among our employees (more information can be found under "People at Merck").

Responsibility for the environment

We seek to impact the environment as little as possible while doing business. This is the reason we work to efficiently conserve resources such as energy, water, and raw materials, while also continuously reducing our emissions and waste.

Environmental management system

In our Corporate Environment, Health and Safety Policy, which is applicable Group-wide, we have defined our principles and strategies for environment, health, and safety. It is an integral component of our EHS management system, which is certified annually by external auditors in accordance with the international standard ISO 14001. At all our sites, local EHS managers oversee operational environmental protection measures. These employees continually receive training and obtain additional qualifications. Since our businesses are constantly changing, we carry out internal audits of our environmental management system and have this

audited externally on a regular basis to ensure that the ISO 14001 requirements are still being met. In 2019, we obtained an ISO 14001 group certificate for the 11th consecutive year. This certificate covers 81 sites around the world. In the course of integrating Versum Materials and Intermolecular, we are examining compliance with our requirements and making any necessary adjustments to the underlying processes. The environmental KPIs reported do not yet include any data relating to these two acquired companies.

Focus areas: Energy efficiency, greenhouse gas emissions, water, waste, and recycling

Climate impact and resource scarcity are key challenges facing society. Seeking to make a positive contribution is for us a given. We have therefore set ourselves the goal of reducing total direct and indirect greenhouse gas emissions by 20% by 2020 (2006 baseline), irrespective of production growth. In total, we emitted 665,000 metric tons of CO_2 equivalents (CO_2eq) in 2019. We have thus reduced our greenhouse gas emissions by around 15% when compared with 2006, even though our operating business has grown.

In 2019, our company received a "C" rating from the CDP (formerly the Carbon Disclosure Project), thus maintaining the results achieved in 2018 (likewise "C"). The CDP analyzes companies in terms of their performance and transparency in climate impact and water management.

ENERGY CONSUMPTION[1]

In gigawatt hours	2016	2017	2018[2]	**2019[3]**
Total energy consumption	**2,117**	**2,194**	**2,227[4]**	**2,240**
Direct energy consumption	**1,330**	**1,319**	**1,323[4]**	**1,339**
Natural gas	1,260	1,254	1,257[4]	1,273
Liquid fossil fuels[5]	36	32	32	33
Biomass and self-generated renewable energy	34	33	34	33
Indirect energy consumption	**787**	**875**	**904[4]**	**901**
Electricity	692	729	755[4]	756
Steam, heat, cold	95	146	149	145
Total energy sold	**0.3**	**0.1**	**0.0**	**0.1**
Electricity	0.3	0.1	0.0	0.1
Steam, heat, cold	0.0	0.0	0.0	0.0

[1] In line with the Greenhouse Gas Protocol, for all previous years (up to the 2006 baseline) the energy consumption has been calculated based on the corporate structure as of December 31 of the reporting year and retroactively adjusted for acquisitions or divestments of (parts of) companies, or for changes in emission factors (portfolio-adjusted).

[2] Since 2018, our reported figures have excluded the Consumer Health business, which was divested on December 1, 2018.

[3] Since 2019, our reported figures have included Intermolecular (acquired on September 20, 2019). Data on Versum Materials (acquired on October 8, 2019) are not yet available. We are presently reviewing the current process for collecting greenhouse gas and energy consumption-related indicators and are working to harmonize methodologies and timelines. Starting in 2020, we will be incorporating the environmental figures for Versum Materials into our reporting.

[4] Figure retroactively adjusted.

[5] Light and heavy fuel oil, liquefied petroleum gas (LPG), diesel and gasoline.

We have consolidated all our climate impact mitigation and energy efficiency activities in the Edison program. Overall, thanks to the Edison programm, we have saved approximately 89,000 megawatt hours of energy since 2012. Most of this is power. By deciding to purchase increasing quantities of energy from renewable sources, in 2019 we took a further big step toward reaching our climate protection target.

Energy management plays a key role in our efforts toward energy efficiency and climate impact mitigation. Our production sites in Darmstadt and Gernsheim account for 28% of our global energy consumption. Both sites meet the international energy management standard ISO 50001. Currently, 13 of our production sites have a certified energy management system.

TOTAL GREENHOUSE GAS EMISSIONS (SCOPE 1 AND 2 OF THE GHG PROTOCOL)[1]

In metric kilotons	2006[2]	2016	2017	2018[3]	**2019[4]**
Total CO_2eq[5] emissions	**782**	**681**	**689**	**666[6]**	**665**
Thereof: Direct CO_2eq emissions	378	384	373	353[6]	359
Indirect CO_2eq emissions	404	297	316	313[6]	306
Biogenic CO_2 emissions	**0**	**14**	**13**	**13**	**12**

[1] In line with the Greenhouse Gas Protocol, for all previous years (up to the 2006 baseline) the greenhouse gas emissions have been calculated based on the corporate structure as of December 31 of the reporting year and retroactively adjusted for acquisitions or divestments of (parts of) companies, or for changes in emission factors (portfolio-adjusted).

[2] Baseline for our emission targets is 2006.

[3] Since 2018, our reported figures have excluded the Consumer Health business, which was divested on December 1, 2018.

[4] Since 2019, our reported figures have included Intermolecular (acquired on September 20, 2019). Data on Versum Materials (acquired on October 8,2019) are not yet available. We are presently reviewing the current process for collecting greenhouse gas and energy consumption-related indicators and are working to harmonize methodologies and timelines. Starting in 2020, we will be incorporating the environmental figures for Versum Materials into our reporting.

[5] eq = equivalent.

[6] Figure retroactively adjusted.

Our acquisition of Versum Materials is expected to increase our reported greenhouse gas emissions in 2020 by around 1.3 million metric kilotons. This estimate is based on the figures reported by Versum Materials for 2017 and 2018. Most of these emissions are generated in manufacturing processes. In the course of the integration, we are investigating the specific causes of these high emissions and analyzing where they could be reduced. Since Versum Materials does not have any data going back to the 2006 baseline for our climate impact mitigation goal, we cannot include these additional emissions in our current goal. In 2019, we began to develop a new climate impact mitigation goal for the period through 2030. We will include Versum Materials' emissions in this.

Alongside energy efficiency and climate protection, we also focus on water. Since 2016, we have been pursuing the goal of implementing a sustainable water management system at sites with high consumption levels by 2020. At sites with relevant water use located in areas of high water stress, we are aiming to cut our water consumption by 10% by 2020 (2014 baseline). At the end of 2019, we had lowered our water consumption at the relevant sites by 21% in comparison with 2014. In 2019, the CDP gave our activities to conserve water a "B" rating (2018: B–). However, it is not just water that is becoming scarcer; other resources are too. This makes it imperative for us to use raw materials as efficiently as possible and reduce the waste generated from these. In 2016, we developed the Merck Waste Score, which allows us to compare the amount of waste our sites are producing and monitor the development of the amount of waste we produce. Based on this score, we have set ourselves the goal of reducing the environmental impact of our waste by 5% by 2025 (2016 baseline). For this purpose, we continuously analyze the improvement potential of our production processes and disposal routes.

Responsibility to society

We see ourselves as part of society – both at our individual sites and worldwide. Taking responsibility in society is an integral part of our entrepreneurial approach. We believe we can make an important contribution to the community through our knowledge, our skills, and our products.

Our social responsibility activities are primarily focused on those areas in which we have particular expertise stemming from our core businesses. We are thus engaged in health and culture projects and furthermore support education, especially in the natural sciences. Additionally, we provide disaster relief and support people in need in the areas in which we operate.

Our subsidiaries are engaged in a wide variety of local projects. We have defined a general set of criteria for selecting projects, and the decisions concerning the implementation of specific projects are made by our subsidiaries. In 2019, we spent a total of

around € 46 million on community engagement activities. This figure also includes the activities of Versum Materials and Intermolecular since October 2019. It does not include contributions from the Merck Foundation.

We carried out more than 300 charitable projects in 60 countries worldwide in 2019. In more than half of all initiatives, our colleagues joined us in our efforts, whether through donations in cash or in kind or through their active collaboration in projects.

Research and Development

Science is at the heart of everything we do. We conduct research and development (R&D) worldwide in order to develop new products and services designed to improve the quality of life of patients and satisfy the needs of our customers. Further optimizing the relevance and efficiency of our research and development activities – either on our own or in cooperation with third parties – is one of our top priorities.

In 2019, approximately 7,800 employees worked for Merck researching innovations to serve long-term health and technology trends in both established and growth markets (2018: approximately 7,200).

Expenditure on research and development (R&D) incurred by Merck amounted to € 2.3 billion in the year under review (2018: € 2.2 billion). In our R&D activities, we focus on both in-house research and external collaborations that enable us to increase the productivity of our research while simultaneously reducing financial outlay. The organizational setup of our R&D activities reflects the structure of Merck with three business sectors. In Healthcare, we aspire with our research pipeline to make a positive difference for patients – always with the purpose to help create, improve, and prolong life. Our main research areas include oncology, immuno-oncology, and immunology including multiple sclerosis. In the Life Science business sector, our research activities focus in particular on technologies for laboratory and life science applications as well as the promotion of new developments. Improved test kits, chromatography methods, substrates for separating active substances, and innovations continue to be in focus in the fields of microbiology and hygiene monitoring. Research activities in the Performance Materials business sector include the development of new and improved basic materials and mixtures for LC displays, for innovative OLED applications, and for materials for the production of integrated circuits. To strengthen the Pigments business, new effect pigments for the automotive, cosmetics, and printing ink sectors are being developed.

RESEARCH AND DEVELOPMENT COSTS[1]

			Change	
€ million	**2019**	2018	€ million	%
Healthcare	1,666	1,687	-21	-1.3%
Life Science	276	251	25	10.1%
Performance Materials	267	242	25	10.5%
Corporate and Other[2]	59	47	12	24.7%
Total	**2,268**	**2,227**	**41**	**1.8%**

[1] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes" in the Notes to the Consolidated Financial Statements.

[2] R&D spending that cannot be allocated to individual business sectors.

The ratio of research spending to sales was 14.0% (2018: 15.0%). The decline is attributable to positive sales development.

Healthcare*

Biopharma

Oncology and immuno-oncology

Oncology and immuno-oncology are core focus areas in our R&D portfolio. With an emphasis on biology-driven research, we aim to deliver transformative treatments. Translational research is embedded into the whole R&D process, with several projects addressing unmet needs in hard-to-treat cancers through innovative treatment approaches and novel combinations. In 2019, we achieved a number of significant milestones across our oncology and immuno-oncology pipeline.

We continue to develop much-needed new treatment options for patients with hard-to-treat cancers and have made key progress in this area with avelumab, an anti-PD-L1 antibody we are co-developing and co-commercializing with Pfizer Inc. To date, avelumab has received approval in more than 50 countries across the world under the brand name Bavencio®. In May, we and Pfizer announced that the U.S. Food and Drug Administration (FDA) approved Bavencio® in combination with axitinib for the first-line treatment of patients with advanced renal cell carcinoma (RCC). As well, in October, we and Pfizer reported that the European Commission (EC) authorized Bavencio® in combination with axitinib for the first-line treatment of adult patients with advanced RCC. In December, the combination was approved in Japan for the treatment of unresectable or metastatic RCC.

The United States, EC and Japanese approvals in RCC were based on interim results from the pivotal Phase III JAVELIN Renal 101 trial, which were published in the New England Journal of Medicine in February. The combination of Bavencio® and axitinib significantly extended median progression-free survival (PFS) by more than five months compared with sunitinib as a first-line treatment for patients with advanced RCC.

Through our strategic alliance with Pfizer, we continue to explore the therapeutic potential of avelumab. Our clinical development program JAVELIN currently involves at least 30 clinical programs and more than 10,000 patients evaluated across more than 15 different tumor types. In addition to RCC, these tumor types include head and neck cancer, Merkel cell carcinoma (MCC), non-small cell lung cancer (NSCLC), and urothelial cancer (UC).

In March, we and Pfizer reported the discontinuation of the ongoing Phase III JAVELIN Ovarian PARP 100 study evaluating the efficacy and safety of avelumab in combination with chemotherapy followed by maintenance therapy of avelumab in combination with talazoparib, a poly (ADP-ribose) polymerase (PARP) inhibitor, versus an active comparator in treatment-naïve patients with locally advanced or metastatic ovarian cancer. The decision was based on several emerging factors since the trial's initiation, including the previously announced interim results from JAVELIN Ovarian 100 as well as the rapidly changing treatment landscape. The discontinuation of the trial was not based on safety results.

In November, we and Pfizer announced topline results of the Phase III JAVELIN Gastric 100 study evaluating avelumab as first-line maintenance therapy following induction chemotherapy in patients with unresectable, locally advanced or metastatic HER2-negative gastric or gastroesophageal junction cancer versus continuation of chemotherapy or best supportive care. While the study showed clinical activity for avelumab in this setting, it did not meet the primary endpoints of improved overall survival (OS) compared with the standard of care in the overall intent-to-treat population or the PD-L1–positive population.

* The contents of this chapter or section are voluntary and therefore not audited. However, our auditor has read the text critically.

At the 2019 American Society of Clinical Oncology (ASCO) Annual Meeting, May 31 – June 4 in Chicago, Illinois, United States, we presented new data:

- For avelumab, we shared data from five studies across tumor types including MCC, RCC, hepatocellular carcinoma and UC. These included an oral presentation of biomarker analyses of baseline tumor samples from the Phase III JAVELIN Renal 101 trial in previously untreated patients with advanced RCC.
- Erbitux® (cetuximab) data from a retrospective analysis of OS by subsequent therapy in patients with RAS wild-type metastatic colorectal cancer from the Phase III EPIC study were presented. The analysis evaluated the effect of post-study therapies (with cetuximab, without cetuximab, or no subsequent therapy) on OS following treatment with cetuximab plus chemotherapy or chemotherapy alone.
- For the investigational targeted therapy tepotinib, updated results from the potentially registrational Phase II VISION study showed promising activity in advanced NSCLC patients harboring MET exon 14 skipping mutations detected by liquid biopsy or tissue biopsy.
- Abstracts also showcased the scientific innovation and diversity of our pipeline, with results from a number of high-priority clinical development programs, including tepotinib, bintrafusp alfa and our comprehensive DNA Damage Response (DDR) portfolio.

In October, we and Pfizer shared three-year results from Part A of the pivotal Phase II JAVELIN Merkel 200 trial regarding long-term OS and durable responses in patients with previously treated metastatic MCC (mMCC) who received avelumab. In this exploratory analysis, the OS rate at three years was 32%; the median duration of response (DOR) was 40.5 months; and the objective response rate (ORR) was 33.0%, which was unchanged from the one-year analysis. These data were presented at the First International Symposium on Merkel Cell Carcinoma in Tampa, Florida, United States on October 21-22.

In September, we shared important milestones for two combination studies of tepotinib in locally advanced or metastatic NSCLC with epidermal growth factor receptor (EGFR) mutation and select MET dysregulations. These include PFS and OS data from the Phase Ib/II INSIGHT study of tepotinib plus the EGFR inhibitor gefitinib, along with an update stating that the Phase II INSIGHT 2 study of tepotinib plus the tyrosine kinase inhibitor (TKI) osimertinib is now open for enrollment. Tepotinib, discovered in-house at Merck, is an investigational oral MET inhibitor that underscores our strategic focus on delivering innovative precision medicines to patients with cancer.

In September, we announced that the FDA granted Breakthrough Therapy Designation (BTD) for tepotinib in patients with metastatic NSCLC harboring MET exon 14 skipping alterations who progressed following platinum-based cancer therapy. This BTD is based on data from the ongoing VISION study (NCT02864992) showing preliminary clinical evidence that tepotinib may offer an improvement over available therapy in patients with metastatic NSCLC harboring MET exon 14 skipping alterations detected by liquid biopsy or tissue biopsy across different lines of treatment.

Also in September, the National Medical Products Administration (NMPA) of China approved Erbitux® for the first-line treatment for patients with RAS wild-type (wt) metastatic colorectal cancer (mCRC) in combination with Folfox or Folfiri, or in combination with irinotecan in patients who are refractory to irinotecan-based chemotherapy. The pivotal Phase III evidence from the TAILOR study, on which the approval was based, shows significant benefit in overall response rate, PFS and OS for patients treated with cetuximab in combination with Folfox, compared to Folfox alone, in the first-line setting for this challenging type of cancer.

At the 2019 European Society for Medical Oncology (ESMO) Congress, September 27 - October 1, in Barcelona, Spain, we presented new data representing several key therapeutic agents from our diverse oncology pipeline, including avelumab data in advanced RCC, cetuximab data in RAS wt mCRC, and our investigational oral MET inhibitor tepotinib in advanced solid tumors. In addition, a number of investigator-sponsored studies (ISS) and collaborative research studies (CRS) exploring our pipeline were also presented.

In early October, the first patient was enrolled in the bintrafusp alfa INTR@PID BTC 055 study (NCT04066491), a Phase II/III, multicenter, randomized, placebo-controlled study of gemcitabine plus cisplatin with or without bintrafusp alfa in patients with 1L biliary tract cancer (BTC). Bintrafusp alfa is our investigational bifunctional fusion protein immunotherapy and currently in clinical development. BTC is a collective term for a group of rare and aggressive gastrointestinal cancers with limited treatment options and poor patient outcomes.

In November, we reported that the Japanese Ministry of Health, Labour and Welfare (MHLW) granted orphan drug designation (ODD) for tepotinib for patients with NSCLC harboring MET gene alterations. The MHLW ODD program is designed to promote research and development of orphan drugs for diseases that affect fewer than 50,000 patients in Japan, and for which significant unmet medical need exists. An investigational drug can qualify for ODD if there is no approved alternative treatment option or if there is an expectation of high efficacy or safety compared to existing treatment options. Drugs receiving ODD qualify for several benefits intended to support development, such as guidance and subsidies for research and development activities from the MHLW, preferential tax treatment, priority consultation for clinical development, and priority review of applications.

In February, we announced a global strategic alliance with GlaxoSmithKline (GSK) to jointly develop and commercialize bintrafusp alfa, including potential registrational studies, for multiple difficult-to-treat cancers. During the year, we achieved our alliance objective of eight trials ongoing or with protocol under development. Our advanced clinical program includes three studies focused on NSCLC, two studies focused on BTC and a study focused on cervical cancer. Our lung cancer studies include a randomized, open-label controlled Phase II study of bintrafusp alfa compared with pembrolizumab as a first-line (1L) treatment in patients with PD-L1 expressing advanced NSCLC (INTR@PID LUNG 037); a Phase II study of bintrafusp alfa with concurrent chemoradiation therapy (cCRT) in unresectable Stage III NSCLC (INTR@PID LUNG 005), and a Phase Ib/II, open-label study of bintrafusp alfa in combination with chemotherapy in participants with Stage IV NSCLC regardless of PD-(L)1 expression status (INTR@PID LUNG 024). Our BTC studies include a phase II, open-label study to evaluate bintrafusp alfa monotherapy in participants with locally advanced or metastatic BTC who failed, or were intolerant to, first line platinum-based chemotherapy (INTR@PID BTC 047), and a phase II/III, multicenter, randomized, placebo-controlled study of gemcitabine plus cisplatin with or without bintrafusp alfa in patients with 1L BTC (INTR@PID BTC 055). In addition to use as a single agent, bintrafusp alfa is also being considered for use in combination with other assets from the pipelines of both companies.

In accordance with the agreement with GSK, Merck received an upfront payment of € 300 million and is eligible for potential development milestone payments of up to € 500 million triggered by data from the lung cancer program. Merck will also be eligible for further payments of up to € 2.9 billion upon successful achievement of future approval and commercial milestones. The total potential deal value is up to € 3.7 billion. Both companies will jointly conduct development and commercialization. In the event of regulatory approval, net sales will be realized by Merck in the United States and by GSK in all other countries, whereas net profits from sales and defined expense components will be shared equally by the alliance partners.

In September, we signed a collaboration and license agreement with Y-Trap Inc. of Baltimore, Maryland, United States for the exclusive development of multiple specific antibody-ligand traps for cancer immunotherapy. The collaboration leverages Y-Trap's proprietary platform of multifunctional antibody-ligand traps for immuno-oncology. The Y-Trap platform exploits combinatorial protein engineering to counteract key determinants of immune dysfunction in the tumor microenvironment. Y-Trap and Merck will collaborate to explore the pharmacology of Y-Trap multifunctional proteins and Merck will be responsible for all development, manufacturing and commercialization activities. Under the agreement, Merck will provide Y-Trap with an upfront payment in addition to milestone payments and royalties based on the achievement of specific pre-clinical, clinical development, regulatory, and commercial milestones.

Neurology & Immunology

Multiple sclerosis (MS) is one of the world's most common neurological disorders. Despite the emergence of a number of therapies in the last two decades, there are still significant unmet needs for MS patients. At the end of March 2019, our MS therapy Mavenclad® (cladribine tablets) was approved in the United States for the treatment of adults with relapsing-remitting multiple sclerosis (RRMS) and active secondary progressive multiple sclerosis (SPMS).

Cladribine tablets have been approved by the FDA as a treatment for RRMS and SPMS that provides two years of proven efficacy with a maximum of 20 days of oral treatment, during a two-year period. Cladribine tablets have demonstrated clinical efficacy across key measures of disease activity, such as annualized relapse rate, disability progression, and magnetic resonance imaging (MRI) activity. We continue to receive regulatory approvals for Mavenclad® around the world. Mavenclad® is now approved in more than 70 countries, including those of the European Union, Australia, Canada and Switzerland.

At the American Academy of Neurology (AAN) 2019 Annual Meeting, May 4–10 in Philadelphia, Pennsylvania, United States, we presented a total of 20 abstracts (18 posters and two platform presentations), including data on Mavenclad®, Rebif® (interferon beta-1a) and evobrutinib.

Key Mavenclad® data included a post-hoc analysis of the CLARITY Extension study to examine the durability of no evidence of disease activity-3 (NEDA-3) in RMS patients receiving cladribine tablets, plus an integrated analysis of pooled long-term safety data of cladribine tablets in patients with MS collated from the CLARITY, CLARITY Extension, ORACLE-MS studies and the PREMIERE registry. We also presented abstracts from the ORACLE-MS study describing the effect of cladribine tablets on early MS, as well as results from studies investigating the biological effects of cladribine tablets to offer further insights on the mode of action.

Key Rebif® data included the results of an investigation into the prevalence of pregnancy outcomes in IFNβ-exposed women from the European Interferon Beta (IFNβ) pregnancy registry and Nordic health study. These data add to the wealth of pregnancy outcome data that have been collected over more than 20 years for Rebif® and other beta interferons.

Key evobrutinib data included new 48-week results of the double-blind, randomized, placebo-controlled, Phase II study in patients with RMS. The new data showed that the effect on T1 gadolinium-enhancing lesions reduction seen at week 12 was maintained through 48 weeks with evobrutinib 75 mg QD and 75 mg BID. The results were simultaneously published in the New England Journal of Medicine.

In July, we shared further new pregnancy outcomes data in women with MS treated with IFNβ, including Rebif®, at the European Academy of Neurology (EAN) 2019 Congress in Oslo, Norway. Results from the largest population-based observational study in women treated with IFNβ who became pregnant showed no increased risk of major congenital anomalies compared to those unexposed. The results are based on Finnish and Swedish health registry data collected between 1996 and 2014.

At the 35th Congress of the European Committee for Treatment and Research in Multiple Sclerosis (ECTRIMS) from September 11-13, 2019 in Stockholm, Sweden, we presented 39 abstracts highlighting key data with Mavenclad®, Rebif® and evobrutinib. The data we presented at ECTRIMS include key insights from real-world follow-up of patients from our clinical trials and the post-approval setting for Mavenclad®, further validating it as an important treatment option available to patients in more than 70 countries worldwide. Among the data presented on cladribine tablets were:

- Long-term efficacy data on our oral treatment for MS, showing that 75% of patients from the CLARITY and CLARITY Extension studies exhibited no disability progression at five years post-treatment.
- A retrospective analysis of real-world follow-up data from an Italian MS registry showed that five years after receiving the last dose of our oral treatment, nearly two-thirds of patients (64%) had no disability progression and more than half of the patients (57%) were free of relapse.
- Final results from the PREMIERE safety registry were presented, which allowed for a thorough characterization of the long-term safety profile of cladribine tablets and showed no new safety findings. Furthermore, post-marketing data in the first 8,419 patients treated with cladribine tablets worldwide were consistent with the safety profile seen in the clinical development program, with no increase in incidence of adverse events from original clinical program findings.

We also presented new long-term efficacy data for Rebif® showing no evidence that exposure to our injectable before and during pregnancy in women with MS affected infant birth weight for gestational age and head circumference. These data points expand on safety data presented at recent congresses that suggest exposure to IFNβ does not increase risk of spontaneous abortions or affect other pregnancy outcomes, such as ectopic pregnancies or fetal malformations.

New data on evobrutinib were also presented at ECTRIMS, further elucidating the proposed mechanism of action for this investigational MS therapy, which is the first oral, highly selective Bruton's Tyrosine Kinase (BTK) inhibitor to demonstrate clinical proof of concept in relapsing multiple sclerosis.

In early September, we reported the initiation of two global pivotal Phase III trials (EVOLUTION RMS 1 and 2) studying the efficacy and safety of evobrutinib in adult patients with RMS.

In late September, we announced that the Committee for Medicinal Products for Human Use (CHMP) of the European Medicines Agency (EMA) issued a positive opinion to update the product label of Rebif® to include that women with RMS may continue treatment with Rebif® during pregnancy if clinically needed and while breastfeeding. Treatment with Rebif® while breastfeeding is an important option as many patients experience a relapse in their MS during the first three months following childbirth.

In October, we gave notice that results from FORWARD, a five-year, multicenter Phase II study of sprifermin, a recombinant human fibroblast growth factor-18, in patients with symptomatic radiographic knee osteoarthritis (OA) were published online in the Journal

of the American Medical Association (JAMA). Published results, based on the two-year primary outcome and the three-year follow-up analysis from the trial, show statistically significant, dose-dependent increases in total femorotibial joint cartilage thickness compared to both baseline and placebo comparator.

We also announced that we are evaluating external partnership opportunities for our OA portfolio, including sprifermin, with the goal of finding the right partner to advance the development of structurally-modifying treatments to change the course of OA. By pursuing alternative paths to internally driven development, our plan is to further focus our efforts in inflammatory neurology and immunology diseases with potentially overlapping inflammatory mechanisms like MS and systemic lupus erythematosus (SLE).

Fertility

To date, an estimated three million babies have been born with the help of our Fertility portfolio.

The Pergoveris® Pen, a convenient and ready-to-use fertility combination treatment option for women with severe follicle stimulating hormone and luteinizing hormone deficiency, was successfully launched in several countries in Europe, Asia-Pacific and Latin America in 2019. Additional launches in other countries are planned.

Fertility Lab Technologies continued to expand its footprint in Asia-Pacific, successfully launching the fertility lab devices Geri®, Gavi®, Gems®, and Gidget® in Korea and India.

In June, we announced we are working with the Leibniz Institute for Zoo and Wildlife Research (IZW), Berlin, Germany and other research partners to support efforts to save the northern white rhinoceros from extinction.

General Medicine & Endocrinology

Our new formulation of Euthyrox® (levothyroxine) for the treatment of hypothyroidism obtained further regulatory approvals in 2019, resulting in a total of 35 countries where this incremental innovation is registered, allowing for more precise dosing. New launches planned for the coming quarters include the remaining eight EU countries (Portugal and Spain, for example), China, Colombia and two countries in Asia-Pacific (Malaysia and Singapore).

Glucophage®, containing the active ingredient metformin, is now approved in 53 countries for prediabetes when lifestyle intervention is not enough to control the condition. At the 55th Annual Meeting of the European Association for the Study of Diabetes (EASD) in Barcelona, Spain in September, a first-of-its-kind Millennial Advisory Board was held with a new generation of healthcare professionals (HCPs) to discuss treatment paradigms for prediabetes. In Brazil, we successfully launched Glucophage XR 850 dedicated to the prediabetes condition.

We continued to execute our Branded Off-Patent Products (BOPPs) strategy. Toreza® (rosuvastatin) was approved in Chile in July. Toreza® is available in two strengths, 10 mg and 20 mg, offering HCPs an important choice for the treatment of dyslipidemia.

The number of patients taking Saizen® (somatropin) enrolled on Easypod® Connect continued to grow in 2019, reaching almost 21,000 at the end of Q4. Saizen® is our main endocrinology product and is indicated for the treatment of growth hormone deficiency in children and adults, while Easypod® Connect is a unique web-based platform that allows HCPs to monitor their patients' adherence to treatment with real-time injection data collected and transmitted from their Easypod® devices.

The launch of Aluetta®, our new pen for the injection of Saizen®, complements our device portfolio and supports the growth of Saizen® by expanding our business in key geographies like Germany. Aluetta® is currently approved in 20 countries.

Other collaborations

In January, we signed a strategic collaboration agreement with Tencent, a leading provider of Internet services. The collaboration will primarily focus on increasing public disease awareness and providing more accessible healthcare services via digital platforms in China.

In March, we entered a collaboration agreement with Iktos, a French start-up company specialized in the development of artificial intelligence (AI) solutions applied to chemical research. The collaboration will comprise the use of Iktos' generative modeling AI technology to facilitate rapid and cost-effective discovery and design of promising new compounds.

BIOPHARMA PIPELINE

As of: December 31, 2019

Therapeutic area Compound	Indication	Status
Neurology		
Evobrutinib (BTK inhibitor)	Multiple sclerosis	Phase III
Oncology		
Tepotinib (MET kinase inhibitor)	Non-small cell lung cancer, *MET*ex14 skipping [4]	Registration
Tepotinib (MET kinase inhibitor)	Non-small cell lung cancer	Phase II
Peposertib (M3814) (DNA-PK inhibitor)	Rectal cancer	Phase II
M3258 (LMP7 inhibitor)	Multiple myeloma	Phase I
Peposertib (M3814) (DNA-PK inhibitor)	Solid tumors [1]	Phase I
M4344 (ATR inhibitor)	Solid tumors	Phase I
M6620 (ATR inhibitor)	Solid tumors	Phase I
M8891 (MetAP2 inhibitor)	Solid tumors	Phase I
Immuno-Oncology		
Avelumab (anti-PD-L1 mAb)	Renal cell cancer, 1st line [5]	Registration
Avelumab (anti-PD-L1 mAb)	Non-small cell lung cancer, 1st line	Phase III
Avelumab (anti-PD-L1 mAb)	Urothelial cancer, 1st line maintenance	Phase III
Avelumab (anti-PD-L1 mAb)	Locally advanced head and neck cancer	Phase III
Abituzumab (pan-αv integrin inhibiting mAb)	Colorectal cancer, 1st line	Phase II
Avelumab (anti-PD-L1 mAb)	Merkel cell cancer, 1st line	Phase II
Avelumab (anti-PD-L1 mAb)	Solid tumors [2]	Phase II
Avelumab (anti-PD-L1 mAb)	Non-small cell lung cancer [2]	Phase II
Avelumab (anti-PD-L1 mAb)	Urothelial cancer [2]	Phase II
Bintrafusp alfa (TGFbeta trap / anti-PD-L1)	Non-small cell lung cancer, 1st line	Phase II
Bintrafusp alfa (TGFbeta trap / anti-PD-L1)	Non-small cell lung cancer, 1st and 2nd line	Phase II
Bintrafusp alfa (TGFbeta trap / anti-PD-L1)	Locally advanced non-small cell lung cancer	Phase II
Bintrafusp alfa (TGFbeta trap / anti-PD-L1)	Biliary tract cancer, 1st line	Phase II
Bintrafusp alfa (TGFbeta trap / anti-PD-L1)	Biliary tract cancer, 2nd line	Phase II
Avelumab (anti-PD-L1 mAb)	Solid tumors	Phase I
Bintrafusp alfa (TGFbeta trap / anti-PD-L1)	Solid tumors	Phase I
M9241 (NHS-IL12, cancer immunotherapy)	Solid tumors [1]	Phase I

Footnotes on next page

BIOPHARMA PIPELINE

As of: December 31, 2019

Immunology		
Atacicept (anti-BLyS / anti-APRIL fusion protein)	Systemic lupus erythematosus	Phase II
Atacicept (anti-BLyS / anti-APRIL fusion protein)	IgA nephropathy	Phase II
Evobrutinib (BTK inhibitor)	Rheumatoid arthritis	Phase II
Evobrutinib (BTK inhibitor)	Systemic lupus erythematosus	Phase II
Sprifermin (fibroblast growth factor 18)	Osteoarthritis	Phase II
M1095 (ALX-0761, anti-IL-17 A/F nanobody) [3]	Psoriasis	Phase II
M5049 (TLR7/8 antagonist)	Immunology	Phase I
M6495 (anti-ADAMTS-5 nanobody)	Osteoarthritis	Phase I
Global Health		
M5717 (PeEF2 inhibitor)	Malaria	Phase I

More information on the ongoing clinical trials can be found at www.clinicaltrials.gov. Pipeline products are under clinical investigation and have not been proven to be safe and effective. There is no guarantee any product will be approved in the sought-after indication.

[1] Includes studies in combination with avelumab.

[2] Avelumab combination studies with talazoparib, axitinib, ALK inhibitors, cetuximab or chemotherapy.

[3] As announced on March 30, 2017 in an agreement with Avillion, anti-IL-17 A/F nanobody will be developed by Avillion for plaque psoriasis and commercialized by Merck.

[4] In Q4 2019, tepotinib was filed in Japan for the treatment of patients with non-small cell lung cancer harboring *MET*ex14 skipping.

[5] On December 20, 2019, avelumab in combination with axitinib was approved in Japan for treatment of patients with curatively unresectable or metastatic renal cell carcinoma.

ADAMTS-5: A disintegrin and metalloproteinase with thrombospondin motifs
APRIL: A proliferation-inducing ligand
ATR: Ataxia telangiectasia and Rad3-related kinase
BLyS: B-lymphocyte stimulator
BTK: Bruton's tyrosine kinase
IgA: Immunoglobulin A
IL: Interleukin
mAb: Monoclonal antibody
MetAP2: Methionine aminopeptidase 2
METex14: MET exon 14
MET: MET proto-oncogene, receptor tyrosine kinase
PD-L1: Programmed cell death ligand 1
PeEF2: Plasmodium eukaryotic elongation factor 2
PK: Protein kinase
TGFbeta: Transforming growth factor beta
TLR7/8: Toll-like receptors 7 and 8

Allergopharma

Allergopharma is a leading manufacturer of diagnostics and prescription drugs for allergen immunotherapy. As scientists, we are determined to fully understand allergies so as to be optimally positioned to discover new solutions and therapeutic concepts. In close cooperation with research institutions and other experts around the world, we are constantly acquiring valuable insights into the complex immunological mechanisms responsible for allergy development. Equipped with these insights, we pursue new pathways to innovative treatments to meet the needs of allergy patients now and in the future.

Life Science*

Across our three business units of Research Solutions, Process Solutions and Applied Solutions, our R&D teams of more than 2,000 employees continue to bring a diversified and relevant portfolio of products and services to our customers around the world. In 2019, our Life Science business sector focused on delivering the promise of accelerating access to health for people everywhere with investment in collaboration with the global scientific community.

As such, we launched more than 18,500 products, including those launched through our "faucet program" for antibodies, reference materials, chemicals and nanomaterials. These included innovations from all our business units, such as ZooMAb® recombinant antibodies, Sucrose Ultrafiltrated, a Millipak® Final Fill extension and a Stericup® extension of our Milli-Q® 7000 line.

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Advancing CRISPR technology globally

In early 2019, we received our first United States patent for proxy-CRISPR technology. The patent addresses a new genome-editing technique that makes CRISPR more efficient, flexible, and specific by opening the genome for modification of DNA. This technique helps scientists modify difficult-to-access regions on the genome.

In April, we were formally granted a Canadian patent for the use of paired CRISPR nickases in eukaryotic cells. Covering paired Cas9 nickase technology, the patent advances gene therapy and research as well as reducing off-target effects. It provides an important and specific solution for scientists who need accurate methods when developing treatments for difficult-to-treat diseases, improving the ability to fix diseased genes without affecting healthy ones. Similar patents were granted in Australia and Europe in late 2018.

Life Science was granted seven additional patents for genome-editing technology in August, adding CRISPR patents in Europe, Israel, South Korea and the United Kingdom. The European Patent Office allowed patents for vectors for CRISPR integration, proxy-CRISPR technology, and engineered Ribonucleic Acid (RNA)-guided endonuclease and protein-RNA complexes. The Israeli and South Korean IP Offices allowed patents for paired nickase technology, while the United Kingdom Office allowed patents for proxy-CRISPR technology.

In November, we again were granted patents covering paired Cas9 nickase CRISPR genome-editing technology, this time from the Japan Patent Office and the Intellectual Property Office of Singapore. This technology increases specificity, reducing off-target effects in gene editing through a highly flexible and efficient approach. In total, we have achieved 22 CRISPR patents across nine markets, including China and Europe.

Furthermore, we announced an agreement with the Massachusetts-based Broad Institute of MIT and Harvard to offer non-exclusive licenses to CRISPR intellectual property (IP) under our respective control for use in research and commercial product development. The offering streamlines access for scientists, contributing to our goal of allowing all entities to apply CRISPR technology with a wider range of tools.

To complete an active year advancing and licensing the IP of our CRISPR technology, in November, we executed an agreement to license our CRISPR IP to Evotec SE of Hamburg, Germany. The license accelerates research and enables testing and development of new drugs.

In addition to patent allowances, we expanded our global network of genome-editing experts by announcing a CRISPR core partnership with Zhejiang University in Hangzhou, China. The CRISPR Core Partnership Program provides researchers from leading institutions with a network of commercial and research scientists stemming from its 80-some partners.

Increasing collaboration with partnerships and agreements

Along with our CRISPR partnerships and agreements, we signed a Memorandum of Understanding (MoU) with Chinese biotech company GenScript in March of 2019. The planned alliance aims to accelerate cell and gene therapy industrialization in China by collaborating to build a global standard platform for plasmid and virus manufacturing. Today, more than 130 companies in China are developing cell and gene therapies. The confluence of demand, growth, and consequent need to scale the cell and gene therapy market is an important driver for us to deliver in this region.

We signed a non-binding MoU with Phanes Therapeutics Inc. of Shanghai, China to collaborate on the development of biologics for the treatment of solid tumors. This allows us to support Phanes in accelerating research and development as well as commercializing new therapies as their demand increases for process development solutions. Under the terms of the MoU, we plan on providing Phanes our BioReliance® End-to-End Solutions for cell line development, process development, and GMP manufacturing up to commercialization.

In April, we announced a partnership with India’s Food Safety and Standards Authority (FSSAI) on food safety skill development, handing over a fully equipped microbiological testing lab. There, food safety scientists from government labs and FSSAI-ratified private labs will be trained by the Center for Microbiological Analysis Training on the latest microbiological testing technology.

In May, we joined the TRANSVAC2 Program to participate in the collaboration to accelerate vaccine development and manufacturing under the European Union’s (EU) Horizon 2020 program. As part of our participation, we provided training sessions at our M Lab™

Collaboration Center in Molsheim, France, tapping into our internal manufacturing expertise and process knowledge in viral vaccines and vectors.

Expanding our portfolio and accessibility to benefit customers

Throughout 2019, we launched innovations across all segments of our portfolio from the Research Solutions, Process Solutions, and Applied Solutions business units. Those included Trehalose Emprove® Expert, a broadly used stabilizer in lyophilization (freeze drying) of biomolecules; recombinant Cas9 and eCas9 GFP fusion proteins, offering all the advantages of ribonucleoprotein-based (RNP) genome editing; and a new formulation of modified Tryptic Soy Broth (mTSB), an enrichment broth for the detection of Salmonella, E. coli O157 and non-O157 STEC from food and animal feed.

In March, we launched our new, cloud-based lab water service and monitoring capability: Milli-Q® Connect. The product combines deep water purification expertise with cloud-based digital technology to allow users to monitor lab performance remotely and securely. Available on all Milli-Q® CLX 7000 clinical water purification systems, the portfolio addition delivers the value of convenience to our customers via remote diagnostics and assistance features. In September, we again advanced the Milli-Q® product portfolio with the launch of Milli-Q® IQ Element. This portfolio addition is a water purification and dispensing unit that provides our customers with ultrapure water tailored for trace elemental analysis.

Additional novel digital offerings launched in 2019 include our Supelco® SmartTitrants and Supelco® SmartStandards. These tools leverage SmartChemicals Radio Frequency Identification (RFID) tags on our titration consumables, allowing seamless transfer of relevant product data to titration instruments. The technology saves time, reduces transcription errors and ensures maximum data integrity for our customers.

In April 2019, we launched our BioContinuum™ Buffer Delivery Platform, a first-of-its kind integrated solution for streamlined buffer management. Used for continuous processing and in batch mode, this configurable platform is comprised of four components: a selection of distinct buffer concentrates, reliably delivered in Mobius® Select single-use assemblies, and an automated, highly accurate, and precise buffer dilution system with tailored system services.

We also launched Cyrene™, a sustainable dipolar aprotic solvent produced in two steps from a renewable cellulose source. The bio-derived alternative reflects our focus on green chemistry and the need for solvents to meet stricter regulation requirements for both employee safety and environmental sustainability.

Over the course of 2019, we expanded our portfolio with acquisitions in addition to our own product launches, adding to our breadth of tools and technology. With the acquisition of BSSN Software of Darmstadt, Germany, which we announced in August, we added marketing data management and integrated software that unifies data from instruments and data systems to make it available for analyzing, processing, and sharing. The middleware offering collects and converts scientific data from a broad range of more than 200 lab instrument models into a single, unified format.

In October, we acquired FloDesign Sonics of Wilbraham, Massachusetts, United States, to leverage their acoustic cell processing platform. The addition allows enhanced cell washing and concentration for manufacturing cell therapies.

We remain conscious of ensuring ease of access to our broad product portfolio. In addition to our industry-leading e-commerce website, www.sigmaaldrich.com, we launched our official flagship store on Alibaba's 1688.com in China. We became the first life science business to do so, improving the e-commerce experience for our customers in China. The launch also allows us to leverage Alibaba's leading technology in big data, cloud services, and artificial intelligence, as well as its digitalized operations and offline channel capabilities.

Recognized for award-winning innovation

To begin the year, Life Science won BioInformatics LLC's 2018 Life Science Industry Award® for best use of social media. Recognized for our strategic use of social media platforms, we were selected for our engagement with scientific customers and industry peers as well as the satisfaction and loyalty of our customers. The award speaks to our dedication to our stakeholders and their experience with our company.

In April, our Pellicon® Capsule with Ultracel® Membrane, an innovation in next-generation bioprocessing, won an INTERPHEX Exhibitor Award for Best New Product. This first-of-its-kind product acts as a single-use tangential flow filtration capsule used in

antibody drug conjugate (ADC) and monoclonal antibody (mAb) bioprocessing. That same month and coinciding with the launch of our new Supelco® products, Supelco® founders Dr. Walter Supina and Mr. Nicholas Pelick received the prestigious 2019 Pittcon Heritage Award for their contributions to the instrumentation and laboratory supplies community.

In November of 2019, Life Science won an R&D 100 Award for our Eshmuno® CP-FT Chromatography Resin. This first-to-market product used in biopharmaceutical manufacturing received the prestigious award to recognize its status as one of the 100 most innovative and significant technologies introduced in 2019. This tool removes aggregates, delivering capacities 10 times higher than traditional bind/elute chromatography. Part of our BioContinuum™ Polishing Platform, the significant reduction in resin and buffer volume results in a smaller manufacturing footprint as well as lower costs.

Through our Advance Biotech Grant Program, we announced 12 total grant recipients for 2019, selected based on the scientific and societal merit of their respective therapies in development, as well as process challenges and expertise gaps.

Performance Materials*

Within our Performance Materials business sector, we are the market and technology leader in most of our industries. As a science and technology company, we offer leading-edge products and solutions that in many cases set us apart from the competition. In order to bring our R&D closer to our businesses and reflect our new organizational structure after the acquisition of Intermolecular and Versum Materials, we transferred our research activities of Early Research & Business Development to our business units. We have also set up a Chief Technology Office (CTO) that bundles important technology competencies and technology scouting. As a dedicated technology organization, the CTO focuses on interacting with top-level customers and the electronics industry, managing research partnerships, shaping our technology roadmap and managing our long-term R&D portfolio.

Semiconductor Solutions

With the additions of Versum Materials and Intermolecular, we are now more capable than ever of addressing all our customers' critical material needs through every step of the wafer manufacturing process. The outstanding capabilities and competencies of the businesses are manifold and will enable us to bring game-changing innovations for our customers into the market faster.

Despite the market experiencing a flat year in the semiconductor space, our R&D teams were busier than ever, taking advantage of the increased bandwidth our customers had for their own product development activities – which is often the case during periods of reduced manufacturing demand. In the logic/foundry space we continue to focus on 3D transistor technology and to interconnect improvements to drive performance, size, and power efficiency. In the memory segment, there is a drive to increase the number of levels in vertical and 3D NAND architectures to enable even higher memory capacities, and in DRAM (dynamic random-access memory), continuing node shrinkage drives density, speed and reliability. This translates into adoption of more new materials and higher volume requirements for our products in the future. Enhanced technological competence in combination with a strengthened supply chain resulting from the acquisition of Versum Materials and Intermolecular will contribute to this growth.

We were successful this year in broadening our portfolio of high-value products for both advanced memory and logic applications. Our pathfinding teams are developing next-generation precursors and processes for flowable CVD (chemical vapor deposition) gap fill applications, high aspect ratio etching, and area selective deposition. In the patterning space, our R&D is expanding the DSA (directed self-assembly) pipeline with several customized solutions for additional applications. We continue to see a strong pull for our high-performance dielectric (HPD) series advanced colloidal ceria slurries for oxide/shallow trench isolation (STI) applications as a result of their demonstrated industry-leading low defectivity, extremely high uniformity, broad operating window, and polishing efficiency. Our conductive paste materials adopted a solutions-focused approach to create high-value products for our customers that go beyond just materials. The unique attributes of our conductive pastes plus novel packaging fabrication techniques, developed by our engineering team, enable packaging architectures needed for the enormous 5G infrastructure deployment.

With respect to our Delivery Systems & Services (DS&S) business, we completed the manufacture and installation of ISO Bulk Specialty Gas Systems (ISO-BSGS) at two new fabs for a customer in Xi'an, China, and another project near Pyeongtaek, Korea. ISO-BSGS systems provide the safe and efficient factory-level distribution of bulk container specialty gases, such as NF_3, N_2O, NH_3, and SiH_4, and are key enablers of our Specialty Gases business.

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To better support our customers in Asia, we opened a new manufacturing facility in Shanghai, China, to produce our latest specialty gas delivery equipment product line, GasSTAR®. Both the GasSTAR cabinet and BSGS enable semiconductor manufacturers in Asia to meet the rising demand for 200 and 300-mm memory and logic devices, flat panel displays, photovoltaics, LEDs, and other applications.

In 2019, we also introduced CHEMGUARD® CG350, which heats process molecules in a safe, process-stable manner and provides the reliable uptime needed for high-volume manufacturing.

Display Solutions

In our Display Solutions business unit, our liquid crystal technology UB-FFS (ultra-brightness fringe-field switching) continues its successful growth, thanks to new product qualifications and rising demand in the liquid crystal displays (LCD) sector for mobile devices, especially mobile phones and tablet PCs. The development of high-resolution 4K and 8K TV sets continues to pose a challenge, as the LCD backlight transmission and efficiency will be reduced due to higher pixel density. We are therefore actively working to expand our ultra-bright (UB) technology offering with our UBplus liquid crystal materials for the TV market. With such technologies, we increase the light transmission efficiency of applications for large-format TV sets and display panels by 10% to 15%.

Merck's VA (vertical alignment) liquid crystal platform including PS-VA (polymer-stabilized vertical alignment) technology remains predominant when it comes to large-format TV sets. Here, our latest materials provide additional performance benefits and improve processing efficiency in the production of TV sets. Moreover, we have successfully demonstrated our manufacturing expertise with respect to the new liquid crystal technology SA-VA (self-aligned vertical alignment). We are now focusing our attention on applications for specialized display products from the premium segment through to TV applications produced in large numbers, as this technology offers the high contrast and image quality of the PS-VA technology while also enabling improvements in display design and panel production, for example through the reduction of waste and energy consumption in the production of LCDs.

OLED technology continues to gain shares in the display market, particularly in the premium segment. Our R&D activities are covering a broad variety of OLED materials, targeting a wide range of applications from smartphones to TVs. We continue to be successfully qualified in a number of upcoming devices from leading consumer electronics players. In addition, we are supporting our customers in their ambition to establish inkjet printing as a new OLED display manufacturing process.

Surface Solutions

In our automotive pigments business, our focus on developing achromatic pigments continues. The latest example is Xirallic NXT Amur Black, a blue-black effect pigment with a silky-silvery fine texture and a wealth of Living Sparkle®. Another key topic in our development is fueled by the evolution of autonomous driving. In our pipeline, we address the special requirements that radar and lidar sensor applications demand of coating pigments.

Completing the Smart Effects initiative in our Cosmetics business, we are further driving the development of cosmetic pigments on matte effects (Allure series) and luster effects (Lights series). The newest additions will be the blue interference effect pigments Ronastar® Blue Lights and Ronastar® Dazzling Lights, a new gold pigment with a spectacular body color. In addition, we further drove the development of active ingredients of natural origin for new cosmetics solutions. We are currently in the process of preparing for the product launches in 2020.

People at Merck*

"Bring Your Curiosity to Life" – our promise as an employer describes how we collaborate at Merck, how we advance our business, how our employees can develop within the company, and who we are. Becoming a global science and technology company would not have been possible without the passion, creativity, and curiosity of our employees. And we are certain that our current and future employees ensure our economic success. They create innovations for patients and customers, and they secure our ability to compete. For this reason, the development of all our employees is very important to us. In short, we are working to create an environment where people are able to develop and reach their full potential.

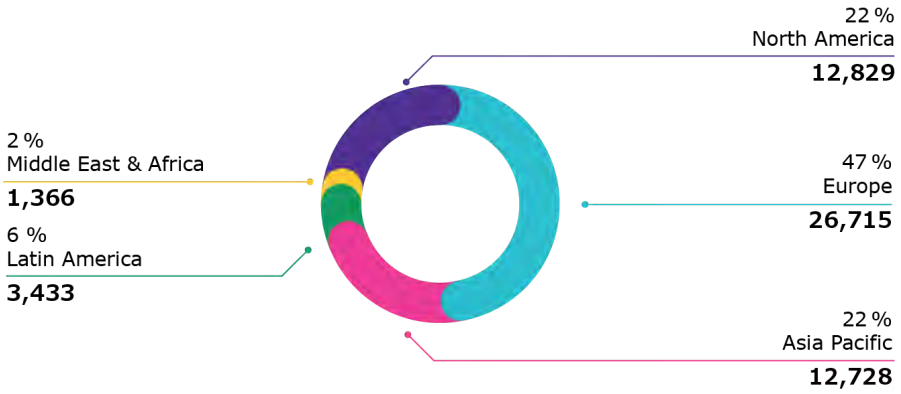
A career with Merck is enriching – both professionally and personally. We offer conditions that meet the individual needs of our employees and encompass an exciting range of tasks and advanced training possibilities, furthering flexible forms of cooperation and a culture of mutual esteem and respect. The latter is particularly important, as our workforce represents a broad range of nationalities, cultures, religions, and age groups, as well as a variety of personal and professional backgrounds. We are convinced that this diversity, paired with a corporate culture based on mutual respect, strengthens our innovative potential and contributes to our success.

Overview of our headcount figures

As of December 31, 2019, we had 57,071 employees worldwide[1] (2018: 51,749). In 2019, we were represented by a total of 222 legal entities with employees in 66 countries[2].

DISTRIBUTION OF EMPLOYEES

by Region



[1] With the completion of the acquisition of Versum Materials on October 7, 2019, around 2,300 employees joined Merck.

[2] Merck also has employees at sites that are not fully consolidated subsidiaries. These figures refer to all people directly employed by Merck and therefore may deviate from figures in the financial section of this report.

Building empowered leaders

Good leaders are key to the success of not only our employees, but also our company. Because they provide our talent with the right framework to unleash their potential and generate new ideas, we highly value the continuing education and development of our managers.

* The contents of this chapter or section are voluntary and therefore not audited. However, our auditor has read the text critically.

Strategic competency development

A transparent competency model is the pillar of our personnel development efforts. Managers and employees should show strategic competence by being purposeful, future-oriented, innovative, results-driven, collaborative, and empowering. By demonstrating these qualities, our managers can build a strong culture of collaboration based on curiosity, creativity, and trust. In addition, our leaders are expected to set an example by living the Merck values and taking responsibility for their own decisions. Based on this competency model, we have defined six leadership behaviors that summarize the conduct we expect from our leaders. To assess the performance and potential of every individual and to establish an effective leadership culture, regular and differentiated feedback is also of great importance. In this way, employees and supervisors can develop a shared vision, execute the business strategy and further develop a unifying corporate culture.

Management programs for executives

In recent years, we have initiated three programs to enhance the skills of our people managers. The Managerial Foundation Program imparts the basics of leadership, such as communication techniques, leadership styles, conflict management, motivation, and emotional intelligence. The Advanced Management Program covers topics such as change management, self-reflection, and resilience. The third initiative is our Global Leadership program, which focuses on competencies needed to ensure successful international collaboration.

For the past 20 years, we have been partnering with top international universities to offer the Merck University program. Over a period of around a year, senior executives take classes on management techniques and strategic business development. To date, a total of 480 executives have completed this program.

Another initiative we have been offering our up-and-coming leaders since the 1990s is our International Management Program, where participants work on an interdisciplinary project over a period of eight months. The results are then presented to the Executive Board. In 2019, 25 of our employees took part in this program.

In addition to these various programs, we partner with universities across the globe to enable our employees to obtain qualifications such as an Executive MBA.

In growth markets, we offer management programs specifically for local people managers, which focus on business management and Merck-specific topics. We have implemented Growth Markets Management Programs in China and the Middle East, for instance.

Diversity and management

In order to manage our global and diverse organization, we need managers who can build international teams and promote international collaboration so as to contribute to a productive and flexible working environment. We seek managers whose inclusive leadership style also reflects different employee and customer traits. This opens up career opportunities for talented employees from all areas of our company and ensures a broad experience base as well as differentiated decision-making.

At Merck, many teams work across sites and internationally. The diversity of competencies and experiences among the team members offers tremendous potential that our leaders can use. Internationality and a global mindset characterize our company culture and are therefore mirrored by our international management team. In 2019, 64% of our executives were not German citizens. Altogether, 73 different nationalities are represented in such positions.

At the end of 2019, women occupied 33% of leadership roles Group-wide, which means that once again we exceeded our goal of maintaining the proportion of women leaders at a stable level of 30% by 2021. At the same time, we developed goals and measures to ensure a balance of men and women when filling vacancies at the different levels of our businesses. We already have a stronger female presence in leadership programs. In addition, we have introduced processes to reduce unconscious bias, thus supporting female candidates when vacancies are being filled. Our flexible working models and unconscious bias training are also helping to increase the percentage of women in the Group.

The report on stipulations to promote the proportion of women in leadership positions at Merck KGaA, pursuant to section 76 (4) and section 111 (5) of the German Stock Corporation Act (AktG), can be found in the Corporate Governance section of this report.

Leveraging the opportunities of digitalization

The digital transformation has been leaving its mark on the world of work for a long time now. New, agile ways of working and artificial intelligence (AI) are thus increasingly gaining ground, a shift we are actively supporting at Merck. For example, since 2017 we have been developing an intelligent humanoid robot in collaboration with Darmstadt Technical University. We aim to find out how people respond to intelligent robots and AI in the workplace and in which areas they could be used. Another goal is to prepare our executives and staff for the introduction of AI in the working environment. Furthermore, the study is intended to make new technologies hands-on so as to create acceptance of them early on.

Using such big data applications developed by our People Analytics HR unit, leaders obtain rapid, specific answers to HR-related questions. Besides consolidating conventional master data, this software also collects information on compensation, performance, and potential, along with information on engagement and succession planning, interconnecting this data in meaningful ways and allowing trends to be identified at an early stage. Managers thus have access to an extensive trove of data that they may utilize as long as they comply with data privacy regulations.

Digitalization is also impacting our vocational training and continuing education programs, where IT skills are becoming increasingly crucial. At the same time, digital media is creating new ways of learning, which is why we are increasingly integrating 3D printing, big data, and artificial intelligence into our curricula. Moreover, we are testing out novel learning and innovation methods such as Scrum and Design Thinking. To learn how to operate plants and machinery, our apprentices also utilize virtual reality environments, initially learning how to operate the machinery through the virtual image before developing the corresponding expertise in real environments.

Furthering and asking more of talent

We believe that curiosity can make great things happen. We therefore seek to provide an environment that gives our employees plenty of scope for creativity and awakens their desire to innovate. In particular, training and career development plays a key role in attracting and retaining people. Focusing on their individual strengths, aspirations, and skills, we support their personal and professional development, thereby laying the groundwork for an enriching and challenging career with our company. We endeavor to discover qualified employees at an early stage in their career and develop their talents.

A holistic recruitment approach

When filling job vacancies, we pursue a holistic recruitment approach coupled with globally uniform and binding procedures. This starts with an internal job posting before external channels such as job portals and recruitment agencies are used. This process enables us to offer employees better development opportunities. For employees with leadership responsibility, we offer targeted interview coaching to support them in selecting candidates and to establish uniform quality standards.

A globally accessible welcome portal is available to new employees in order to help them prepare for their new job at Merck and to support their onboarding phase. To further improve the onboarding process, supervisors, Human Resources, and new employees can exchange information and documents before their first day of work. In addition, all new employees are assigned an experienced colleague who can help them familiarize themselves with the daily work routine. Our managers are also given detailed information such as onboarding plans and process descriptions to support them with this task.

Vocational training to recruit young people

In 2019, we again maintained a constant, high vocational training rate in Darmstadt, our largest site. A total of 552 young people were enrolled in vocational training in 25 different occupations at our headquarters in the reporting period. We give unlimited employment contracts to all employees in vocational training who work in occupations for which we have sustainable demand. On average, the post-vocational training hiring rate – taking voluntary terminations into account – was more than 90% over the past five years. We also offer vocational training at other sites in Germany, in which a total of 589 young employees participated. We promote the professional and social expertise of our employees in vocational training through numerous regional and global project activities.

In Darmstadt, through our "Start in die Ausbildung" (Starting Vocational Training) program, we help prepare young people who have a school-leaving qualification but have been searching for a vocational training position for at least one year without success. At our company, they complete an 11-month program, gain insights into working life, and become ready for vocational training. The number of interns remained stable year-on-year, with 20 participants aged between 16 and 25 years.

Since 2016, we have also been working on a specially developed program to help refugees enter the job market. As part of the Integrating Refugees through Training" program, a further group of ten young people who were forced to flee their home countries started language, technical, cultural, and career-related training in 2019 to prepare them for vocational training and thus for the labor market.

Targeted advanced training and maximizing performance capability

Our focus on systematic personnel development allows us to sustainably strengthen the performance potential within our company and to increase the motivation of our people. Only by expanding the abilities of each individual can we count on innovative and curious employees and managers in the future and flexibly respond to different requirements.

Employee development at Merck is founded on regular exchanges and a culture in which employees aspire to high levels of performance and engagement. As the basis for internal strategic talent management, the performance and potential management process is globally aligned for all employees in accordance with the same principles and is part of a shared IT system. We systematically combine talent recognition with performance assessments based on employee target agreements, as we are convinced that ongoing feedback helps all employees to grow in terms of their performance and potential. Regular individual assessments permit us to more readily identify high-potential employees and to further them accordingly. Clear objectives, differentiated and open feedback, and individual development plans are thus important prerequisites for both the personal development of every individual and the success of the company.

Furthermore, we have continued the Merck Science Network project. Due to the broad positioning of our company, we do not have a central research and development organization that unites expertise across our businesses. Through this project, we are promoting the establishment of a science community within the company to accelerate the exchange of innovative ideas and facilitate collaboration among all our R&D employees. One element of this project are the Continuous Performance Dialogues between 1,300 employees and their supervisors to align performance and potential appraisals with research and development needs. Other aspects focus on the advanced training of experts and their career paths and on the transfer of knowledge within the network.

Global classroom training courses and workshops developed specifically for teams help our employees develop and build individual abilities in line with new requirements and perspectives. In 2019, more than 11,200 employees participated. Digital solutions in the form of more than 2,900 e-learning and language courses are available to our employees. To enable our employees and managers to realize their full potential, we also provide local business and function-related offers. All measures are documented in a globally standardized development plan. Individual development opportunities are also supported by our job architecture, which applies globally and enables us to harmonize all positions and simplify their classification. This job architecture defines three fundamental career types: managers, experts, and project managers. They are all equal. Employees who wish to advance in their careers and aim for a top position within the company can also do so via the expert and project manager career paths.

A transparent and flexible employee reward system

At Merck, we reward the performance of every individual through appropriate and competitive total compensation. For years, we have been achieving this through global processes and programs that are supported by digital platforms. We also offer our managers flexible, market and needs-oriented compensation tools. These support well-informed decisions and thus provide comprehensible, performance and position-based compensation. Apart from monetary compensation components, we also offer our employees attractive fringe and social benefits. Our fringe benefits feature globally under the internal benefits4me brand. Its offerings comprise three pillars:

- Company benefits including a company pension
- Health and well-being
- Service offers

Specific benefit packages are in place at a national level to meet the different needs of our employees using well-established management mechanisms. Focusing more closely on individualized fringe and social benefits in the future will continue to enable our employees to individually choose those benefits that best meet their personal situation and stage of life.

Valuing diversity and dialogue

We are a global science and technology company. At Merck people work together closely – regardless of their gender and gender identity, skin color, religion or creed, age, disability status, country of origin, ancestry, nationality, family situation or marital status, military or veteran status, genetic information, and sexual orientation. All bring their specialist backgrounds, individual life experiences, and outlook to the company. We firmly believe that a diverse workforce and a respectful corporate culture are indispensable for our Group's ability to innovate and contribute significantly to our business success.

Our diversity strategy

Our Chief Diversity Officer is responsible for overseeing our Group's diversity strategy. Consisting of executives from all our business sectors and select Group functions, our Diversity Council specifically works on the further implementation of our diversity strategy. This focuses on two areas. First, we aim to promote the advancement of women into leadership positions and give talented people from the Asian region greater opportunities. Second, we aim to develop a better understanding of this growth market. However, our other goals remain unchanged: We aim to recruit people representing a breadth of qualifications, skills, and experiences. In addition, we support specific employee networks in order to foster exchange among like-minded individuals. Apart from our women's networks in various countries, we also support networks that promote the interests of the LGBTQI (lesbian, gay, bisexual, trans, queer or questioning, intersex) community as well as African American and international employees. Our Carer network brings together employees from all over the world who care for a relative.

Furthermore, we create awareness of unconscious bias throughout the Group. We help executives to identify and reassess unconscious thought patterns in their daily encounters as well as in decision-making processes and to bring about long-term changes in their own behavior in this regard. We also use the Job Analyzer, an online tool that allows job advertisements to be checked for critical wordings prior to their publication, thus fostering gender-neutral communication with those applying for jobs.

In Germany, we signed the Charta der Vielfalt (Diversity Charter) in 2013, the Charta der Gleichstellung (Equal Opportunity Charter) in 2015, and the Inclusion Action Plan of the German Mining, Chemical, and Energy Industrial Union (IG BCE) in 2017. At the international level, we support the Women Empowerment Principles, an initiative of UN Women and the UN Global Compact aimed at empowering women in the workplace. In 2019, we also joined the Business Coalition for Equality Act, a group of leading U.S. employers that support the Equality Act. By joining these initiatives, we underscore our commitment to fairness and tolerance in the workplace.

Different aspects of diversity

As a global employer with intercultural expertise, people from a total of 139 nations work for Merck; 22% of our employees are German citizens and 76% of our employees work outside Germany. At our headquarters in Darmstadt, 11% of staff are not German citizens.

Women currently make up 43% of our workforce. However, the ratio of women to men varies widely across the different regions, businesses, and functions. We are therefore working to raise the proportion of women wherever they are underrepresented, taking into account the situation typical for the industry as well as regional differences.

Demographic change is posing challenges to society in Germany as well as several other EU countries, the United States, China, and Japan. The average age of our employees is approximately 42. We assume that this figure will continue to rise in the coming years and are preparing for this situation. As part of our range of Health and Well-Being offerings, we specifically promote our employees' physical and psychological well-being throughout their entire career.

Understanding our employees

We want to create a working environment that empowers our employees to think outside of the box and find new solutions, opening the door to creative ideas and the discovery of new market opportunities. In order to promote this and to allow us to carry out even better comparisons both within the company and with our competitors, we conduct Group-wide employee engagement surveys every year. In this way, we ensure a regular exchange between employees, leaders, and senior management. The honest feedback we receive from staff shows us whether the measures and initiatives specified here are successful and highlights areas where we can improve further.

In October and November 2019, the global employee engagement survey was again conducted in 22 languages and the status of implementation reviewed. Around 47,000 employees (88%) took part. Our Group-wide score, which indicates how attached our employees feel to the company, was 74%. The survey methodology was fundamentally changed in 2019, which means that this year's result is not comparable with the results for previous years.

These surveys are supplemented by smaller snapshot surveys, where employees are asked about selected strategic issues or projects. The results are used to identify strategic focus areas, and they feed into the company-wide work on an ongoing basis.

Differentiated solutions to support employee well-being

As an employer, we take responsibility for the well-being of our people and offer a wide range of opportunities to optimize work-life balance and protect their health and safety.

Fostering work-life balance

We know that people's priorities in life can change and we take this into account, for example by offering flexible working time/location models, working time accounts for early retirement, and the possibility of taking an extended break from work. We also place great emphasis on family life. Here our commitment ranges from parental leave to childcare as well as support of employees caring for a relative.

Our employees can choose between different flexible working models. For instance, at our German sites in Darmstadt and Gernsheim as well as in Australia and many countries in Asia and Europe, we offer a model we developed ourselves. The mywork@merck working model allows employees to freely choose their working hours and location in agreement with their teams and supervisors. Employees agree with their direct supervisors on when and how often all team members are required to be in the office. Time tracking and time control are no longer required. The model reinforces our company's performance culture and culture of trust. Workplace permitting, the model can be taken up both by employees formally covered by collective agreements and employees exempt from them. Over the coming years, mywork@merck will be rolled out across the company. The model is currently being implemented in Brazil, China, Colombia, Ecuador, France, Guatemala, Italy, Korea, Mexico, Spain, Switzerland, the United Kingdom, and the United States. At the end of 2019, a total of 5,990 employees in Germany made use of this model. In 2019, 5% of our employees worldwide worked part-time, 17% of whom are men.

By offering information, advice, and assistance in finding childcare and nursing care as well as home and garden services, we help employees to reconcile the demands of their professional and personal lives. At various sites, employees benefit from childcare options that we subsidize. For example, for over 50 years, our headquarters in Darmstadt has featured a daycare center that offers 150 slots in crèche, kindergarten, and after-school care. The Parents@Merck program makes it easier for our employees to return to work following parental leave, giving mothers and fathers on parental leave the chance to talk and interact while also helping them keep in touch with the company. Moreover, they can make use of our various training and networking opportunities. We have established a similar program in the United States.

A constant focus on health and safety

The health and safety of our employees constitutes an important part of our daily responsibilities. We do everything to protect them against accidents and work-related illnesses, principally in the areas of stress prevention, nutrition, and exercise. We focus on preventive measures that can be easily incorporated into the daily work routine. They are designed to help our employees avoid short-term and protracted health problems.

At our Darmstadt and Gernsheim sites, our Health Management unit conducts an array of campaigns and programs to promote the health of our workforce. Our employees have access to a health catalog detailing our Health Management services in both English and German. Among other things, this contains information on ergonomics, nutrition, stress, and mental health issues.

Workplace safety and health protection are the highest priority at Merck. It is especially important to us to do everything we can to prevent workplace-related illnesses and accidents. We apply the lost time injury rate (LTIR) as an indicator to determine the success of measures aimed at accident prevention as well as occupational health and safety. This key performance indicator describes the number of workplace accidents resulting in lost time of one day or more per one million working hours. After having reached the goal of 2.5 that we had set in 2010, in 2015 we set ourselves a new, ambitious goal: By 2020 we intend to sustainably lower the LTIR to 1.5. In 2019, our LTIR was 1.5.

Experience shows that most workplace accidents can be prevented by proper conduct. Through our BeSafe! safety culture initiative, we are working to educate our employees on dangers in the workplace and provide them with rules of conduct that help keep them safe. Uniform standards as well as local modules to meet specific safety requirements at individual sites can help achieve a steady improvement in the current situation. The program focuses on engaging managers in the safety culture and building their buy-in, aiming to make safety an intrinsic value and empower our employees to take responsibility for their own safety. In 2019, we continued to sensitize our employees to workplace hazards through numerous awareness campaigns.

OVERVIEW OF EMPLOYEE FIGURES[1]

			Merck (overall) Dec. 31 2017	Merck (overall) Dec. 31 2018[2]	**Merck (overall) Dec. 31 2019[6]**
Number of employees	global, total		52,941	51,749	57,071
	by region	Asia-Pacific (APAC)	11,294	10,486	12,728
		Europe	25,980	25,792	26,715
		Latin America	4,050	3,340	3,433
		Middle East and Africa (MEA)	1,097	1,153	1,366
		North America	10,520	10,978	12,829
Number of employees in FTE (FTE = full-time equivalents)	global, total		52,223.5	51,039.8	56,204.6
	by region	Asia-Pacific (APAC)	11,272.1	10,462.9	12,694.2
		Europe	25,302.5	25,126.8	26,013.1
		Latin America	4,046.2	3,339.5	3,427.8
		Middle East and Africa (MEA)	1,096.1	1,151.1	1,365.2
		North America	10,506.7	10,959.6	12,704.4
Number of countries			66	66	66
Number of legal entities	global, total		217	207	222
Number of nationalities	global, total		131	136	139
Number of nationalities working in Germany			97	95	96
Percentage of employees with German citizenship			23.2%	24.1%	22.4%
Percentage of employees working outside Germany			74.9%	73.9%	75.8%
Percentage of employees with global managers			10.2%	10.6%	11%
Percentage of women in the workforce	global, total		43.1%	44.0%	43%
	In Germany		39.1%	38.9%	38.9%
Percentage of women in leadership positions (= role 4 or higher)	global, total		30.3%[3]	32.3%[5]	33.5%[7]
	In Germany		29.7%[3, 4]	30.9%[5]	31.6%[7]
Percentage of executives (= role 4 or higher)	global, total		6.0%[3, 4]	6.5%[5]	6.2%[7]
	Percentage of executives who are not German citizens		64.4%[3]	63.6%[5]	64%[7]
	Number of nationalities		65[3]	70[5]	73[7]
Number of employees in vocational training in Germany			588	604	589
Vocational training rate			4.4%	4.1%	4.3%
Number of employees in the mywork@merck model (Germany)			5,267	5,698	5,990
Percentage of employees working part-time	global, total		4.6%	4.8%	4.9%
	Men		10.7%	12.5%	16.9%
Percentage of employees aged 17–29 years			14.5%	14.5%	15%
Percentage of employees aged 30–49 years			62.1%	61.1%	60.2%
Percentage of employees aged 50+			23.4%	24.4%	24.8%
Average age globally			41.4	41.7	41.7
Average age by region	Asia-Pacific (APAC)		36.9	36.9	36.8
	Europe		42.5	42.8	43
	Latin America		40.3	40.4	40.3
	Middle East and Africa (MEA)		39.4	39.2	38.6
	North America		44.1	44.1	44.4
	Germany		43.0	43.3	43.7
Average length of service	global, total		9.8	10.0	9.5
Average length of service in Germany			14.0	14.5	14.8

[1] Merck also has employees at sites that are not fully consolidated subsidiaries. These figures refer to all people directly employed by Merck and therefore may deviate from figures in the financial section of this report.

[2] The Consumer Health business was transferred to Procter & Gamble (P&G) as of December 1, 2018, and was already classified as a discontinued operation according to IFRS 5 in April 2018. With the completion of the sale, around 3,300 employees joined P&G.

[3] Not including Sigma-Aldrich legal entities in Germany or Allergopharma.

[4] Ratio adjusted retrospectively.

[5] Not including the Sigma-Aldrich legal entity in Steinheim, Germany, or Allergopharma.

[6] With the completion of the acquisition of Versum Materials on October 7, 2019, around 2,300 employees joined Merck.

[7] Not including the Versum Materials legal entities or Allergopharma.

Report on Economic Position

Macroeconomic and Sector-Specific Environment

In keeping with expectations, the global economy experienced weakening growth in 2019. According to the International Monetary Fund (IMF), however, projected growth for 2020 should be slightly above the 2019 level. The global economy is thus showing initial signs that its growth momentum is stabilizing.

According to the latest forecasts available from the IMF, the global gross domestic product (GDP) rose at a significantly lower growth rate of 2.9% in 2019 (2018: 3.6%). Despite strong differences between the various regions and between industrial nations and emerging economies, the trend toward weakening growth is visible. While growth in industrial nations fell to 1.7% (2018: 2.2%), the emerging markets and developing countries saw growth of 3.7% (2018: 4.5%). The United States, the world's largest economy, achieved slightly weaker growth of 2.3% (2018: 2.9%). The same trend is apparent in the eurozone, whose GDP growth weakened to 1.2% (2018: 1.9%), as well as in Asia's emerging economies, which reported growth of 5.6% (2018: 6.4%). The strongest drivers were again China with 6.1% (2018: 6.6%) and India with a year-on-year slowdown in growth to 4.8% (2018: 6.8%). Japan reported GDP growth of 1.0% (2018: 0.3%), Taiwan registered GDP growth of 2.0% (2018: 2.6%), and Korea of 2.0% (2018: 2.7%).

As in 2018, Merck's organic sales growth was above the IMF's global growth expectations in 2019 and came to 5.3%. This growth was supported by all regions. The Asia-Pacific region accounted for the largest share of growth across the Group at 42.3%, followed by Europe at 22.6%, North America at 19.0%, Latin America at 12.5%, and the Middle East and Africa at 3.6%. Overall growth and growth in the Asia-Pacific, Europe, and Latin America regions was driven primarily by the Healthcare and Life Science business sectors, while Performance Materials was below the 2018 figure. Growth in North America was attributable in particular to the Life Science business sector.

	Change 2019[1]	Change 2018
Healthcare		
Global pharmaceutical market	5.7%	5.4%
Market for multiple sclerosis therapies[2]	1.0%	2.7%
Market for type 2 diabetes therapies[2]	12.8%	9.8%
Market for fertility treatment[2]	4.8%	9.2%
Market for the treatment of colorectal cancer[3]	7.7%	4.8%
Life Science		
Market for laboratory products	3.2%	3.6%
Share of biopharmaceuticals in the global pharmaceutical market[2]	30.1%	28.0%
Performance Materials		
Growth of wafer area for semiconductor chips	-6.3%	8.0%
Growth of LC display surface area[4]	0.9%	10.1%
Global sales of cosmetics and care products	3.6%	4.1%
Global automobile sales volumes	-5.4%	-1.2%

[1] Predicted development. Final development rates for 2019 were not available for all industries when this report was prepared.

[2] Growth rates based on market data in local currency, translated at a constant euro exchange rate. The IQVIA market data on the growth of indications are based on current figures, including the third quarter of 2019. Annual growth based on the values for the past 12 months. The type 2 diabetes market excludes the United States, since this market is insignificant to Merck.

[3] Growth rates based on market data stated in U.S. dollars. Market data from EvaluatePharma on the growth of indications are based on published company reports and are subject to exchange rate fluctuations.

[4] Growth of display area is a pure volume indicator, which is counteracted by a negative price momentum.

Healthcare

In its latest study (as of September 2019), the pharmaceutical market research firm IQVIA forecast an increased year-on-year growth for 2019 of 5.7% for the global pharmaceutical market (2018: 5.4%). The main contributors to growth were the Latin America and Asia-Pacific regions. Latin America reported significant growth of 12.0% (2018: 9.3%). The Asia-Pacific region also continued to expand and recorded growth of 5.6% in 2019 (2018: 3.8%). Growth in North America slowed slightly in comparison with 2018 but remains solid, especially in the United States at 5.3% (2018: 5.9%). The EMEA (Europe, the Middle East, and Africa) region recorded weaker growth of 5.2% compared to the previous year (2018: 5.5%).

Not only the growth of the pharmaceutical sector as a whole, but also in particular the development of the biopharmaceutical market, is relevant for our business. According to IQVIA, the market volume for biological pharmaceuticals was approximately € 295 billion in 2019, continuing the recent trend of a continuously increasing market share. These products accounted for 30.1% of the global pharmaceutical market in 2019 (2018: 28.0%). The most important market for biological pharmaceuticals is the United States with a 62.4% share of global market volume.

The developments in the therapeutic areas of relevance to Merck reflect robust growth, albeit with different trends. The global market for type 2 diabetes excluding the United States followed the positive trend of previous years and reached growth of 12.8% in 2019 (2018: 9.8%). In the therapeutic area of infertility, growth dropped to 4.8% (2018: 9.2%). After a strong upturn in 2018, the growth rate in the market for colorectal cancer reached 7.7% (2018: 4.8%). Growth in the market for multiple sclerosis patients continued the trend of previous years and declined to 1.0% in 2019 (2018: 2.7%).

Life Science

Our Life Science business sector is a leading supplier of products and services for both research and applied laboratory applications, as well as for formulating, purifying, manufacturing, and quality-assuring drug therapies of chemical and biological origin.

According to the market research firm Frost & Sullivan, growth in the laboratory product market relevant to Research Solutions and Applied Solutions businesses slowed to 3.2% in 2019 (2018: 3.6%). Growth moderated from a peak in 2018 due to negative impacts from macroeconomic and geopolitical factors, despite a positive impact from continued strong demand from customers in the biopharmaceutical industry, specifically emerging biotech.

Our Life Science business sector competes in markets all around the globe. The European market growth slowed to 2.0% (2018: 2.4%), attributable to continuing uncertainties, most notably surrounding the outcome of Brexit. The market in the United States softened, growing 3.5% (2018: 4.2%), also due to increased geopolitical uncertainty, despite solid National Institutes of Health (NIH) funding to academic research customers. The Chinese market growth decelerated to 6.5% (2018: 7.0%) due to slowing GDP growth, trade relations, and imposed tariffs that have led to uncertainties in procurement, though domestic stimulus policies in China are providing some buffer for scientific tools and product investments in the laboratory area. The Indian market grew 7.8% (2018: 8.2%), where increased government spending, recovery from currency reform, and implementation of the national Goods and Services Tax (GST) has contributed to elevated spending.

The demand for Process Solutions products depends heavily on the sales of biopharmaceutical companies with biologics, as well as on the productivity of their research and development activities. According to IQVIA, the market volume of biotechnological pharmaceuticals grew to € 295 billion in 2019 (equivalent to 30.1% of the global pharmaceutical market). This is equivalent to growth of around 13.6% (2018: 13.2%), which is supported by all regions.

Performance Materials

The semiconductor industry is the most important market for business with material for integrated circuits (Semiconductor Solutions). The growth in demand for semiconductor materials depends on the wafer area produced for semiconductors. The silicon wafers required as raw materials are used as an indicator to estimate the demand for semiconductor materials. According to the global industry association SEMI.org, the area of delivered silicon wafers decreased by approximately 6% in 2019. The

semiconductor industry was in a correction phase in 2019. Demand for semiconductor chips weakened due to the high economic uncertainty in connection with trade restrictions between the United States and China, as well as between Japan and Korea, the export restrictions relating to Huawei, and Brexit. However, due to the expansion of capacity in recent years, this resulted in a significant increase in inventory levels within the entire semiconductor industry. Prices for semiconductor chips, in particular memory chips, thus came under strong pressure and only stabilized toward the end of the year. Semiconductor manufacturers countered this in the course of the year with production cutbacks and delayed further expansion of capacities. Toward the end of the year, however, there were increasing signs that the industry had navigated past the bottom and swung back to its long-term growth trajectory.

With its Liquid Crystals business, Merck is the leading producer of liquid crystal mixtures for the display industry. According to surveys by market researchers at IHS, the growth rate of display surfaces area was about 1% in 2019. This weak growth was mainly due to the low demand for televisions due to uncertainties caused by the trade conflict between the United States and China, as well as an overall weaker economic situation. In addition, inventories of display panels were carried over from 2018 into 2019. Liquid crystals will continue to play a key role in the display industry in the future. OLED technology, for which Merck also ranks among the leading material suppliers, is gaining importance in the high-quality display sector.

The markets for cosmetics and automotive coatings are crucial to Merck’s Pigments business. The market for cosmetics and care products grew by around 4% overall in 2019, a slightly slower rate than in 2018. The Asia-Pacific region, particularly China, was the main growth driver. The reasons for the slowdown in growth are the trade conflicts between the United States and China and uncertainties surrounding Brexit. Furthermore, the economic downturn in Europe is leading to a declining price structure.

Global automobile production fell by around 5% in 2019. Due to the major importance of China, the sharp decline in the production figures there was reflected globally. The declining figures in China are primarily due to the trade conflict between the United States and China, the implementation of new emission standards, and high inventories in 2018.

Review of Forecast against Actual Business Developments

The forecast of the Merck Group for fiscal 2019 published in the Annual Report for fiscal 2018 comprised the forecast for the Group as well as the forecast for the three business sectors Healthcare, Life Science, and Performance Materials. On April 12, 2019, Merck signed a final agreement to acquire Versum Materials Inc. for US$ 53 per share. On October 7, 2019, the successful closing of the acquisition of Versum Materials for a purchase price of approximately € 5.3 billion was announced. Consequently, the acquisition was not included at the time the Annual Report for 2018 was prepared and the forecast at the time did not include the Versum Materials business.

Due to this portfolio change, the following analysis reflects the new structure of the Merck Group and only includes the Versum Materials business from the date the acquisition was successfully closed.

Net sales

For 2019, we had forecast moderate organic net sales growth for the Group. In the course of the year Merck reported a more dynamic organic sales growth driven particularly by the strong organic growth of Life Science. This meant that we generated a solid organic net sales growth of +5.3%, all told, in fiscal 2019, thus slightly exceeding our forecast. Due to the unfavorable development of several currencies in emerging markets at the start of the year, we anticipated a slightly negative exchange rate effect on our net sales. Contrary to our original assessment, however, the trend of these currencies in the first half of 2019, especially in Latin America, was not as unfavorable as we had assumed at the start of the year. Furthermore, the depreciation of the euro against the U.S. dollar continued during this period. The exchange rate between the euro and the U.S. dollar remained supportive in the second half of the year compared with the previous year. The positive exchange rate effect in 2019 as a whole was +2.1% and thus slightly above our updated range. The portfolio effect due to the acquisition of Versum Materials was included in the forecast at the next possible date, following the successful completion of the acquisition. It was included in our reporting on the third quarter of 2019.

Healthcare

For our Healthcare business sector, we had forecast moderate organic sales growth at the start of the year. Sales growth of the business sector in 2019 as a whole was solid at +6.2% and thus slightly exceeded both our original forecast and our updated forecast in the first quarter, which provided for organic growth ranging between +4% and +6%. Growth was supported by the sales development of the base business and the significant growth contribution of our newly approved products, mainly Mavenclad® and, in particular, the successful market approval of Mavenclad® in the United States.

Life Science

Our Life Science business sector generated organic sales growth of +9.0% in 2019 and thus significantly exceeded our forecast of organic growth slightly above medium-term market growth in the amount of 4% per annum due to increased demand in our main customer industries. The forecast raised to between +8% and +9% in our reporting on the third quarter of 2019 was achieved. As expected, Process Solutions was the most dynamic business unit, delivering the largest contribution to organic sales growth within Life Science. Also as expected, Applied Solutions and Research Solutions contributed positively to the organic sales performance, albeit to a lesser extent than Process Solutions.

Performance Materials

For our Performance Materials business sector, we had forecast a moderate organic decline compared with the previous year. The main assumption was a continuing price decline in the Liquid Crystals business, which is only mitigated by a temporary rise in volume due to capacity expansions of customers in China. We also anticipated high growth momentum in Semiconductor Solutions, but this failed to materialize in fiscal 2019 due to weaker end markets. Against this backdrop, we updated our forecast of organic growth for the business in our reporting on the second quarter of 2019 to a range from -4% to -7%; we were within this range with

a reported decline in growth of -6.5% for 2019. Following the successful completion of the acquisition of Versum Materials on October 7, 2019, this acquisition was also included in the forecast in our reporting on the third quarter of 2019 with an expected sales effect of around € 270 million. The reported acquisition-related increase in sales was slightly below this figure at € 250 million, which was due to phasing effects at Versum Materials in the second half of the year and a slight weakening on the relevant semiconductor end markets.

EBITDA pre

For 2019 we expected a strong organic growth of EBITDA pre amounting to a low teens percentage figure over the prior year for the Merck Group. The assumption was based on growth driven by Healthcare and Life Science, which should be more than able to offset the decline of Performance Materials, and a positive contribution from the first-time application of IFRS 16 Leases. Furthermore, because of the unfavorable foreign exchange environment, we still expected negative exchange rate effects to burden EBITDA pre by between -3% and -4% over the prior year. In 2019, EBITDA pre came to € 4,385 million, equivalent to an increase of +15.4% compared with the prior year (2018: € 3,800 million). The organic growth of +11.3% entailed by this figure was in line with our forecast. By contrast, at +2.5% the foreign exchange effect on EBITDA pre in 2019 as a whole was substantially more positive than expected at the start of the year, although it was only slightly above the range of between 0% and +2% to which we had adjusted in the course of our reporting on the first quarter of 2019. The positive depreciation of the euro against the U.S. dollar in 2019 was more supportive than we expected at the start of the year. The portfolio effect of Versum Materials was included in the forecast at the next possible date, following the successful completion of the acquisition. It was included in our reporting on the third quarter of 2019.

Healthcare

For our Healthcare business sector, we were forecasting strong organic growth of EBITDA pre over the prior year due to substantial expected earnings contributions from our new products, particularly Mavenclad®, and a decline in development expenses in relation to sales as well as earnings contributions from the strategic alliance with GlaxoSmithKline plc. In addition to this, we had expected strongly negative exchange rate effects. In 2019, EBITDA pre in Healthcare amounted to € 1,922 million (2018: € 1,556 million). This is equivalent to an increase of +23.5% over 2018; the organic rise of +19.5% corresponded to the lower end of the forecast range we issued at the start of the year. The exchange rate effects had a substantially greater positive impact than expected at the start of the year, however. As a result, in our reporting over the course of the year, we ultimately narrowed our forecast range to between 0% and +2%. We closed out the year 2019 at +4.1%.

Life Science

For Life Science, we had expected a strong up to double-digit rise in organic EBITDA pre in percentage terms due to the expected organic sales growth. Thanks to a better-than-expected development of the main end markets, the forecast was raised in the course of the year. In our reporting on the third quarter of 2019, we forecast a range of between +12% and +14%. In fiscal 2019, the business sector generated organic growth of +14.4% to € 2,129 million and was thus at the top end of our forecast range. The exchange rate development supported EBITDA pre with +1.5% and was thus more positive than projected at the start of the year, when we forecast a moderately negative development.

Performance Materials

Owing to a price decline in liquid crystals, for which it was not expected that it would be able to be offset by growth in other businesses or active cost management, we forecast an organic decline of EBITDA pre in the Performance Materials business sector totaling a high single-digit to low teens percentage figure at the start of the year. For the exchange rate effects, we projected a roughly neutral impact on EBITDA pre over 2018. For 2019 as a whole, Performance Materials achieved an EBITDA pre of € 803 million (2018: € 786 million). This corresponded to an increase of +2.3% over 2018, of which -12.3% was attributable to the organic business performance and a further +6.1% to exchange rate developments. The forecast of organic growth was thus within the range we issued at the start of the year; however, the exchange rate trend ended up substantially more positive than we originally assumed. Our reporting on the third quarter of 2019, following the successful completion of the acquisition of Versum Materials on October 7, 2019, expected an earnings effect of around € 80 million to € 90 million from the acquisition for the year as a whole. The total reported portfolio effect of the Performance Materials business sector was +8.5% and slightly below this range.

This is primarily attributable to phasing effects at Versum Materials in the second half of 2019, a weaker momentum in the relevant semiconductor end markets, and the negative portfolio contribution from the acquisition of Intermolecular.

Corporate and other

EBITDA pre of Corporate and Other, which reached a level of € –469 million in 2019, was within our forecast range of € -460 million to € -490 million that we specified in the reporting on the third quarter of 2019. Compared with the prior-year figure of € -381 million, this corresponded to a rise in costs of 23.0%. This development was mainly due to higher losses from currency hedging and resulted from exchange rate developments that were forecast differently. The rising organic costs from the further expansion of our innovation and digitalization initiatives corresponded to our original forecast.

Business free cash flow

For 2019, we expected business free cash flow of the Merck Group to see a moderate increase. This forecast was exceeded with a rise of +8.9% to € 2,732 million (2018: € 2,508 million). In the Healthcare business sector, the increase of +22.1% over the prior year was in line with our forecast of growth in the low twenties percentage range, issued at the start of the year. The business free cash flow of the Life Science business sector was -1.3% below the prior year. We thus slightly exceeded our forecast of a moderate performance below the previous year. For the Performance Materials business sector, we anticipated a decline in the low teens range. With growth of 9.1% over the previous year, the business sector significantly exceeded the figure we forecast at the start of the year, mainly thanks to the acquisition of the Versum Materials business, which had not been included in the forecast issued at the start of the year but was included in our reporting on the third quarter of 2019 with an additional € 70 million to € 85 million.

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€ million	Net sales	EBITDA pre	Business free cash flow	EPS pre
Actual results 2018	14,836	3,800	2,508	€ 5.10
Forecast for 2019 in the 2018 Annual Report	Moderate organic growth Slightly negative foreign exchange effect of -1% to -2%	Strong organic percentage growth in the low teens range Negative foreign exchange effect of between -3% and -4%	Moderate increase	
Main comments	Growth driven by Life Science and Healthcare, which more than offsets the decline of Performance Materials Foreign exchange effect primarily resulting from several emerging market currencies	Growth driven by Healthcare and Life Science, which more than offsets the decline of Performance Materials First-time application of IFRS 16 with a positive contribution of around € 130 million Foreign exchange effect primarily resulting from several emerging market currencies	Higher EBITDA pre and positive effects in working capital offset higher investments in property, plant and equipment as well as digitalization initiatives	
Forecasts for 2019 in the interim report:				
Q1/2019	~15,300 to 15,900 Organic growth of +3% to +5% vs. 2018 Exchange rate effect of 0% to +2%	~4,150 to 4,350 Organic growth of +10% to +13% vs. 2018 Exchange rate effect of 0% to +2%	~2,500 to 2,750	€ 5.30 to € 5.65
Q2/2019	~15,300 to 15,900 Organic growth of +3% to +5% vs. 2018 Exchange rate effect of 0% to +2%	~4,150 to 4,350 Organic growth of +10% to +13% vs. 2018 Exchange rate effect of 0% to +2%	~2,550 to 2,800	€ 5.30 to € 5.65
Q3/2019	~15,700 to 16,300 Organic growth of +3% to +5% vs. 2018 Exchange rate effect of +1% to +2% Versum Materials included with approximately 270	~4,230 to 4,430 Organic growth of +10% to +13% vs. 2018 Exchange rate effect of 0% to +2% Versum Materials included with approximately 80 to 90	~2,600 to 2,850 Versum Materials included with 70 to 85	€ 5.30 to € 5.65
Results 2019 in € million	16,152 (+8.9%: +5.3% organic, +1.4% portfolio, +2.1% currency)	4,385 (+15.4%: +11.3% organic, +1.6% portfolio, +2.5% currency)	2,732 +8.9%	€ 5.56 +9.0%

HEALTHCARE

€ million	Net sales	EBITDA pre	Business free cash flow
Actual results 2018	6,246	1,556	1,025
Forecast for 2019 in the 2018 Annual Report	Moderate organic growth Moderately negative foreign exchange effect	Strong organic growth rate in the low to mid-twenties percentage range Strongly negative foreign exchange effect	Increase in the low teens percentage range
Main comments	At least stable sales development of the base business in organic terms Substantial growth contribution of our newly approved products, particularly Mavenclad® ; expected market approval in the United States has been taken into account Negative foreign exchange effect due to trend of exchange rates on several growth markets	Expected substantial earnings contributions from our new products, especially Mavenclad® , more than offset negative mix effects associated with the projected decline of Rebif® Moderate increase in research and development expenses due to the development of our pipeline, but down in relation to sales Earnings contributions from the strategic alliance with GlaxoSmithKline plc of approximately € 100 million and owing to license payments for Erbitux® that were lower than expected Negative foreign exchange effect due to trend of exchange rates on several growth markets	Rise in EBITDA pre Positive net working capital effects (including positive effects from the sale of the Consumer Health business)
Forecasts for 2019 in the interim report:			
Q1/2019	~6,450 to 6,750 Moderate organic growth of +4% to +6% Exchange rate effect of -1% to +2%	~1,820 to 1,950 Organic growth of +19% to +23% Exchange rate effect of -2% to +3%	~1,200 to 1,300
Q2/2019	~6,450 to 6,750 Solid organic growth of +4% to +6% Exchange rate effect of -1% to +2%	~1,830 to 1,940 Organic growth of +19% to +23% Exchange rate effect of -1% to +2%	~1,200 to 1,300
Q3/2019	~6,500 to 6,700 Solid organic growth of +4% to +6% Exchange rate effect 0% to +2%	~1,830 to 1,940 Organic growth of +19% to +23% Exchange rate effect 0% to +2%	~1,200 to 1,300
Results 2019 in € million	6,714 (+7.5%: +6.2% organic, 0.0% portfolio, +1.3% currency)	1,922 (+23.5%: +19.5% organic, 0.0% portfolio, +4.1% currency)	1,252 +22.1%

LIFE SCIENCE

€ million	Net sales	EBITDA pre	Business free cash flow
Actual results 2018	6,185	1,840	1,393
Forecast for 2019 in the 2018 Annual Report	Organic growth slightly above medium-term market growth of 4% p.a. Slightly negative foreign exchange effect	Strong organic growth of up to a double-digit percentage rate Moderately negative foreign exchange effect	Moderately below 2018 levels
Main comments	Process Solutions is likely to remain the strongest growth driver, followed by Applied Solutions Research Solutions will also make a moderately positive contribution to the organic sales development No material portfolio effect as a result of the sale of the flow cytometry business Negative foreign exchange effect, particularly on account of the development of emerging market currencies	Organic earnings growth on account of the expected sales growth and slight margin expansion In addition, positive contribution to organic earnings growth from the switch to IFRS 16 Negative foreign exchange effect, particularly on account of the development of emerging market currencies	Improved EBITDA pre Increase in investments in property, plant, and equipment in strategic projects
Forecasts for 2019 in the interim report:			
Q1/2019	~6,550 to 6,750 Organic growth of +6% to +7% Exchange rate effect 0% to +3%	~2,000 to 2,100 with an operating margin expansion of 20 to 30 base points Organic growth of around +10% to +12% Exchange rate effect 0% to +3%	~1,300 to 1,400
Q2/2019	~6,620 to 6,820 Strong organic growth of +7% to +8% Exchange rate effect 0% to +3%	~2,020 to 2,120 with an operating margin expansion of 20 to 30 base points Organic growth of around +11% to +13% Exchange rate effect 0% to +2%	~1,350 to 1,450
Q3/2019	~6,700 to 6,900 Organic growth of +8% to +9% Exchange rate effect +1% to +3%	~2,040 to 2,140 with an operating margin expansion of 20 to 30 base points Organic growth of +12% to +14% Exchange rate effect 0% to +2%	~1,350 to 1,450
Results 2019 in € million	6,864 (+11.0%: +9.0% organic, -0.6% portfolio, +2.6% currency)	2,129 (+15.7%: +14.4% organic, -0.2% portfolio, +1.5% currency)	1,375 -1.3%

PERFORMANCE MATERIALS

€ million	Net sales	EBITDA pre	Business free cash flow
Actual results 2018	2,406	786	588
Forecast for 2019 in the 2018 Annual Report	Organically moderate decline from the prior year level Exchange rate effect roughly neutral	Organic high single-digit to low double-digit percentage decline Foreign exchange effect roughly neutral	Decline in the low teens
Main comments	Strong growth momentum in the Semiconductor Solutions business unit Continuing price decline in Liquid Crystals business, mitigated by a temporary rise in volume due to capacity expansions of customers in China Neutral foreign exchange effect due to the development of the exchange rate of the euro against the U.S. dollar	Drop in liquid crystal prices cannot be offset by growth in other businesses and active cost management Neutral foreign exchange effect due to the development of the exchange rate of the euro against the U.S. dollar	Decline in EBITDA pre
Forecasts for 2019 in the interim report:			
Q1/2019	~2,250 to 2,400 Moderate organic decline of -3% to -6% Exchange rate effect 0% to +2%	~700 to 760 Organic growth of -7% to -11% Exchange rate effect 0% to +4%	~500 to 600
Q2/2019	~2,230 to 2,380 Organic decline of -4 % to -7 % Exchange rate effect 0% to +2%	~685 to 745 Organic growth of -9% to -13% Exchange rate effect +1% to +4%	~500 to 600
Q3/2019	~2,250 to 2,400 Organic decline of -4 % to -7 %* Exchange rate effect +1% to +3% Additionally around 270 due to Versum Materials	~695 to 755 Organic growth of -9% to -13%* Exchange rate effect +3% to +5% Additionally around 80 to 90 due to Versum Materials	~500 to 600 Additionally around 70 to 85 due to Versum Materials
Results 2019 in € million	2,574 (+7.0%: -6.5% organic, +10.4% portfolio, +3.1% currency)	803 (+2.3%: -12.3% organic, +8.5% portfolio, +6.1% currency)	641 +9.1%

*Lower half of the corridor

CORPORATE AND OTHER

€ million	EBITDA pre	Business free cash flow
Actual results 2018	-381	-497
Forecast for 2019 in the 2018 Annual Report	The expenses for Corporate and Other will, in our opinion, show an increase in the low to mid-teens range on an organic basis in 2019. This increase will be based on a further expansion of our innovation and digitalization initiatives. A greater focus on the costs of the administrative functions and substantially reduced burden from foreign exchange effects are likely to partly offset the increase.	
Main comments		
Forecasts for 2019 in the interim report:		
Q1/2019	~-420 to -480	~-500 to -580
Q2/2019	~-420 to -480	~-500 to -580
Q3/2019	~-460 to -490	~-500 to -580
Results 2019 in € million	-469 +23.0%	-536 +7.9%

Course of Business and Economic Position

Merck Group

Overview of 2019

- Increase in Group net sales of 8.9% to € 16.2 billion; organic growth (5.3%) was supported by positive exchange rate effects (2.1%) and acquisition-related growth (1.4%)
- Organic sales growth was achieved by the Life Science (9.0%) and Healthcare (6.2%) business sectors
- EBITDA pre rose by 15.4% and amounted to € 4.4 billion (2018: € 3.8 billion)
- Profitable growth for the Group: increase in EBITDA pre margin to 27.1% (2018: 25.6%)
- Growth in earnings per share pre to € 5.56 (2018: € 5.10)
- Increase in business free cash flow to € 2.7 billion (2018: € 2.5 billion)
- Acquisition-related rise in net financial debt to € 12.4 billion (December 31, 2018: € 6.7 billion)

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Key figures

			Change	
€ million	**2019**	2018	€ million	%
Net sales	16,152	14,836	1,315	8.9%
Operating result (EBIT)[1]	2,120	1,727	393	22.8%
Margin (% of net sales)[1]	13.1%	11.6%		
EBITDA[1]	4,066	3,528	539	15.3%
Margin (% of net sales)[1]	25.2%	23.8%		
EBITDA pre[1]	4,385	3,800	585	15.4%
Margin (% of net sales)[1]	27.1%	25.6%		
Profit after tax	1,324	3,396	-2,072	-61.0%
Earnings per share (in €)	3.04	7.76	-4.72	-60.8%
Earnings per share pre (€)[1]	5.56	5.10	0.46	9.0%
Business free cash flow[1]	2,732	2,508	224	8.9%

[1] Not defined by International Financial Reporting Standards (IFRSs).

Development of sales and results of operations

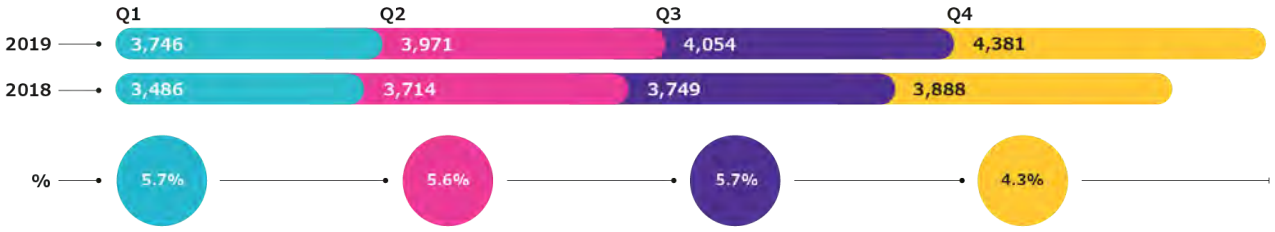
In fiscal 2019, the Merck Group generated net sales of € 16,152 million (2018: € 14,836 million). This represented a year-on-year increase of € 1,315 million or 8.9%, to which all business sectors contributed. Organic sales growth for the Group amounted to € 790 million or 5.3% and was attributable to the Life Science (9.0%) and Healthcare (6.2%) business sectors. Performance Materials reported a decline in organic sales of -6.5%. Sales growth attributable to foreign exchange rates came to € 312 million or 2.1% and was primarily due to the U.S. dollar, the Japanese yen, and the Chinese renminbi; exchange rate developments in particular in some South American countries, such as Argentina and Brazil, had the opposite effect. Because of portfolio changes, Group net sales rose by € 213 million or 1.4%. This was essentially due to the acquisition, completed on October 7, 2019, of Versum Materials, Inc., United States (Versum Materials), and the completed acquisition of Intermolecular, Inc., United States (Intermolecular), on September 20, 2019, both of which supplement the semiconductor business of the Performance Materials business sector. The divestment in December 2018 of the flow cytometry business that was allocated to the Life Science business sector diminished sales.

The net sales in the individual quarters as well as the respective organic growth rates in 2019 are presented in the following graph:

MERCK GROUP

Net sales and organic growth[1] by quarter[2]

€ million/organic growth in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

Driven by the gratifying organic sales growth of 9.0%, net sales of the Life Science business sector rose by 11.0% to € 6,864 million overall (2018: € 6,185 million). Life Science therefore was the strongest business sector in terms of sales with a share of 42% (2018: 42%) of Group sales in fiscal 2019. With organic growth of 6.2% and an exchange rate-related increase in sales of 1.3%, the Healthcare business sector recorded an overall rise in net sales of 7.5% to € 6,714 million (2018: € 6,246 million). In 2019, net sales of the Performance Materials business sector rose by 7.0% to € 2,574 million (2018: € 2,406 million). This was primarily due to acquisition-related sales growth (10.4%) and positive exchange rate effects (3.1%), which more than offset the decline in organic sales (-6.5%). Performance Materials thus generated 16% (2018: 16%) of net sales of the Merck Group.

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Net sales by business sector – 2019

€ million/% of net sales

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Net sales by business sector

€ million	2019	Share	Organic growth[1]	Exchange rate effects	Acquisitions/ divestments	Total change	2018	Share
Healthcare	6,714	42%	6.2%	1.3%	–	7.5%	6,246	42%
Life Science	6,864	42%	9.0%	2.6%	-0.6%	11.0%	6,185	42%
Performance Materials	2,574	16%	-6.5%	3.1%	10.4%	7.0%	2,406	16%
Merck Group	16,152	100%	5.3%	2.1%	1.4%	8.9%	14,836	100%

[1] Not defined by International Financial Reporting Standards (IFRSs).

In fiscal 2019, the Merck Group recorded the following regional sales performance:

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Net sales by region

€ million	2019	Share	Organic growth[1]	Exchange rate effects	Acquisitions/ divestments	Total change	2018	Share
Europe	4,735	29%	3.9%	–	–	3.9%	4,559	31%
North America	4,214	26%	3.9%	5.3%	1.1%	10.4%	3,818	26%
Asia-Pacific (APAC)	5,599	35%	6.7%	2.7%	3.3%	12.8%	4,965	33%
Latin America	1,012	6%	10.4%	-3.8%	–	6.5%	950	6%
Middle East and Africa (MEA)	591	4%	5.2%	2.4%	1.0%	8.6%	544	4%
Merck Group	16,152	100%	5.3%	2.1%	1.4%	8.9%	14,836	100%

[1] Not defined by International Financial Reporting Standards (IFRSs).

The Consolidated Income Statement of the Merck Group is as follows:

MERCK GROUP

Consolidated Income Statement[1]

					Change	
€ million	**2019**	**%**	2018	%	€ million	%
Net sales	**16,152**	**100.0%**	**14,836**	**100.0%**	**1,315**	**8.9%**
Cost of sales	-6,006	-37.2%	-5,382	-36.3%	-624	11.6%
Gross profit	**10,145**	**62.8%**	**9,454**	**63.7%**	**691**	**7.3%**
Marketing and selling expenses	-4,576	-28.3%	-4,396	-29.6%	-180	4.1%
Administration expenses	-1,154	-7.1%	-1,183	-8.0%	29	-2.5%
Research and development costs	-2,268	-14.0%	-2,227	-15.0%	-41	1.8%
Impairment losses and reversals of impairment losses on financial assets (net)	-8	-0.0%	27	0.2%	-35	100.0%
Other operating income and expenses	-19	-0.1%	52	0.3%	-71	100.0%
Operating result (EBIT)[2]	**2,120**	**13.1%**	**1,727**	**11.6%**	**393**	**22.8%**
Financial result	-385	-2.4%	-266	-1.8%	-119	44.6%
Profit before income tax	**1,735**	**10.7%**	**1,461**	**9.8%**	**275**	**18.8%**
Income tax	-440	-2.7%	-368	-2.5%	-72	19.7%
Profit after tax from continuing operations	**1,296**	**8.0%**	**1,093**	**7.4%**	**203**	**18.5%**
Profit after tax from discontinued operation	**28**	**0.2%**	**2,303**	**15.5%**	**-2,275**	**-98.8%**
Profit after tax	**1,324**	**8.2%**	**3,396**	**22.9%**	**-2,072**	**-61.0%**
Non-controlling interests	-3	-0.0%	-22	-0.2%	19	-85.1%
Net income	**1,320**	**8.2%**	**3,374**	**22.7%**	**-2,053**	**-60.9%**

[1] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes" in the Notes to the Consolidated Financial Statements.

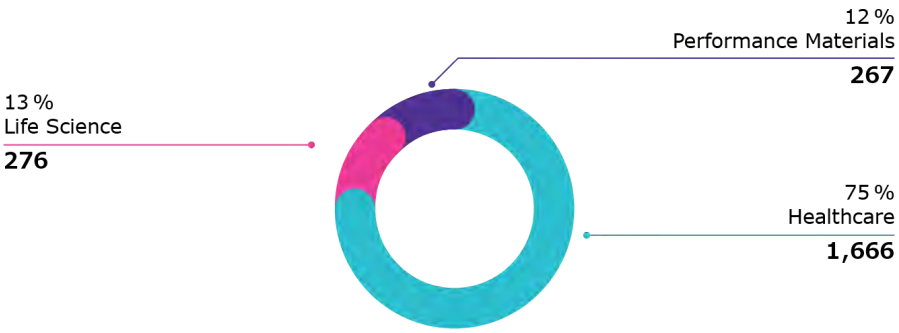
[2] Not defined by International Financial Reporting Standards (IFRSs).

The positive development of net sales led to an increase of 7.3% in gross profit of the Merck Group to € 10,145 million (2018: € 9,454 million). The resulting gross margin of the Group, i.e. gross profit as a percentage of net sales, amounted to 62.8% (2018: 63.7%). Group-wide research and development costs rose by 1.8% to € 2,268 million and led to a research spending ratio (research and development costs as a percentage of net sales) of 14.0% (2018: 15.0%). Accounting for 75% (2018: 77%) of Group R&D spending, Healthcare remained the most research-intensive business sector of the Merck Group.

MERCK GROUP

Research and development costs by business sector[1] – 2019

€ million/%



[1] Not presented: research and development costs of € 59 million allocated to Corporate and Other

Other operating income and expenses showed an expense balance of € 19 million in 2019, after an income balance of € 52 million in 2018. Detailed information about the development and composition of other operating expenses and income can be found in Note (15) "Other operating income" and Note (16) "Other operating expenses" in the Notes to the Consolidated Financial Statements.

The further deterioration of the financial result of 44.6% to € –385 million (2018: € –266 million) resulted mainly from higher interest expenses due to new borrowings of financial liabilities to finance the acquisition of Versum Materials. Details with respect to the development of finance income and finance expenses of the Group are shown in Note (40) "Financial income and expenses/Net profit and losses from financial instruments" in the Notes to the Consolidated Financial Statements.

Income tax expense came to € 440 million in 2019 (2018: € 368 million) and resulted in a tax rate of 25.3% (2018: 25.2%). Further information on income taxes are included in Note (17) "Income taxes" in the Notes to the Consolidated Financial Statements.

Profit after tax from discontinued operations of € 28 million (2018: € 2,303 million) resulted from the sale of the Consumer Health business in December 2018 and arose from subsequent effects in connection with the transaction. This profit must be reported separately in the Consolidated Income Statement pursuant to IFRS 5. The high figure for 2018 essentially includes the profit from the sale of the Consumer Health business amounting to € 2,244 million. Further information on the divestment of the Consumer Health business can be found in Note (5) "Acquisitions and divestments" in the Notes to the Consolidated Financial Statements.

The decline in net income of -60.9% to € 1,320 million (2018: € 3,374 million) was mainly attributable to the profit from the sale of the Consumer Health business realized in 2018. Earnings per share accordingly decreased to € 3.04 (2018: € 7.76).

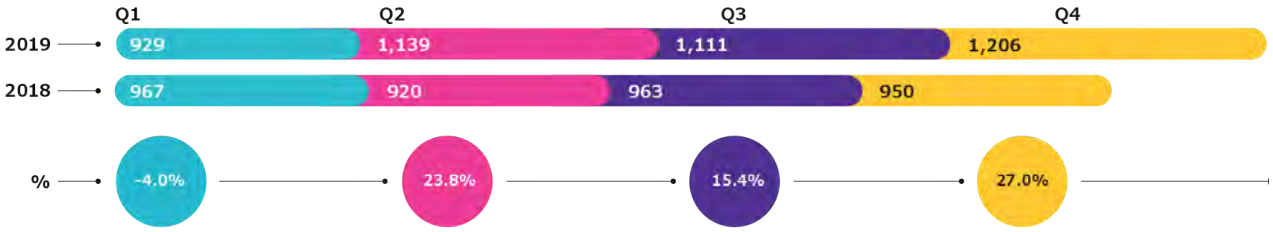
EBITDA pre, the key financial indicator used to steer operating business, rose by € 585 million, or 15.4%, to € 4,385 million (2018: € 3,800 million). The organic increase in this key performance indicator was 11.3%. It included favorable effects from the application of IFRS 16 "Leases" amounting to € 143 million. Furthermore, the development of EBITDA pre was positively influenced by foreign exchange effects and portfolio effects. Relative to net sales, the EBITDA pre margin was 27.1% in 2019 (2018: 25.6%). The reconciliation of the operating result (EBIT) to EBITDA pre is presented in the chapter entitled "Internal Management System."

The development of EBITDA pre in the individual quarters in comparison with 2018 as well as the respective growth rates are presented in the following overview:

MERCK GROUP

EBITDA pre[1] and change by quarter[2]

€ million/change in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

All business sectors contributed to the growth in Group EBITDA pre. Life Science, the business sector with the highest EBITDA pre, generated a 15.7% increase to € 2,129 million (2018: € 1,840 million) in fiscal 2019. At the same time, the EBITDA pre margin of this business sector also rose to 31.0% (2018: 29.8%). EBITDA pre of Healthcare even increased by 23.5% to € 1,922 million in 2019 (2018: € 1,556 million). The resulting EBITDA pre margin improved substantially to 28.6% (2018: 24.9%). The share of Group EBITDA pre accounted for by Healthcare (not taking into account the € –469 million reduction due to Corporate and Other) rose by 3 percentage points to 40% (2018: 37%). With an EBITDA pre of € 803 million (2018: € 786 million), the share of this Group key performance indicator attributable to Performance Materials decreased to 16% (2018: 19%). The EBITDA pre margin declined slightly to 31.2% (2018: 32.7%).

MERCK GROUP

EBITDA pre[1] by business sector[2] – 2019

€ million/%

[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Not presented: Decline in Group EBITDA pre by €–469 million due to Corporate and Other.

MERCK GROUP

Balance sheet structure[1]

	Dec. 31, 2019		Dec. 31, 2018		Change	
	€ million	**%**	€ million	%	€ million	%
Non-current assets	**34,808**	**79.4%**	**27,652**	**75.0%**	**7,155**	**25.9%**
thereof:						
Goodwill	17,141		13,764		3,377	
Other intangible assets	9,175		7,237		1,938	
Property, plant and equipment[2]	6,213		4,811		1,402	
Other non-current assets	2,278		1,840		438	
Current assets	**9,003**	**20.6%**	**9,236**	**25.0%**	**-232**	**-2.5%**
thereof:						
Inventories	3,342		2,764		577	
Trade and other current receivables	3,488		3,226		262	
Other current financial assets	57		29		28	
Other current assets	1,336		1,048		289	
Cash and cash equivalents	781		2,170		-1,390	
Total assets	**43,811**	**100.0%**	**36,888**	**100.0%**	**6,923**	**18.8%**
Equity	**17,914**	**40.9%**	**17,233**	**46.7%**	**681**	**4.0%**
Non-current liabilities	**14,056**	**32.1%**	**11,138**	**30.2%**	**2,918**	**26.2%**
thereof:						
Provisions for pensions and other post-employment benefits	2,957		2,336		620	
Other non-current provisions	490		780		-290	
Non-current financial debt[2]	8,644		6,681		1,963	
Other non-current liabilities	1,965		1,340		624	
Current liabilities	**11,842**	**27.0%**	**8,517**	**23.1%**	**3,324**	**39.0%**
thereof:						
Current provisions	933		600		333	
Current financial debt[2]	4,550		2,215		2,336	
Trade and other current payables/refund liabilities	2,618		2,238		380	
Other current liabilities	3,740		3,464		276	
Total equity and liabilities	**43,811**	**100.0%**	**36,888**	**100.0%**	**6,923**	**18.8%**

[1] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes" in the Notes to the Consolidated Financial Statements.

[2] The first-time application of IFRS 16 led to an increase in property, plant and equipment as well as financial debt as of January 1, 2019; see Note (45) "Effects of new accounting standards and other presentation changes" in the Notes to the Consolidated Financial Statements.

The total assets of the Merck Group amounted to € 43,811 million as of December 31, 2019 (December 31, 2018: € 36,888 million), representing an increase of 18.8% or € 6,923 million. The main reason for the strong increase in total assets and the development of the balance sheet items was the first-time consolidation of Versum Materials (see Note (5) "Acquisitions and divestments" in the Notes to the Consolidated Financial Statements). Due to exchange rate changes, total assets rose by around € 0.4 billion.

The growth in working capital of 13.2% to € 3,944 million (December 31, 2018: € 3,486 million) was largely attributable to the acquisition-related inventory build-up and increase in receivables.

MERCK GROUP

Working capital[1]

			Change	
€ million	**Dec. 31, 2019**	Dec. 31, 2018	€ million	%
Trade accounts receivable	3,174	2,931	243	8.3%
Receivables from royalties and licenses	45	29	17	57.9%
Inventories/right of return for goods already delivered	3,344	2,764	579	21.0%
Trade and other current payables/refund liabilities	-2,618	-2,238	-380	17.0%
Working capital[1]	**3,944**	**3,486**	**459**	**13.2%**

[1] Not defined by International Financial Reporting Standards (IFRSs).

The composition and the development of net financial debt were as follows:

MERCK GROUP

Net financial debt[1]

			Change	
€ million	**Dec. 31, 2019**	Dec. 31, 2018	€ million	%
Bonds and commercial paper	10,059	7,286	2,773	38.1%
Bank loans	1,587	620	967	>100.0%
Liabilities to related parties	809	824	-16	-1.9%
Loans from third parties and other financial debt	97	72	25	34.9%
Liabilities from derivatives (financial transactions)	76	90	-14	-15.2%
Lease liabilities[2]	567	4	563	>100.0%
Financial debt	**13,194**	**8,896**	**4,299**	**48.3%**
less:				
Cash and cash equivalents	781	2,170	-1,390	-64.0%
Other current financial assets[3]	50	24	26	>100.0%
Net financial debt[1]	**12,363**	**6,701**	**5,663**	**84.5%**

[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] The first-time application of IFRS 16 led to an increase of €465 million as of January 1, 2019.
[3] Excluding current derivatives (operational).

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Reconciliation of net financial debt[1]

€ million	**2019**	2018
Jan. 1	**6,701**	**10,144**
Currency translation difference	79	126
Change in lease liabilities[2]	663	–
Dividend payments[3]	689	768
Acquisitions[3]	5,020	–
Payments for/proceeds from the disposal of assets held for sale[3]	110	-3,129
Transfer of financial debt due to acquisitions	966	–
Free cash flow[1]	-1,889	-1,301
Other	24	93
Dec. 31	**12,363**	**6,701**

[1] Not defined by International Financial Reporting Standards (IFRSs).

[2] Thereof € 465 million due to the first-time application of IFRS 16 as of January 1, 2019.

[3] According to the Consolidated Cash Flow Statement.

In 2019, equity of the Merck Group rose by 4.0% to €17,914 million (December 31, 2018: €17,233 million). The increase in equity was essentially due to profit after tax generated in fiscal 2019 (€1.3 billion). Opposing effects resulted from dividend payments and profit distribution (€0.7 billion) (see "Consolidated Statement of Changes in Net Equity" in the Consolidated Financial Statements). Despite the increase in equity, the equity ratio declined by around 6 percentage points to 40.9% (December 31, 2018: 46.7%) due to the aforementioned rise in total assets. The composition of free cash flow as well as the development of the relevant items are presented in the following table:

MERCK GROUP

Free cash flow[1]

			Change	
€ million	**2019**	2018	€ million	%
Cash flow from operating activities according to the consolidated cash flow statement	2,856	2,219	637	28.7%
Payments for investments in intangible assets	-208	-106	-102	95.8%
Proceeds from the disposal of intangible assets	23	67	-44	-65.6%
Payments for investments in property, plant and equipment	-813	-910	98	-10.7%
Proceeds from the disposal of property, plant and equipment	31	31	-1	-2.3%
Free cash flow[1]	**1,889**	**1,301**	**588**	**45.2%**

[1] Not defined by International Financial Reporting Standards (IFRSs).

For further information on the impact of the first-time application of IFRS 16 "Leases" on the consolidated cash flow statement, please refer to Note (41) "Net cash flows from financing activities" in the Notes to the Consolidated Financial Statements.

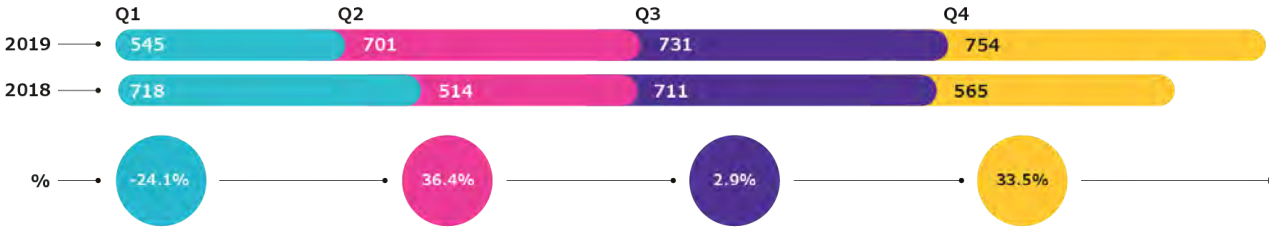
In fiscal 2019, the Merck Group generated business free cash flow of € 2,732 million (2018: € 2,508 million). The increase was mainly attributable to a higher EBITDA pre. The composition of business free cash flow is presented in the chapter entitled "Internal Management System."

The distribution of business free cash flow across the individual quarters and the percentage changes in comparison with 2018 were as follows:

MERCK GROUP

Business free cash flow[1] and change by quarter[2]

€ million/change in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

MERCK GROUP

Business free cash flow[1] by business sector[2] – 2019

€ million/%

[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Not presented: decline in Group business free cash flow by € –536 million due to Corporate and Other.

The contributions of the operating business sectors to business free cash flow of the Group in 2019 developed as follows: Life Science generated business free cash flow amounting to € 1,375 million (2018: € 1,393 million). Consequently, with a 42% share (2018: 46%) of Group business free cash flow (excluding the decline of € –536 million due to Corporate and Other), Life Science was the business sector with the highest cash inflows. In 2019, the Healthcare business sector showed a double-digit increase of 22.2% to € 1,252 million (2018: € 1,025 million), thus contributing a share of 38% to Group business free cash flow (2018: 34%). With business free cash flow of € 641 million (2018: € 588 million), Performance Materials contributed 20% (2018: 20%) to this Group key performance indicator.

Investments in property, plant, equipment, and software, as well as advance payments for intangible assets included in the calculation of business free cash flow, rose in 2019 by 10.1% to € 1,026 million (2018: € 932 million). The investments in property, plant, and equipment included therein amounted to € 1,104 million in 2019 (2018: € 890 million), of which € 497 million (2018: € 480 million) was attributable to strategic investment projects each with a project volume of more than € 2 million; the remainder was attributable to smaller investment projects.

In 2019, strategic investments of € 116 million (2018: € 161 million) were made to expand our site in Darmstadt, of which the Performance Materials business sector invested € 20 million in a new research center and € 15 million in a silica production facility. The Life Science business sector invested € 11 million in a new membrane production plant.

Outside Germany, high levels of strategic investments were made particularly in Switzerland (€ 105 million), China (€ 60 million), and the United States (€ 54 million). In Switzerland, the Healthcare business sector invested € 34 million in a new development center to produce biotechnological products and € 30 million in a new production building for bottling these products. In China, Life Science invested € 16 million in a production campus; Healthcare invested € 13 million in a logistics center. The United States saw a Healthcare investment of € 15 million in the expansion of the research and development center in Billerica, Massachusetts.

Our credit ratings from the independent rating agencies did not change in 2019. Merck is currently rated by Standard & Poor's, Moody's, and Scope. Standard & Poor's has issued a long-term credit rating of A with a stable outlook, Moody's a rating of Baa1 with a stable outlook, and Scope a rating of A–, likewise with a stable outlook. An overview of the development of our rating in recent years is presented in the Report on Risks and Opportunities.

The development of key balance sheet figures was as follows:

MERCK GROUP

Key balance sheet figures

%		Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2017	Dec. 31, 2016	Dec. 31, 2015
Equity ratio[1]	Total equity / Total assets	40.9%	46.7%	39.5%	36.7%	33.8%
Asset ratio[1]	Non-current assets / Total assets	79.4%	75.0%	79.1%	80.0%	80.7%
Asset coverage[1]	Total equity / Non-current assets	51.5%	62.3%	49.9%	45.9%	41.8%
Finance structure[1]	Current liabilities / Liabilities (total)	45.7%	43.3%	40.1%	37.5%	37.2%

[1] Not defined by International Financial Reporting Standards (IFRSs).

Overall assessment of business performance and economic situation

In fiscal 2019 we continued to implement our strategy in a disciplined fashion and reached important milestones. The financial targets we had set ourselves for 2019 were reached or even exceeded. In particular, we were able to return to profitable growth. Group sales in fiscal 2019 rose by 8.9% to € 16,152 million and EBITDA pre, the key financial indicator used to measure operating business, grew by 15.4% to € 4,385 million. All business sectors contributed to this success.

We also realized important strategic milestones in respect of the Group's long-term orientation: following the takeovers of Versum Materials and Intermolecular, our Performance Materials business sector is in a very good position to become a leading provider on the market for electronic materials, and to push further ahead with future innovations in this field. Our research results in Healthcare are promising. The United States Food and Drug Administration (FDA) has approved our therapy Mavenclad® for the treatment of specific forms of multiple sclerosis in the United States. Our cancer immunotherapy Bavencio® was granted approval in the United States, Europe, Japan, and in other markets for the treatment of patients with locally advanced kidney cancer in combination with another medicine. We entered into a global strategic alliance with GlaxoSmithKline to push further ahead with the clinical development of new therapy bintrafusp alfa to fight cancers that are difficult to treat. In Life Science, we made progress with our genome editing technologies. Last year we received further patents in this important area. All told, we now hold more than 22 patents for CRISPR technologies worldwide.

The solid accounting and financing policies of the Merck Group find expression in persistently good key balance sheet figures. The equity ratio as at December 31, 2019, was 40.9% (December 31, 2018: 46.7%) and thus remains at a very good level. Due to the

acquisition of Versum Materials, net financial debt as of December 31, 2019, rose to € 12,363 million (December 31, 2018: € 6,701 million). To achieve a rapid reduction of financial liabilities we are focusing on generating organic growth and on high inflows of financial resources from operating business activities.

Based on our solid net assets and financial position, and our profitable operations, we view the economic situation of the Merck Group as positive overall. Thanks to our leading position in science and technology we are able to look to the future with optimism.

Healthcare

HEALTHCARE

Key figures

€ million	**2019**	2018	Change € million	Change %
Net sales	6,714	6,246	468	7.5%
Operating result (EBIT)[1]	1,149	731	418	57.2%
Margin (% of net sales)[1]	17.1%	11.7%		
EBITDA[1]	1,896	1,492	404	27.1%
Margin (% of net sales)[1]	28.2%	23.9%		
EBITDA pre[1]	1,922	1,556	366	23.5%
Margin (% of net sales)[1]	28.6%	24.9%		
Business free cash flow[1]	1,252	1,025	227	22.1%

[1] Not defined by International Financial Reporting Standards (IFRSs).

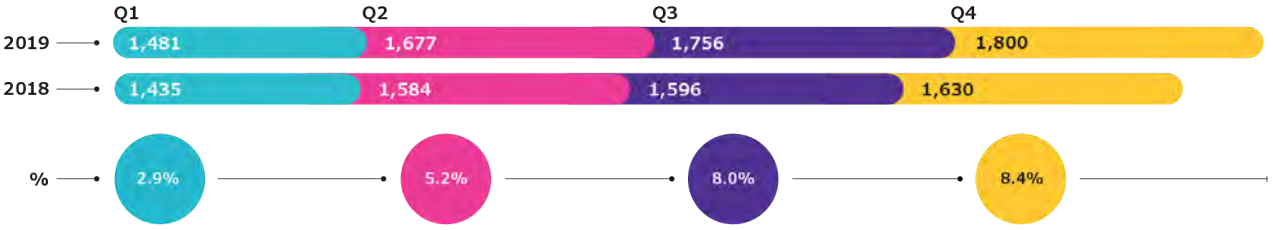
Development of sales and results of operations

In fiscal 2019, the Healthcare business sector recorded net sales of € 6,714 million (2018: € 6,246 million). Total growth of € 468 million or 7.5% was generated compared to the 2018 reporting period, consisting of organic growth amounting to 6.2% and positive exchange rate effects of 1.3%. The positive exchange rate effects resulted, in particular, from the trends of the U.S. dollar, the Chinese renminbi, and the Japanese yen.

The net sales in the individual quarters as well as the respective organic growth rates in 2019 are presented in the following graph:

Net sales and organic growth[1] by quarter[2]

€ million/organic growth in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

Net sales of the key product lines and products developed as follows in 2019:

HEALTHCARE

Net sales by major product lines/products

€ million	2019	Share	Organic growth[1]	Exchange rate effects	Total change	2018	Share
Oncology	**1,030**	**15%**	**8.9%**	**0.2%**	**9.1%**	**944**	**15%**
thereof: Erbitux®	871	13%	6.7%	-0.1%	6.6%	816	13%
thereof: Bavencio®	103	2%	44.1%	3.9%	48.0%	69	1%
Neurology & Immunology	**1,594**	**24%**	**1.8%**	**2.5%**	**4.2%**	**1,529**	**24%**
thereof: Rebif®	1,273	19%	-13.9%	2.4%	-11.5%	1,438	23%
thereof: Mavenclad®	321	5%	>100.0%	3.7%	>100.0%	90	1%
Fertility	**1,247**	**19%**	**5.9%**	**1.4%**	**7.3%**	**1,162**	**19%**
thereof: Gonal-f®	743	11%	3.3%	1.6%	4.9%	708	11%
General Medicine & Endocrinology	**2,557**	**38%**	**8.3%**	**0.9%**	**9.2%**	**2,341**	**38%**
thereof: Glucophage®	877	13%	18.5%	1.1%	19.6%	733	12%
thereof: Concor®	530	8%	10.4%	1.2%	11.6%	475	8%
thereof: Euthyrox®	402	6%	10.4%	0.2%	10.6%	363	6%
thereof: Saizen®	238	4%	3.3%	-1.6%	1.7%	234	4%
Other	**287**	**4%**				**270**	**4%**
Healthcare	**6,714**	**100%**	**6.2%**	**1.3%**	**7.5%**	**6,246**	**100%**

[1] Not defined by International Financial Reporting Standards (IFRSs).

Oncology drug Erbitux® (cetuximab) showed a positive organic sales trend of 6.7%, with the addition of Erbitux® to the National Reimbursement Drug List (NRDL) in China being a major contributing factor. In addition, in September 2019, the National Medical Products Administration (NMPA) of China approved Erbitux® for the first-line treatment for patients with RAS wild-type metastatic colorectal cancer (mCRC) in combination with FOLFOX or FOLFIRI, or in combination with irinotecan in patients who are refractory to irinotecan-containing chemotherapy. As a result, the Asia-Pacific region generated organic sales growth of 31.1%. By contrast, the situation in Europe remained marked by a difficult competitive environment, which led to an organic sales decline of -6.8%. Global net sales of Erbitux® in fiscal 2019, taking into account slightly negative exchange rate effects, increased by 6.6% to € 871 million (2018: € 816 million).

In the field of immuno-oncology, sales of oncology drug Bavencio® (avelumab) rose organically by 44.1% and reached € 103 million (2018: € 69 million), supported by a positive exchange rate trend of 3.9%. The extension of approval in various regions contributed to this growth. In May 2019, for example, the United States Food and Drug Administration (FDA) issued approval for the combination of Bavencio® (avelumab) plus axitinib for patients with advanced renal cell carcinoma. The European Commission followed suit in October with the approval of Bavencio® (avelumab) in combination with axitinib as a first-line treatment in patients with advanced renal cell carcinoma. In Japan, too, approval was granted in December 2019.

A material contribution to the pleasing organic growth of the Healthcare business sector amounting to 6.2% came from Mavenclad®, a medicine for the oral short-course treatment of highly active relapsing multiple sclerosis. Mavenclad® generated net sales of € 321 million in fiscal 2019 (2018: € 90 million), a three and a half times increase on the prior-year figure. The sharp rise in sales of Mavenclad® was also thanks to the FDA approval in the United States in March 2019, where Mavenclad® was approved as the first and only oral short-course treatment of highly active relapsing and active secondary progredient multiple sclerosis. This means that the therapy is now available in more than 70 countries, including the countries of the European Union, Australia, Canada, and the United States.

HEALTHCARE

Sales and organic growth[1] of Rebif® and Erbitux® by region – 2019

		Total	Europe	North America	Asia-Pacific (APAC)	Latin America	Middle East and Africa (MEA)
Rebif®	€ million	1,273	340	809	12	43	70
	Organic growth[1] in %	-13.9%	-13.7%	-16.5%	-5.9%	0.1%	9.9%
	% of sales	100%	27%	64%	1%	3%	5%
Erbitux®	€ million	871	405	–	344	72	50
	Organic growth[1] in %	6.7%	-6.8%	–	31.1%	16.5%	-11.1%
	% of sales	100%	47%	–	39%	8%	6%

[1] Not defined by International Financial Reporting Standards (IFRSs).

Sales of the drug Rebif®, which is used to treat relapsing forms of multiple sclerosis, saw an organic decline in net sales of -13.9% in 2019. Including positive exchange rate effects, net sales of € 1,273 million were recorded in 2019 (2018: € 1,438 million). This trend resulted from an organic decline on the main sales market, North America, amounting to -16.5%, followed by Europe with -13.7%. The drop in sales was attributable to the persistently difficult competitive situation on the interferon market and the competition from alternative therapies, including oral dosage forms. Since October 2019, Rebif® has been approved as well in the European Union for use during pregnancy and breast-feeding if clinically needed. The use of Rebif® while breast-feeding is an important option because many patients experience a relapse in the first three months after birth.

Gonal-f®, the leading recombinant hormone used in the treatment of infertility, generated organic growth of 3.3%. Including positive exchange rate effects, global sales increased by 4.9% to € 743 million (2018: € 708 million). North America and China, in particular, contributed to the organic growth.

The General Medicine & Endocrinology franchise (including CardioMetabolic Care) generated organic growth of 8.3% in comparison with the prior-year period. The franchise includes medicines to treat cardiovascular diseases, thyroid disorders, diabetes, and growth disorders. In all, the franchise generated net sales of € 2,557 million in fiscal 2019 (2018: € 2,341 million), equivalent to growth of 9.2%, of which 8.3% was organic and 0.9% currency-related.

The diabetes drug Glucophage®, the best-selling product in this area, recorded organic growth of 18.5%. The main driver was the positive development in China. Taking into account positive exchange rate effects, global Glucophage® sales increased to € 877 million (2018: € 733 million).

Double-digit sales growth (10.4%) was also achieved with beta-blocker Concor®. Additional positive exchange rate effects prompted an increase in sales of 11.6% to € 530 million. Net sales in the previous year were € 475 million.

A positive performance was also recorded by Euthyrox®, a medicine to treat thyroid disorders, with organic sales growth of 10.4%. Net sales thus increased to € 402 million (2018: € 363 million), with exchange rate effects playing only a minor role.

The organic sales growth of 3.3% reported by growth hormone Saizen® was reduced to 1.7% due to a negative exchange rate effect; as a result, sales overall rose to € 238 million (2018: € 234 million).

Net sales of the Healthcare business sector by region in 2019 developed as follows:

HEALTHCARE

Net sales by region

€ million	2019	Share	Organic growth[1]	Exchange rate effects	Acquisitions/divestments	Total change	2018	Share
Europe	2,241	33%	2.1%	-0.4%	–	1.7%	2,203	35%
North America	1,474	22%	-2.0%	4.9%	–	2.9%	1,432	23%
Asia-Pacific (APAC)	1,816	27%	19.0%	2.0%	–	21.0%	1,501	24%
Latin America	702	11%	9.8%	-3.6%	–	6.2%	661	11%
Middle East and Africa (MEA)	482	7%	4.4%	3.0%	–	7.4%	448	7%
Healthcare	**6,714**	**100%**	**6.2%**	**1.3%**	**–**	**7.5%**	**6,246**	**100%**

[1] Not defined by International Financial Reporting Standards (IFRSs).

The following table presents the composition of EBITDA pre in fiscal 2019 in comparison with 2018. The IFRS figures have been modified to reflect the elimination of adjustments included in the functional costs.

HEALTHCARE

Reconciliation EBITDA pre[1]

	2019			2018[2]			Change
€ million	IFRSs	Elimination of adjustments	Pre[1]	IFRSs	Elimination of adjustments	Pre[1]	Pre[1]
Net sales	**6,714**	**–**	**6,714**	**6,246**	**–**	**6,246**	**7.5%**
Cost of sales	-1,605	–	-1,605	-1,425	7	-1,419	13.1%
Gross profit	**5,109**	**–**	**5,109**	**4,820**	**7**	**4,827**	**5.8%**
Marketing and selling expenses	-2,305	3	-2,303	-2,349	10	-2,339	-1.5%
Administration expenses	-344	15	-329	-329	28	-301	9.2%
Research and development costs	-1,666	2	-1,663	-1,687	1	-1,686	-1.4%
Impairment losses and reversals of impairment losses on financial assets (net)	-1	–	-1	-3	–	-3	-61.7%
Other operating income and expenses	357	6	363	279	29	308	17.8%
Operating result (EBIT)[1]	**1,149**			**731**			
Depreciation/amortization/impairment losses/reversals of impairment losses	747	-1	746	761	-11	749	-0.5%
EBITDA[1]	1,896			1,492			
Restructuring expenses	17	-17	–	12	-12	–	
Integration expenses/IT expenses	13	-13	–	18	-18	–	
Gains (-)/losses (+) on the divestment of businesses	-5	5	–	26	-26	–	
Acquisition-related adjustments	–	–	–	–	–	–	
Other adjustments	–	–	–	8	-8	–	
EBITDA pre[1]	**1,922**	**–**	**1,922**	**1,556**	**–**	**1,556**	**23.5%**
thereof: organic growth[1]							19.5%
thereof: exchange rate effects							4.1%
thereof: acquisitions/divestments							–

[1] Not defined by International Financial Reporting Standard (IFRSs).

[2] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes" in the Notes to the Consolidated Financial Statements.

Gross profit of the Healthcare business sector after adjustments amounted to € 5,109 million and was 5.8% above the prior-year period (2018: € 4,827 million). The increase is essentially attributable to the strong organic development of net sales. The resulting gross margin declined slightly compared to the prior year, to 76.1% (2018: 77.2%). The 13.1% rise in the cost of sales also includes higher license expenses for Mavenclad®, which developed in line with the higher sales volume.

Marketing and selling expenses after adjustments amounted to € 2,303 million (2018: € 2,339 million) and showed a slight decline (-1.5%). At € 1,663 million (2018: € 1,686 million), research and development costs also remained at a comparable level to the prior year (-1.4%). This reflects continued investments in the development pipeline. The income balance of other operating expenses and income rose by 17.8% to € 357 million after adjustments (2018: € 308 million). Various lump sums recognized in fiscal 2019 made a material contribution to this increase. In connection with the sale of Palynziq™ rights to BioMarin Pharmaceutical Inc., United States, in 2016, a milestone payment of € 75 million was recognized in 2019 (2018: € 50 million). Following the extension of approval of Bavencio® for the treatment of advanced renal cell carcinoma in combination with axitinib in the United States, the EU, and Japan, milestone payments of € 90 million were generated from the partnership with Pfizer.

The upfront cash payment of € 300 million from the alliance with GlaxoSmithKline plc., United Kingdom, for the joint development and marketing of bintrafusp alfa is recognized in the income statement in accordance with the fulfillment of contractually promised goods and services, and had a positive effect of € 92 million in fiscal 2019. The increase in income was also accompanied by higher expenses. Among other things, an impairment loss was recognized in 2019 in connection with an intangible asset from the collaboration with F-star Delta Ltd. in the field of immuno-oncology (see Note (6) "Collaborations" in the Notes to the Consolidated Financial Statements).

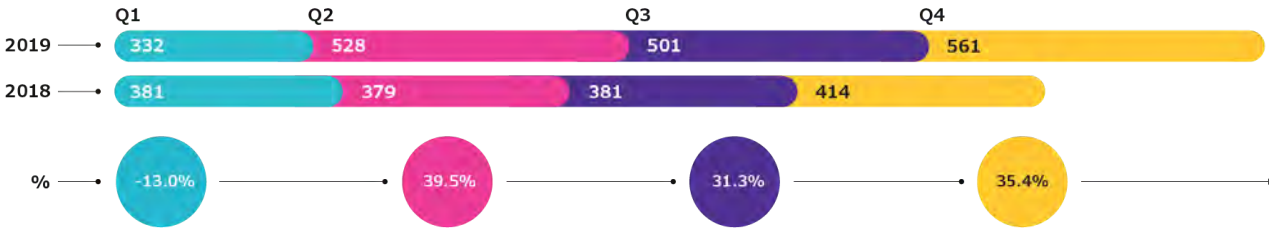
EBITDA pre recorded a highly gratifying development in 2019, rising by 23.5% to € 1,922 million (2018: € 1,556 million). Organic earnings growth was 19.5%; this figure includes the positive effects from the application of IFRS 16 "Leases" amounting to € 52 million. Overall, the EBITDA pre margin also showed growth of more than 3 percentage points to 28.6% (2018: 24.9%).

The development of EBITDA pre in the individual quarters in comparison with 2018 is presented in the following overview:

HEALTHCARE

EBITDA pre[1] and change by quarter[2]

€ million/change in %



[1] Not defined by International Financial Reporting Standards (IFRSs). L
[2] Quarterly breakdown unaudited.

Development of business free cash flow

In 2019, the business free cash flow amounted to € 1,252 million (2018: € 1,025 million) and thus grew by 22.1%. This development was primarily attributable to the higher EBITDA pre, which more than offset the inventory build-up and increase in receivables.

HEALTHCARE

Business free cash flow[1]

			Change	
€ million	**2019**	2018	€ million	%
EBITDA pre[1]	1,922	1,556	366	23.5%
Investments in property, plant and equipment, software as well as advance payments for intangible assets	-427	-395	-32	8.1%
Changes in inventories	-94	-55	-38	69.3%
Changes in trade accounts receivable as well as receivables from royalties and licenses	-100	-81	-19	23.6%
Lease payments[2]	-50			
Business free cash flow[1]	**1,252**	**1,025**	**227**	**22.1%**

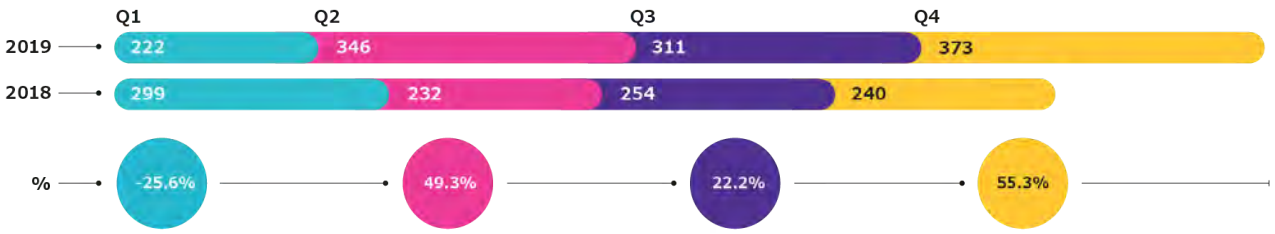
[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Excluding payments for low-value leases and interest components included in lease payments.

The development of business free cash flow items in the individual quarters in comparison with 2018 is presented in the following overview:

HEALTHCARE

Business free cash flow[1] **and change by quarter**[2]

€ million/change in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

Life Science

LIFE SCIENCE

Key figures

€ million	**2019**	2018	Change € million	Change %
Net sales	6,864	6,185	679	11.0%
Operating result (EBIT)[1]	1,280	1,036	245	23.6%
Margin (% of net sales)[1]	18.7%	16.7%		
EBITDA[1]	2,070	1,755	315	17.9%
Margin (% of net sales)[1]	30.2%	28.4%		
EBITDA pre[1]	2,129	1,840	289	15.7%
Margin (% of net sales)[1]	31.0%	29.8%		
Business free cash flow[1]	1,375	1,393	-18	-1.3%

[1] Not defined by International Financial Reporting Standards (IFRSs).

Development of sales and results of operations

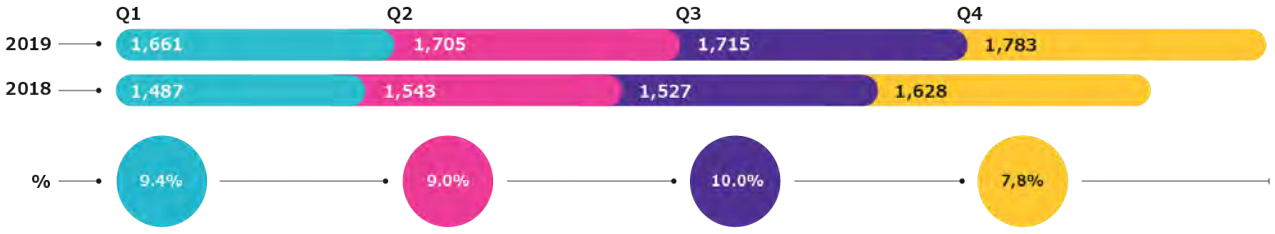
In fiscal 2019, Life Science posted a strong organic sales growth of 9.0%, assisted by a favorable foreign exchange impact of 2.6% and offset by a negative portfolio effect of -0.6%, resulting in a total growth of 11.0% compared to the previous year. All three business units contributed to organic growth, with the largest contribution coming from Process Solutions, followed by Applied Solutions. Taking these effects into account, Life Science net sales increased overall to € 6,864 million (2018: € 6,185 million).

The development of sales in the individual quarters in comparison with 2018 as well as the respective organic growth rates are presented in the following graph:

LIFE SCIENCE

Net sales and organic growth[1] by quarter[2]

€ million/organic growth in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

LIFE SCIENCE

Net sales by business unit[1]

€ million	2019	Share	Organic growth[2]	Exchange rate effects	Acquisitions/divestments	Total change	2018	Share
Process Solutions	3,003	44%	15.1%	3.0%	–	18.1%	2,543	41%
Research Solutions	2,176	32%	3.9%	2.4%	–	6.3%	2,046	33%
Applied Solutions	1,685	24%	5.9%	2.0%	-2.3%	5.6%	1,596	26%
Life Science	**6,864**	**100%**	**9.0%**	**2.6%**	**-0.6%**	**11.0%**	**6,185**	**100%**

[1] Previous year's figures have been adjusted due to an internal realignment.
[2] Not defined by International Financial Reporting Standards (IFRSs).

The Process Solutions business unit, which markets products and services for the pharmaceutical production value chain, generated organic sales growth of 15.1%, which was the highest rate within the Life Science business sector. Assisted by a favorable foreign exchange effect of 3.0%, sales amounted to € 3,003 million in 2019 (2018: € 2,543 million). Therefore, Process Solutions accounted for 44% of total net sales in the Life Science business sector. Nearly all businesses contributed to the sales increase with double-digit growth rates. In regional terms, all regions except Middle East and Africa experienced double-digit growth within Process Solutions.

The Research Solutions business unit, which provides products and services to support research for pharmaceutical, biotechnology, and academic research laboratories, recorded an increase in organic sales of 3.9%. Supported by favorable exchange rate effects of 2.4%, sales totaled € 2,176 million in fiscal 2019 (2018: € 2,046 million). Organic growth was driven by all business fields. Research Solutions thus accounted for 32% of Life Science net sales. In regional terms, Asia-Pacific was the strongest organic growth driver for Research Solutions.

The Applied Solutions business unit, which accounted for a 24% share of Life Science net sales in 2019, delivered strong organic sales growth of 5.9% with its broad range of products for researchers as well as scientific and industrial laboratories. The negative portfolio impact was attributable to the divestment of the flow cytometry business. Assisted by favorable exchange rate effects of 2.0%, sales totaled € 1,685 million in 2019 (2018: € 1,596 million). The sales performance of Applied Solutions was driven by all business fields and in all regions.

Net sales of the business sector by region developed as follows:

LIFE SCIENCE

Net sales by region

€ million	2019	Share	Organic growth[1]	Exchange rate effects	Acquisitions/ divestments	Total change	2018	Share
Europe	2,277	33%	6.7%	0.4%	-0.5%	6.6%	2,136	35%
North America	2,474	36%	8.9%	5.6%	-0.6%	13.8%	2,173	35%
Asia-Pacific (APAC)	1,743	26%	11.8%	2.7%	-0.7%	13.8%	1,532	25%
Latin America	278	4%	13.6%	-4.9%	-0.2%	8.5%	256	4%
Middle East and Africa (MEA)	92	1%	5.7%	-0.4%	-0.4%	4.9%	88	1%
Life Science	**6,864**	**100%**	**9.0%**	**2.6%**	**-0.6%**	**11.0%**	**6,185**	**100%**

[1] Not defined by International Financial Reporting Standards (IFRSs).

The following table presents the composition of EBITDA pre for 2019 in comparison with 2018. The International Financial Reporting Standards (IFRS) figures have been modified to reflect the elimination of adjustments included in the respective functional costs.

LIFE SCIENCE

Reconciliation EBITDA pre[1]

	2019			2018[2]			Change
€ million	IFRSs	Elimination of adjustments	Pre[1]	IFRSs	Elimination of adjustments	Pre[1]	Pre[1]
Net sales	**6,864**	**–**	**6,864**	**6,185**	**–**	**6,185**	**11.0%**
Cost of sales	-2,962	5	-2,957	-2,723	38	-2,685	10.1%
Gross profit	**3,903**	**5**	**3,908**	**3,463**	**38**	**3,500**	**11.6%**
Marketing and selling expenses	-1,924	2	-1,922	-1,777	2	-1,775	8.3%
Administration expenses	-341	34	-307	-335	52	-282	8.9%
Research and development costs	-276	–	-276	-251	1	-249	10.7%
Impairment losses and reversals of impairment losses on financial assets (net)	-7	–	-7	-4	–	-4	56.1%
Other operating income and expenses	-75	19	-56	-60	14	-46	21.8%
Operating result (EBIT)[1]	**1,280**			**1,036**			
Depreciation/amortization/impairment losses/reversals of impairment losses	789	–	789	719	-23	696	13.3%
EBITDA[1]	**2,070**			**1,755**			
Restructuring expenses	13	-13	–	3	-3	–	
Integration expenses/IT expenses	36	-36	–	86	-86	–	
Gains (-)/losses (+) on the divestment of businesses	9	-9	–	-8	8	–	
Acquisition-related adjustments	2	-2	–	2	-2	–	
Other adjustments	–	–	–	3	-3	–	
EBITDA pre[1]	**2,129**	**–**	**2,129**	**1,840**	**–**	**1,840**	**15.7%**
thereof: organic growth[1]							14.4%
thereof: exchange rate effects							1.5%
thereof: acquisitions/divestments							-0.2%

[1] Not defined by International Financial Reporting Standard (IFRSs).

[2] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes" in the Notes to the Consolidated Financial Statements.

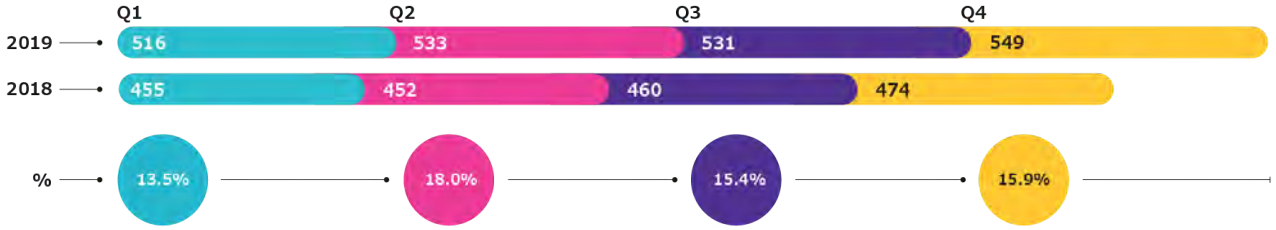
Adjusted gross profit increased by 11,6% to € 3,908 million (2018: € 3,500 million). The strong increase was driven by organic sales growth across all business units and production capacity utilization. The gross margin of Life Science, i.e. gross profit as a percentage of net sales, amounted to 56.9% (2018: 56.6%). Marketing and selling expenses increased by 8.3% to € 1,922 million (2018: € 1,775 million) while research and development costs increased by 10.7% to € 276 million (2018: € 249 million). Other operating expenses (net) increased by 21.8% to € 56 million (2018: € 46 million). After eliminating adjustments, amortization, and depreciation, EBITDA pre rose by 15.7% to € 2,129 million (2018: € 1,840 million). This double-digit increase in the most important key figure used to steer the operating business was mainly organic (14.4%) and included a positive earnings contribution of € 59 million due to the first-time application of IFRS 16 "Leases." The result margin, i.e. EBITDA pre as a percentage of net sales, increased in 2019 to 31.0% (2018: 29.8%). This reflects the strong performance of the combined Life Science businesses along with continued focus on driving sales and managing costs.

The development of EBITDA pre in the individual quarters in comparison with 2018 is presented in the following overview:

LIFE SCIENCE

EBITDA pre[1] and change by quarter[2]

€ million/change in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

Development of business free cash flow

In 2019, business free cash flow amounted to € 1,375 million (2018: € 1,393 million). Higher EBITDA pre was primarily offset by the build-up of inventories supporting the sales growth, increased capital spending, and an increase in trade accounts receivable following the underlying sales development.

LIFE SCIENCE

Business free cash flow[1]

			Change	
€ million	**2019**	2018	€ million	%
EBITDA pre[1]	2,129	1,840	289	15.7%
Investments in property, plant and equipment, software as well as advance payments for intangible assets	-384	-315	-69	21.8%
Changes in inventories	-232	-116	-117	>100.0%
Changes in trade accounts receivable as well as receivables from royalties and licenses	-81	-17	-65	>100.0%
Lease payments[2]	-56			
Elimination first-time consolidation	1			
Business free cash flow[1]	**1,375**	**1,393**	**-18**	**-1.3%**

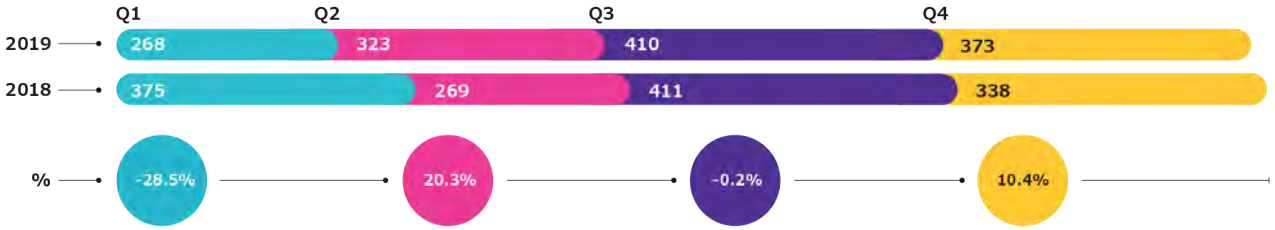
[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Excluding payments for low-value leases and interest components included in lease payments.

The development of business free cash flow items in the individual quarters in comparison with 2018 is presented in the following overview:

LIFE SCIENCE

Business free cash flow[1] and change by quarter[2]

€ million/change in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

Performance Materials

PERFORMANCE MATERIALS

Key figures

			Change	
€ million	**2019**	2018	€ million	%
Net sales	2,574	2,406	168	7.0%
Operating result (EBIT)[1]	307	508	-200	-39.5%
Margin (% of net sales)[1]	11.9%	21.1%		
EBITDA[1]	637	769	-132	-17.1%
Margin (% of net sales)[1]	24.8%	32.0%		
EBITDA pre[1]	803	786	18	2.3%
Margin (% of net sales)[1]	31.2%	32.7%		
Business free cash flow[1]	641	588	54	9.1%

[1] Not defined by International Financial Reporting Standards (IFRSs).

Development of net sales and results of operations

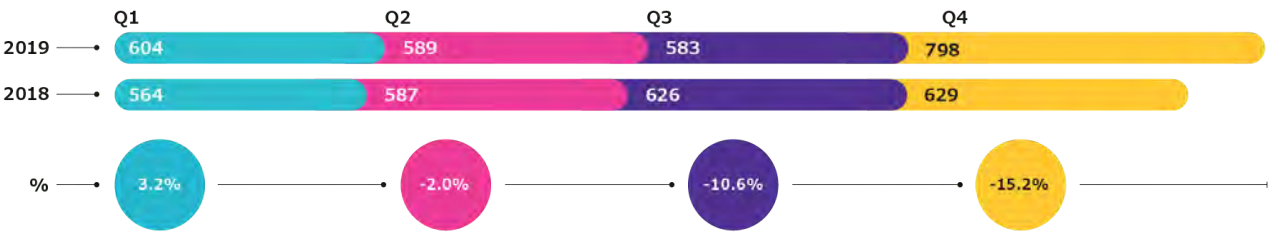
In 2019, net sales of the Performance Materials business sector rose by 7.0% to € 2,574 million (2018: € 2,406 million). This growth was attributable to additional net sales from the acquisitions of Versum Materials and Intermolecular (10.4%) and positive exchange rate effects of 3.1%. Both of these positive effects more than offset a decline in net sales in the original franchises.

The net sales in the individual quarters as well as the respective organic growth rates in 2019 are presented in the following graph:

PERFORMANCE MATERIALS

Net sales and organic growth[1] by quarters[2]

€ million/organic growth in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

Organic sales growth of the individual quarters developed from 3.2% in the first quarter of 2019 to -15.2% in the fourth quarter of 2019. The performance in the second half of 2019 was attributable, in particular, to the strong 2018 figures for Display Solutions.

As expected, the Display Solutions business unit, consisting mainly of the business with liquid crystals, photoresists for display applications, and OLED materials, recorded an organic decline in 2019. This organic decline of -8.6% was partly offset by positive exchange rate effects of 2.8%. Capacity ramp-up projects for panel makers in China had shown a strong performance in the third quarter of 2018, peaking in the fourth quarter of 2018. Although net sales in the first two quarters of 2019 continued to benefit from this ramp-up of production capacity, they did so to a comparatively lesser extent.

Following the acquisitions of Versum Materials and Intermolecular, the Semiconductor Solutions business unit has been structured into two new franchises: Semiconductor Materials and Delivery Systems & Services. Semiconductor Materials will continue to concentrate on the distribution and development of materials-based solutions for the semiconductor industry. Delivery Systems & Services focuses on the development and use of delivery systems for semiconductor manufacturers. Furthermore, Delivery Systems & Services will provide services for the installation of systems and safe handling of the specialist materials they process.

Overall, in 2019, customer silicon wafer processing remained below expectations against the backdrop of continued weakness in the semiconductor market. Weighed down by weak market activity, net sales in the original Semiconductor Solutions business units declined organically by -3.6%. However, this was more than offset by positive exchange rate effects of 4.1%.

Driven by the acquisitions of Versum Materials and Intermolecular, overall growth in Semiconductor Solutions was 42.5%. The proportion of Performance Materials sales accounted for by this business unit thus rose from 25% to 33%.

Net sales of the Surface Solutions business unit in fiscal 2019 were down -1.9% overall. An organic decline of -4.2%, attributable to weaker demand from the automotive segment in particular, was partly offset by positive exchange rate effects of 2.3%.

PERFORMANCE MATERIALS

Net sales by business unit

€ million	**2019**	**Share**	**organic growth[1]**	**Exchange rate effects**	**Acquisitions/ divestments**	**Total change**	2018	Share
Display Solutions	1,256	49%	-8.6%	2.8%	–	-5.7%	1,332	55%
Semiconductor Solutions	848	33%	-3.6%	4.1%	42.0%	42.5%	596	25%
Surface Solutions	468	18%	-4.2%	2.3%	–	-1.9%	476	20%
Other	2	0%	8.7%	2.4%	–	11.1%	1	0%
Performance Materials	**2,574**	**100%**	**-6.5%**	**3.1%**	**10.4%**	**7.0%**	**2,406**	**100%**

[1] Not defined by International Financial Reporting Standards (IFRSs).

Net sales of the Performance Materials business sector by region developed as follows:

PERFORMANCE MATERIALS

Net sales by region

€ million	**2019**	**Share**	**organic growth[1]**	**Exchange rate effects**	**Acquisitions/ divestments**	**Total change**	2018	Share
Europe	217	9%	-5.5%	0.1%	4.2%	-1.2%	220	9%
North America	267	10%	-7.0%	4.9%	27.0%	24.9%	214	9%
Asia-Pacific (APAC)	2,041	79%	-6.8%	3.2%	9.2%	5.6%	1,932	80%
Latin America	32	1%	-2.0%	0.2%	0.9%	-0.9%	32	2%
Middle East and Africa (MEA)	17	1%	48.3%	2.0%	71.8%	> 100.0%	8	0%
Performance Materials	**2,574**	**100%**	**-6.5%**	**3.1%**	**10.4%**	**7.0%**	**2,406**	**100%**

[1] Not defined by International Financial Reporting Standards (IFRSs).

The following table presents the composition of EBITDA pre for 2019 in comparison with 2018. The IFRS figures have been modified to reflect the elimination of adjustments included in the respective functional costs.

PERFORMANCE MATERIALS

Reconciliation EBITDA pre[1]

	2019			2018[2]			Change
€ million	IFRSs	Elimination of adjustments	Pre[1]	IFRSs	Elimination of adjustments	Pre[1]	Pre[1]
Net sales	**2,574**	**–**	**2,574**	**2,406**	**–**	**2,406**	**7.0%**
Cost of sales	-1,437	51	-1,386	-1,231	–	-1,230	12.6%
Gross profit	**1,137**	**51**	**1,188**	**1,175**	**–**	**1,175**	**1.1%**
Marketing and selling expenses	-329	6	-323	-255	–	-255	26.8%
Administration expenses	-118	11	-107	-107	17	-90	18.8%
Research and development costs	-267	26	-241	-242	–	-242	-0.5%
Impairment losses and reversals of impairment losses on financial assets (net)	–	–	–	-1	–	-1	–
Other operating income and expenses	-116	80	-37	-64	21	-43	-14.6%
Operating result (EBIT)[1]	**307**			**508**			
Depreciation/amortization/impairment losses/reversals of impairment losses	330	-7	323	261	-21	241	34.1%
EBITDA[1]	**637**			**769**			
Restructuring expenses	61	-61	–	1	-1	–	
Integration expenses/IT expenses	23	-23	–	15	-15	–	
Gains (-)/losses (+) on the divestment of businesses	–	–	–	–	–	–	
Acquisition-related adjustments	82	-82	–	–	–	–	
Other adjustments	–	–	–	1	-1	–	
EBITDA pre[1]	**803**	**–**	**803**	**786**	**–**	**786**	**2.3%**
thereof: organic growth[1]							-12.3%
thereof: exchange rate effects							6.1%
thereof: acquisitions/divestments							8.5%

[1] Not defined by International Financial Reporting Standard (IFRSs).

[2] Previous year's figures have been adjusted; see Note (45) "Effects from new accounting standards and other presentation changes" in the Notes to the Consolidated Financial Statements.

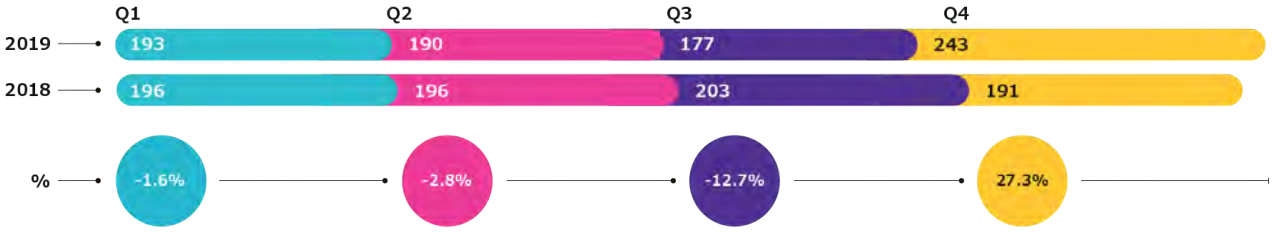
Gross profit of the Performance Materials business sector after adjustments rose by 1.1% to € 1,188 million in fiscal 2019 (2018: € 1,175 million). A key driver of this increase was the contribution provided by the Versum Materials acquisition, which more than offset the lower absorption of fixed costs amid the organic decline in sales in the Semiconductor Solutions and Surface Solutions business units. At 46.2% (2018: 48.9%), the gross margin in 2019 was below the previous year's level. Not including adjustments, the operating result (EBIT) decreased by € 200 million to € 307 million in 2019 (2018: € 508 million). The main drivers here were the restructuring expenses for the Bright Future transformation program, the acquisition and integration expenses for Versum Materials and Intermolecular, and IT expenses for enterprise resource planning (ERP) systems. These effects were only partly offset by the additional EBIT contribution from acquisitions. The rise in marketing and selling expenses and in administrative expenses was due to the additional costs of the Versum Materials and Intermolecular organizations. The so far successful implementation of the Bright Future transformation program more than offset the additional expenses of the Versum Materials and Intermolecular organizations in the adjusted research and development costs. EBITDA pre of the business sector grew by 2.3% to € 803 million (2018: € 786 million). The additional EBITDA pre from the acquisitions (8.5%) and positive foreign exchange effects (6.1%) more than offset the expected decline in organic EBITDA pre (-12.3%). The organic EBITDA pre development included favorable effects from the application of IFRS 16 "Leases" amounting to € 12 million. At 31.2%, the EBITDA pre margin in 2019 was down on the prior-year figure (2018: 32.7%).

EBITDA pre developed roughly in line with net sales over the first three quarters of 2019. The highly positive development in the fourth quarter of 2019 is attributable to additional EBITDA pre from the acquired businesses.

PERFORMANCE MATERIALS

EBITDA pre[1] and change by quarter[2]

€ million/change in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

Development of business free cash flow

The business free cash flow of the Performance Materials business sector rose by 9.1% to € 641 million in 2019 (2018: € 588 million). Higher EBITDA pre and the reduction in receivables in fiscal 2019 substantially offset higher investments.

PERFORMANCE MATERIALS

Business free cash flow[1]

			Change	
€ million	**2019**	2018	€ million	%
EBITDA pre[1]	803	786	18	2.3%
Investments in property, plant and equipment, software as well as advance payments for intangible assets	-158	-118	-40	33.9%
Changes in inventories	-251	-44	-207	>100.0%
Changes in trade accounts receivable as well as receivables from royalties and licenses	-88	-36	-51	>100.0%
Lease payments[2]	-11			
Elimination first-time consolidations of Versum/Intermolecular	346			
Business free cash flow[1]	**641**	**588**	**54**	**9.1%**

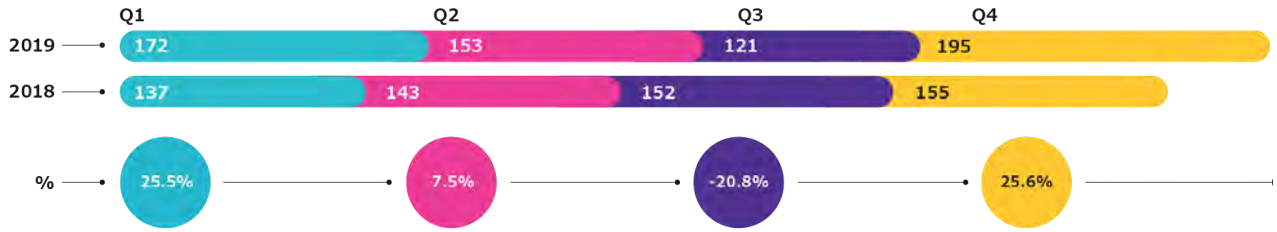
[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Excluding payments for low-value leases and interest components included in lease payments.

The development of business free cash flow items in the individual quarters in comparison with 2018 is presented in the following overview:

PERFORMANCE MATERIALS

Business free cash flow[1] and change by quarter[2]

€ million/change in %



[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Quarterly breakdown unaudited.

Corporate and Other

Corporate and Other comprises Group administration expenses for central Group functions that cannot be directly allocated to the business sectors, such as Finance, Procurement, Legal, Communications, and Human Resources. Corporate costs additionally encompass expenses for central, non-allocated IT functions, including expenses related to the expansion and harmonization of IT systems within the Merck Group as well as research and development costs spanning business sectors.

CORPORATE AND OTHER

Key figures

			Change	
€ million	**2019**	2018	€ million	%
Operating result (EBIT)[1]	-617	-548	-69	12.6%
EBITDA[1]	-537	-488	-48	9.9%
EBITDA pre[1]	-469	-381	-88	23.0%
Business free cash flow[1]	-536	-497	-39	7.9%

[1] Not defined by International Financial Reporting Standards (IFRSs).

After eliminating adjustments, administrative costs declined to €302 million in fiscal 2019 (2018: €320 million). Cross-business research and development costs amounting to €59 million (2018: €47 million), such as operating expenses for the Innovation Center, were allocated to Corporate. Other operating expenses (net) rose to €–167 million (2018: € –90 million), due primarily to the development of the foreign exchange result. A reversal of an impairment loss (€ 37 million) for receivables in connection with contractual refund claims from the sale of the Generics business in 2007 had a positive effect on the operating result. After eliminating depreciation, amortization, and adjustments, EBITDA pre amounted to € –469 million in 2019 (2018: € –381 million). The increase in negative business free cash flow to € –536 million (2018: € –497 million) was largely the outcome of the development of EBITDA pre as well as lower investments.

Report on Risks and Opportunities[1]

Risks and opportunities are inherent to entrepreneurial activity. We have put systems and processes in place to identify risks at an early stage and to counteract them by taking appropriate action. Within the company, opportunity management is an integral component of internal decision-making processes such as short- and medium-term planning and intra-year business plans.

Risk and opportunity management

Merck is part of a complex, global business world and is therefore exposed to a multitude of external and internal influences. Every business decision is therefore based on the associated risks and opportunities.

In our internal risk reporting, risks are defined as potential future events or developments that could lead to a negative deviation from our (financial) targets. In parallel, opportunities are defined as potential events or developments that imply a positive deviation from our planned (financial) targets. Identified future events and expected developments are taken into account in internal planning, provided that it can be assumed that their occurrence is likely in the planning period. The risks and opportunities presented in the following risk and opportunities report are those potential future events that could respectively lead to a negative or positive deviation from the topics covered by planning.

Risk management process

The objective of our risk management activities is to recognize, assess, and manage risks early on and to implement appropriate measures to minimize them. The responsibilities, objectives, and processes of risk management are described in our internal risk management guidelines. The business heads, managing directors of Merck subsidiaries, and the heads of Group functions are specified as employees with responsibility for risks. The group of consolidated companies for risk reporting purposes is the same as the group of consolidated companies for the Consolidated Financial Statements. Every six months, the risk owners assess their risk status and report their risk portfolio to Risk Management. We use special risk management software in the context of these activities.

Likewise, risk-mitigating measures are reported and assessed. The effectiveness of these measures and the planned implementation time frame are monitored by Group Risk Management.

The residual risk after the implementation of these measures is presented in the internal risk report as net risk.

Group Controlling & Risk Management forms the organizational framework for risk management and reports directly to the Group Chief Financial Officer. Group Risk Management uses the information reported to determine the current risk portfolio for the Merck Group, presenting this in a report to the Executive Board, the Supervisory Board, and the Finance Committee with detailed explanations twice per year. This also encompasses a probability-weighted aggregation of risks at the Group level using a Monte Carlo simulation. Furthermore, significant changes in the assessment of the risks already known and new significant risks can be reported at any time, and are communicated to the Executive Board on an ad hoc basis.

For reporting risks with a potential negative impact on our EBIT, a minimum threshold is set at a value of € 5 million in the standard process and at a value of € 25 million in the ad hoc process. Risks below these thresholds are steered independently within the business sectors. The relevant timeframe for internal risk reporting is five years. The effects of risks described in this report on risks and opportunities are presented as annual values. The assessment of the risks presented relates to December 31, 2019. There were no relevant changes after the balance sheet date that would have necessitated an amended presentation of the risk situation of the Group.

[1] Owing to an altered risk assessment as regards the Covid-19 pandemic, the section entitled "Overall view of the risk and opportunity situation and management assessment" of this Report on Risks and Opportunities was correspondingly supplemented on May 12, 2020.

Within the scope of audits, Group Internal Auditing regularly reviews the performance of risk management processes within the units and, at the same time, the communication of relevant risks from the operating businesses to Group Risk Management.

Opportunity management process

The risk management system described concentrates on business risks, and not on opportunities at the same time. The opportunity management process is integrated into our internal controlling processes and carried out in the operating units on the basis of the Group strategy. The businesses analyze and assess potential market opportunities as part of strategy and planning processes. In this context, investment opportunities are examined and prioritized primarily in terms of their potential value proposition in order to ensure an effective allocation of resources. We specifically invest in growth markets to leverage the opportunities of dynamic development and customer proximity at a local level.

If the occurrence of the identified opportunities is rated as likely, they are incorporated into the business plans and the short-term forecasts. Trends going beyond this, or events that could lead to a positive development in the net assets, financial position, and results of operations, are presented in the following report as opportunities. These could have a positive effect on our medium-term prospects.

Risk and opportunity assessment

Risks

The significance of risks is calculated on the basis of their potential negative impact on the forecast financial targets in conjunction with the probability of occurrence of the respective risk. In line with these two factors, risks are classified as "high," "medium" or "low."

The underlying scales for measuring these factors are shown below:

PROBABILITY OF OCCURRENCE

Probability of occurrence	Explanation
< 20%	Unlikely
20–50%	Possible
51–80%	Likely
> 80%	Very likely

DEGREE OF IMPACT

Degree of impact	Explanation
> € 50 million	Critical negative impact on the net assets, financial position, and results of operations
€ 20 – 50 million	Substantial negative impact on the net assets, financial position, and results of operations
€ 5 – < 20 million	Moderate negative impact on the net assets, financial position, and results of operations
< € 5 million	Immaterial negative impact on the net assets, financial position and results of operations

The combination of the two factors results in the risk matrix below, which shows the individual risks and their significance to the Group.

RISK MATRIX

Impact \ Probability of occurrence	< 20%	20 – 50%	51 – 80%	> 80%
> € 50 million	Medium	Medium	High	High
€ 20 – 50 million	Medium	Medium	Medium	High
€ 5 – < 20 million	Low	Medium	Medium	Medium
< € 5 million	Low	Low	Low	Low

Opportunities

Opportunities are assessed in their respective specific business environment. General measures of the business functions are quantified during operational planning, usually in relation to sales, EBITDA pre, and business free cash flow. Net present value, internal rate of return, the return on capital employed (ROCE), and the amortization period of the investment are primarily used to assess and prioritize investment opportunities. Similarly, scenarios are frequently set up to simulate the influence of possible fluctuations and changes in the respective factors on results. There is no overarching, systematic classification of the probability of occurrence and impact of opportunities.

Internal control system for the Group accounting process

The objective of the internal control system for the accounting process is to implement controls that provide assurance that the financial statements are prepared in compliance with the relevant accounting laws and standards. This system covers measures designed to ensure the complete, correct, and timely conveyance and presentation of information that is relevant for the preparation of the Consolidated Financial Statements and the combined management report.

Key tools

The internal control system aims to ensure the accuracy of the consolidated accounting process through functioning internal controls with reasonable assurance. The Group Accounting function centrally steers the preparation of the Consolidated Financial Statements of Merck KGaA as the parent company of the Merck Group. This Group function defines the reporting requirements that all Merck subsidiaries must meet. At the same time, this function steers and monitors the scheduling and process-related requirements of the Consolidated Financial Statements. Group Accounting centrally manages all changes to the equity holding structure and correspondingly adapts the Group's scope of consolidation. The proper elimination of intragroup transactions within the scope of the consolidation process is ensured. Group-wide accounting guidelines form the basis for the preparation of the statutory financial statements of the parent company and of the subsidiaries, which are reported to Group Accounting; the guidelines are adapted in a timely manner to reflect changes in the financial regulatory environment, and are updated in accordance with internal reporting requirements. For special issues, such as the accounting treatment of intangible assets within the scope of company acquisitions or pension obligations, external experts are additionally involved where necessary.

The individual companies have a local internal control system. Where financial processes are handled by a Shared Service Center, the internal control system of the Shared Service Center is additionally applied. Both ensure that accounting complies with IFRSs (International Financial Reporting Standards) and with the Group accounting guidelines.

Group Accounting provides support to the local contacts and ensures a consistently high quality of reporting throughout the entire reporting process.

For Group financial reporting purposes, most of our subsidiaries use standard SAP software. Consolidation software from SAP is also used for the elimination of intragroup transactions. A detailed authorization concept ensures the separation of duties with respect to both single-entity reporting and the Consolidated Financial Statements. In principle, the accounting process is designed to ensure that all units involved adhere to the principle of dual control.

The effectiveness of Merck's internal control system with regard to accounting and the compliance with financial reporting by the individual companies is confirmed by both the local managing director and the local chief financial officer by signing the single-entity reporting. For the accounting treatment of balance sheet items, Group Accounting closely cooperates with Group Risk Management in order to correctly present potential risks in the balance sheet. All the structures and processes described are subject to regular review by Group Internal Auditing based on an annual audit plan set out by the Executive Board. The results of these audits are dealt with by the Executive Board, the Supervisory Board, and the Finance Committee. The internal control system at Merck makes it possible to lower the risk of material misstatements in accounting to a minimum. However, no internal control system – regardless of its design – can entirely rule out a residual risk.

Business-related risks and opportunities

Political and regulatory risks and opportunities

As a global company, we face political and regulatory changes in a large number of countries and markets.

Risk of more restrictive regulatory requirements regarding drug pricing and reimbursement

In the Healthcare business sector, the known trend towards increasingly restrictive requirements in terms of drug pricing, reimbursement, and expansion of high-rebate groups is continuing. An important example here is the volume-based procurement initiative in the People's Republic of China. These requirements can negatively influence the profitability of our products, as can market referencing between countries, and the success of market launches. Foreseeable effects are taken into account as far as possible in the business sector's plans. Close communication with health and regulatory authorities serves as a preventive measure to avert risks.

Remaining risks beyond the current plans resulting from restrictive regulatory requirements are classified as a medium risk owing to the possible critical negative impact.

Risk of stricter regulations for the manufacturing, testing, and marketing of products

Likewise, in our Life Science and Performance Materials business sectors, we must adhere to a multitude of regulatory specifications regarding the manufacturing, testing, and marketing of many of our products. Specifically in the European Union, we are subject to the European chemicals regulation REACH. It demands comprehensive tests for chemical products. Moreover, the use of chemicals in production could be restricted, which would make it impossible to continue manufacturing certain products. We are constantly pursuing research and development in substance characterization and the possible substitution of critical substances so as to reduce the occurrence of this risk, and therefore view it as unlikely. Nevertheless, it is classified as a medium risk given its critical negative impact on the net assets, financial position, and results of operations.

Risk of negative political and macroeconomic developments

The destabilization of political systems, and the possible establishment of trade barriers, sanctions, and foreign exchange policy changes, can lead to declines in sales in certain countries and regions. These risks are taken into account as far as possible in the business plans of the affected countries and regions, and mitigated through product, industry, and regional diversification.

Potential negative macroeconomic developments can also impact our business. To minimize these impacts, corresponding measures pertaining to the sales strategy have been initiated in these countries.

The spread of the Corona virus since the beginning of 2020 is associated with risks in global macroeconomic developments, likewise with the potential for negative effects on our businesses.

The United Kingdom's exit from the European Union ("Brexit") gives rise to risks for our existing business in that country, including the devaluation of the pound sterling, a weakening of the United Kingdom's economy, regulatory changes, the creation of trade barriers such as tariffs, and in particular operational risks due to, for example, delays in the supply chain that could have an impact on our profitability. To analyze these risks and in order to counteract them early in a targeted manner, we established Group-internal working groups that considered various scenarios. Mitigation measures exist for these scenarios, which shall ensure market access and the stability of the supply chain in the best possible way. They also include, for example, a relocation of the marketing

authorization holder for drugs currently registered via the United Kingdom; and changes to supply routes and the planned build-up of inventories of critical products, which are also designed to cushion the risk of delays in cross-border traffic, which is difficult to predict.

The net risk of negative political and macroeconomic developments is seen as possible and has critical negative effects on the net assets, financial position, and results of operations. We thus rate this as a medium risk.

Market risks and opportunities

We compete with numerous companies in the pharmaceutical, chemical, and life science sectors. Rising competitive pressure can have a significant impact on the quantities that can be sold and prices attainable for our products.

Opportunities due to new technologies in the manufacturing of displays

We see major opportunities in significant market growth of organic light-emitting diode (OLED) materials in high-quality display applications. We are building on more than ten years of experience in manufacturing OLED materials as well as a strong portfolio of worldwide patents in order to develop ultrapure and extremely stable materials that are precisely tailored to customer requirements. Development in the OLED market is being driven by the diversification of applications for small and large-area OLED displays.

According to industry estimates, the overall market volume for OLED materials will exceed that for liquid crystal materials as of 2022. In particular, the cooperation with Universal Display Corporation (UDC) announced in August will contribute to the joint further development of OLED technology and the accelerated development of new products. To further strengthen our OLED presence in Asia, we opened an OLED technology center in Shanghai in 2018 in addition to our existing centers in Southeast Asia. As local partner, we want to work with our customers to advance innovations and bring them to market faster.

Opportunities due to new application possibilities for liquid crystals

We are pursuing a strategy of leveraging our expertise as the global market leader in liquid crystals in order to develop new fields of application for innovative liquid crystal technologies. For instance, we are pressing ahead to capture the future markets for liquid crystal windows (LCWs) and mobile antennas. Thanks to licrivision™ technology, LCWs create new architectural possibilities. Through continuously variable brightness control, they can for example increase a building's energy efficiency. Moreover, the dynamic solar shading product eyrise™ s350 launched in the EU and North America allows solar shading to be managed while the windows remain transparent and color-neutral. Due to growing demand for dynamic glass, we see great potential for the new eyrise™ product brand. Antennas that can receive signals transmitted in the high frequency range can also be realized with the aid of corresponding liquid crystal mixtures. As a result, mobile data exchange could improve significantly in a wide variety of fields of application. Since novel liquid crystal materials for antennas are currently being developed, the market launch of liquid crystal antennas could take a few years.

Opportunities in the semiconductor industry

We see huge opportunities with our innovative Directed Self Assembly (DSA) technique for advanced lithography processing in Semiconductor Solutions. As semiconductor manufacturers continue to advance their device technologies, the processing steps are becoming more complex and significantly costlier to enable device performance. Our novel DSA platform and recent material advancements enable improved device performance and reduce the cost of sales and operating costs for our customers. This has resulted in Merck securing a leading position as qualified standard supplier with several key semiconductor customers. Adoption of this disruptive lithography platform is expected to completely change how semiconductor manufacturing is conducted and could lead to a market leadership position for advanced lithography over the next few years. We are developing new dielectric platforms in cooperation with our key customers for 3D NAND applications. There has been a change in 3D NAND device architecture and some of our customers are moving away from floating gate to replacement gate. Therefore, we are currently working with those customers on this new device architecture.

In addition, we reached important milestones in our Bright Future transformation program in 2019 in the Performance Materials business sector, through which we are focusing more strongly on the electronic materials market. These milestones include the acquisitions of Versum Materials and Intermolecular in the area of semiconductor technologies. Intermolecular has application-specific materials expertise and platforms for accelerated learning and experimentation with a powerful analytical infrastructure that

complements Merck's Performance Materials business and technology portfolio. Intermolecular's manufacturing and testing capabilities allow material combinations to be tested directly in the specific application environment. Compared to conventional methods, this means enormous time savings in the development process, considerably faster learning cycles, and findings on new material combinations, providing a unique service for customers. Versum Materials is a leading global provider of innovative, high-purity process chemicals, gases, and equipment for semiconductor manufacturing. The expertise in our combined business will enable us to offer our customers in the electronics industry state-of-the-art technological innovations. They also benefit from our expanded portfolio of products and services as well as our broader global footprint. We are thus excellently positioned to benefit from long-term growth trends in the electrical materials industry.

Going forward, our offer for the semiconductor industry will consist of two specialized units: Semiconductor Materials and Delivery Systems & Services. Semiconductor Materials will continue to concentrate on the distribution and development of materials-based solutions. Delivery Systems & Services will focus on the development, distribution, installation, and safe operation of delivery systems for chemicals and gases for the manufacture of semiconductors.

Opportunities from new active ingredients for cosmetics

In the current reporting year, Merck has systematically pushed ahead with the expansion of its research on cosmetic raw materials and supplies according to the principles of pharmaceutical drug development. The synergies from the knowledge and technology transfer from the Healthcare and Life Science business sector have substantially improved the development times and efficiencies of new active ingredients for cosmetics. Combined with the establishment of advanced 3D skin models, this results in a range of promising new cosmetic raw materials that are due to be launched over the coming quarters.

Partnerships with leading providers from growth markets beyond Europe and North America play an increasingly important role when it comes to commercializing these products, which are offered for optimized management of the tanning or whitening of the skin, among other things.

Opportunities from leveraging the e-commerce and distribution platform

With the acquisition of Sigma-Aldrich in 2015, we gained access to the leading e-commerce platform in life science, www.sigmaaldrich.com. With this distribution platform, our customers continue to benefit from a portfolio of more than 300,000 products, including highly respected brands. We are further expanding this platform to continuously increase the number of products available through e-commerce. Increasing speed and convenience during our customers' ordering processes as well as offering support through individualized product recommendations can lead to higher sales volumes and the winning of new customers. Consequently, this distribution channel can lead to an above-average development of sales in the medium term.

Risks due to increased competition and customer technology changes

In the Healthcare business sector, both our biopharmaceutical products and classic pharmaceutical business are exposed to increased competition from rival products (in the form of biosimilars and generics). In the Life Science and Performance Materials business sectors, risks are posed by not only cyclical business fluctuations, but also changes in the technologies used or customer sourcing strategies, particularly with respect to liquid crystals. We use close customer relationships and in-house further developments as well as market proximity, including precise market analyses, as mitigating measures. Overall, owing to its possible occurrence with a critical negative impact, the market risk is classified as a medium risk.

Opportunities offered by digitalization and activities to boost innovative strength

Digital technologies are becoming increasingly important for our markets and our world of work. In 2015, we launched several strategic digital initiatives geared toward improving the efficiency of our internal processes and toward evaluating the opportunities of digitalization for our products and customers. We are also working on establishing new business outside our three business sectors, with a focus on digitalization and our innovation fields of Clean Meat, Liquid Biopsy, and Biosensing and Interfaces. In addition to collaborations with external partners such as the European Space Agency, the Accelerator program, which is being driven by our Innovation Center, is one component of our innovation strategy.

Another innovation driver is the patent received in the United States in 2019 for a new way to connect physical objects with a digital twin using artificial intelligence and blockchain technology. This novel technology allows physical objects to be securely anchored in the digital world, thereby protecting the integrity of supply chains and preventing product counterfeiting. The three-year collaboration launched in 2019 with the Karlsruhe start-up HQS Quantum Simulations also opens up revolutionary possibilities

in the field of quantum computing. The collaboration between the start-up company and our Chief Digital Organization focuses on the application and commercialization of quantum chemistry software on dedicated computers.

In the Healthcare business sector, we entered into a cooperation with Iktos in 2019, which gives us access to generative technology based on Iktos' artificial intelligence (AI) for three drug discovery projects. This enables us to design new drugs quickly and cost-effectively.

In November 2018, our Life Science business sector launched its new BioContinuum™ Platform to optimize biotherapeutic drug manufacturing through improved efficiency, simplified plant operations, and greater quality and consistency. Continuing to drive this innovation in 2019, Life Science launched the BioContinuum™ Buffer Delivery Platform. This integrated solution is tailored to provide the highest possible levels of accuracy and precision in buffer preparation and management. It represents the next advancement in drug manufacturing for the biopharmaceutical industry, elevating continuous process technology while simultaneously working toward fully optimized, contiguous biotechnological process management of the future. This seamless physical and digital integration of all components of the BioContinuum™ Platform makes process development more efficient, safer, and less costly.

The 2019 acquisitions of FloDesign Sonics and BSSN Software contributed to the extension of Life Science's innovative strength. With FloDesign Sonics, we receive access to a unique platform for industrial production of cell and gene therapies, which allows the processing of cells by means of sound waves. Merck is the first company to use sound wave technology for the production of cell therapies.

The acquisition of BSSN Software, a laboratory informatics provider in Darmstadt, contributed to an acceleration of the digital transformation in customer laboratories. The solutions developed by BSSN Software equip Merck's customers with better and more efficient access to their laboratory data. These acquisitions strengthen our business with digital solutions for laboratory productivity and grant us a unique position in this extremely dynamic market. The 2019 performance enhancement of the Milli-Q® CLX 7000 clinical water purification systems with Milli-Q® Connect – a new cloud-based, remote monitoring and service capability – also contributes to this purpose.

In the Performance Materials business sector, there are opportunities with regard to digitalization, in particular from our positioning in the area of electronic materials for the semiconductor and display industries. These include in particular the acquisitions of Versum Materials and Intermolecular mentioned above, which will enable us to offer our customers not only state-of-the-art technological innovations, but an expanded product portfolio as well.

Opportunities provided by the CRISPR technology

A pioneer of genome-editing innovation for 15 years, Merck is leveraging CRISPR technology as a core competency of its business. In 2019, we obtained multiple patent awards from the European Patent Office as well as from patent offices in the United Kingdom, Israel, Korea, Canada, and the United States. In total, we have 22 existing CRISPR patents in nine regions.

CRISPR technologies open up promising new avenues for medical research and potential solutions to treat some of the most difficult diseases, including cancer as well as hereditary and rare diseases. To simplify what has become a difficult-to-navigate CRISPR patent landscape, we entered into an innovative CRISPR licensing agreement with the United States-based Broad Institute of MIT and Harvard in 2019. This new framework eases and accelerates access to CRISPR intellectual property for research purposes.

Opportunities offered by customer proximity

In 2019, we opened another state-of-the-art site for customer collaboration, our new M Lab™ Collaboration Center in Molsheim, France. The Center includes non-good manufacturing practice (GMP) pilot and bench scale labs for customers to engage in process development support, troubleshooting, and hands-on training. It is one of nine such centers around the world, each of which allows pharmaceutical manufacturers to explore new ways to increase productivity, improve processes, and mitigate risks. Other M Lab™ Collaboration Center are located in the United States, Singapore, Japan, Korea, India, France, Brazil, and China, where an additional M Lab™ Collaboration Center is planned to open in 2020.

Risks and opportunities of research and development

For us, innovation is a major element of the Group strategy. Research and development projects can experience delays, expected budgets can be exceeded, or targets can remain unmet. Research and development activities are of special importance to the Healthcare business sector. In the course of portfolio management, we regularly evaluate and, if necessary, refocus research areas and all R&D pipeline projects. Alliances with external partners and the out-licensing of programs also form part of the catalog of measures for the efficient allocation of resources. The conclusion and continuation of these partnerships and externalizations plays an important role. A deviation from the strategic targets defined in this area could have a critical negative impact on net assets, financial position, and results of operations. The occurrence of a risk of this magnitude is considered unlikely, which means that this is a medium risk.

The global strategic alliance formed in early 2019 with GlaxoSmithKline plc (GSK) for the joint development and marketing of the bintrafusp alfa (M7824) immunotherapy developed by Merck can be highlighted as an opportunity for research and development in the Healthcare business sector. This novel immunotherapy is currently undergoing clinical trials and shows potential for new options for several hard-to-treat cancers.

The strategic alliance concluded with Pfizer Inc. in 2014 enabled us to jointly develop Bavencio®. Following approvals for patients with metastatic Merkel cell carcinoma and those with locally advanced or metastatic urothelial carcinoma in 2017, the United States Food and Drug Administration (FDA), the European Commission, and the Japanese Ministry of Health, Labor and Welfare issued approvals for Bavencio® (avelumab) plus Inlyta® (axitinib) for first-line treatment of patients with advanced renal cell carcinoma in 2019. Additional applications for these products have been submitted to regulatory authorities worldwide.

Mavenclad® was approved in 2017 by the European Commission. It is the first short-course oral treatment approved in Europe for the treatment of relapsing multiple sclerosis in patients with high disease activity. In 2018, approvals were also granted in the Middle East and Africa (United Arab Emirates) and Latin America (Argentina). With the approvals in the United States and Switzerland in 2019, Mavenclad® is currently approved in over 65 countries.

After Japan granted "fast-track" regulatory designation to tepotinib in 2018, it was granted the "breakthrough therapy" designation by the FDA in September 2019, and the "orphan drug" designation by the Japanese Ministry of Health, Labor and Welfare in November 2019. The molecule may have the potential to treat patients with advanced non-small cell lung cancer (NSCLC) harboring MET exon 14 skipping mutations.

The approval of Erbitux® (cetuximab) in combination with FOLFOX or FOLFIRI as a first-line therapy for patients with RAS wild-type metastatic colorectal cancer (mCRC) in China is another important milestone in our claim to be a global specialty innovator.

In addition to marketing already approved medicines, we are pushing ahead with research projects in other important therapeutic areas. The portfolio of projects is evaluated on a regular basis. This may also lead to in-licensing or out-licensing, or further strategic alliances.

Investments made in 2019, for example to expand biopharmaceutical research in the United States, are intended to accelerate scientific progress and the further development of our innovative clinical pipeline worldwide. The expenses currently being incurred, especially in our Healthcare research and development, are already reflected in the current plans. The same applies to sales of Bavencio® and Mavenclad® for approved indications in the respective markets. Further approvals may result in an increased sales potential.

Risks of discontinuing development projects and regulatory approval of developed medicines

Sometimes development projects are discontinued after high levels of investment at a late phase of clinical development. Decisions – such as those relating to the transition to the next clinical phase – are taken with a view to minimizing risk. We are currently not aware of any risks beyond general development risks that could significantly affect the net assets, financial position, and results of operations.

Furthermore, there is the risk that regulatory authorities either do not grant or delay approval or grant only restricted approval. Additionally, there is the risk that undesirable side effects of a pharmaceutical product could remain undetected until after approval or registration, which could result in a restriction of approval or withdrawal from the market. Well-advanced programs in our pipeline and those of our partners result in potential new approvals; on the other hand, missing targets in this area may have

critical negative effects on the financial position and operating result, for example due to lower net sales or the non-occurrence of milestone payments from collaboration agreements. Overall, these risks, with probabilities ranging from unlikely to possible, are considered to be medium risks.

Risks and opportunities related to the quality and availability of products

Risk of a temporary ban on products/production facilities or of non-registration of products due to non-compliance with quality standards

We are required to comply with the highest standards of quality in the manufacturing of pharmaceutical products (Good Manufacturing Practice or official pharmacopoeia). In this regard, we are subject to the supervision of the regulatory authorities. Conditions imposed by national regulatory authorities could result in a temporary ban on products/production facilities, and possibly affect new registrations with the respective authority. We make the utmost effort to ensure compliance with regulations, regularly perform our own internal inspections and also carry out external audits. Thanks to these quality assurance processes, the occurrence of a risk with a critical negative impact is unlikely; however, it cannot be entirely ruled out. Depending on the product concerned and the severity of the objection, such a risk can have a moderate negative impact on the net assets, financial position, and results of operations. Therefore, we rate this as a medium risk.

Risks of production availability

Further risks include operational failures due to fire or force majeure, for example natural disasters such as floods or earthquakes, which could lead to a substantial interruption or restriction of business activities. Insofar as it is possible and economically viable, the Group limits its damage risks with insurance coverage, the nature and extent of which is constantly adapted to current requirements. Likewise, we are exposed to risks of production outages and the related supply bottlenecks that can be triggered by technical problems in production facilities with very high capacity utilization. Furthermore, there are risks of supply bottlenecks due to a lack or disappearance of capacity. We are working to continuously mitigate the risks by making regular investments, setting up alternative sourcing options, and maintaining inventory levels.

Although the occurrence of these risks is considered unlikely, an individual event could have a critical negative effect on the net assets, financial position, and results of operations, and they are therefore classified as a medium risk.

Risks of dependency on suppliers

Quality controls along the entire value chain reduce the risks related to product quality and availability. This starts with the qualification of our suppliers. Quality controls also include comprehensive quality requirements for raw materials, purchased semi-finished products, and plants. We are dependent on individual suppliers for a number of precursor products, packaging materials, and finished goods. In the event that one of these suppliers curtails or discontinues production, or supply is disrupted, this could potentially have a critical impact on the business concerned. With long-term strategic alliances for precursor products critical to supply and price as well as alternative sourcing strategies, we reduce the probability of occurrence of these risks and rate them as possible. Overall, these are classified as medium risks.

Product liability risks

Companies in the chemical and pharmaceutical industries are exposed to product liability risks in particular. Product liability risks can lead to considerable claims for damages, loss of reputation, and costs to avert damages. We have taken out the liability insurance that is standard in the industry for such risks. However, it could be that the insurance coverage available is insufficient for individual cases. Although the probability of occurrence of product liability claims in excess of the existing insurance coverage is considered unlikely, individual cases could still have a critical negative effect on the net assets, financial position, and results of operations. We therefore rate a potential product liability risk as a medium risk.

Risks due to product-related crime and espionage

Owing to our portfolio, we are exposed to a number of sector-specific crime risks. This relates primarily to products, including among other things, counterfeiting, illegal channeling, and misuse, as well as all types of property crime, including attempts at these crimes. Crime phenomena such as cybercrime and espionage could equally affect our innovations or innovation abilities as such.

To combat product-related crime, an internal coordination network covering all functions and businesses ("Merck Anti-Counterfeiting Operational Network" was set up several years ago. In addition, security measures are in use to protect products against counterfeiting. Innovative technical security solutions and defined preventive approaches are used to ward off dangers relating to cybercrime and espionage. Measures to prevent risks and to prosecute identified offenses are conducted in all the relevant crime areas in close and trustworthy cooperation with the responsible authorities. The impact of these risks on business operations depends on the respective individual case, product-specific factors, the value chain, and regional aspects in particular. Our Corporate Security department is responsible for the overall coordination of all measures in this area. Overall, the threat resulting from crime in general is seen as being possible and is classified as a medium risk.

Opportunities due to expanding local presence in high-growth markets

For numerous markets in the emerging economies, we expect continuous above-average contributions to growth in the coming years. In order to further expand this potential for our businesses, we have moved forward with several investment projects in recent years. Following the investments already made in China in 2018, we have made further investments there of € 17 million in 2019 to expand the capacity of our pharmaceutical production facilities. In addition, the Life Science Nantong and Wuxi sites began operation in 2019, improving our local capacities in China. We also launched a seed fund of RMB 100 million (€ 13 million in 2019, which is specifically aimed at financing start-up companies in the Healthcare, Life Science, and Performance Materials business units, as well as new businesses in China. This is intended to promote relevant innovations from China and bring Merck closer to the Chinese start-up scene in view of the country's increased focus on innovation. The innovation hubs in Shanghai and Guangzhou will also contribute to the nationwide acceleration of innovation development.

Risks and opportunities from the use of social media

The Merck company and its employees are active on numerous social media channels. The consistent and legally compliant use of the channels and their content is important in terms of increasing awareness of our brand, among other things. Merck takes precautions and implements processes to ensure awareness of the proper handling of social media, controlling publication, and actively managing communication.

Nevertheless, reputational risks could result, for instance through public dialogues in social media.

Overall, we rate this as a low risk.

Financial risks and opportunities

As a corporate group that operates internationally, and due to our presence in the capital market, we are exposed to various financial risks and opportunities. Above all, these are liquidity and counterparty risks, financial market risks and opportunities, risks of fluctuations in the market values of operational tangible and intangible assets, as well as risks and opportunities from pension obligations.

Risk and opportunity management in relation to the use of financial instruments

In the area of financial risks and opportunities, we use an active management strategy to reduce the effects of fluctuations in exchange and interest rates. The management of financial risks and opportunities by using derivatives in particular is regulated by extensive guidelines. Speculation is prohibited. Derivative transactions are subject to constant risk controls. A strict separation of functions between trading, settlement, and control functions is ensured.

Liquidity risks

In order to ensure its continued existence, a company must be able to fulfill its commitments from operating and financial activities at all times. Therefore, to reduce potential liquidity risks, we have a central Group-wide liquidity management system in place, and a balanced maturity profile. The maturities of our financial liabilities are aligned with our planned free cash flow. Furthermore, we have a multicurrency revolving credit facility of € 2 billion with a term until 2024, which ensures continuing solvency if any liquidity bottlenecks occur. As our loan agreements do not contain any financial covenants, these agreed lines of credit can be accessed even if Merck's credit rating should deteriorate. Additionally, we have a commercial paper program with a maximum volume of € 2 billion.

Overall, the liquidity risk is unlikely and rated as low.

Counterparty risks

Counterparty risks arise from the potential default by a partner in connection with financial investments, loans, and financing commitments on the one hand and receivables in operating business on the other.

As for counterparty risks from financial transactions, we review all positions relating to trading partners and their credit ratings on a daily basis. We manage financial risks of default by diversifying our financial positions and through the related active management of our trading partners. Significant financial transactions involving credit risk are entered into with banks and industrial companies that have a good credit rating. Moreover, our large banking syndicate – the multi-currency revolving credit facility of € 2 billion was syndicated by 20 banks – reduces possible losses in the event of default.

The solvency and operational development of trading partners is regularly reviewed as part of the management of operational counterparty risks. Sovereign risks are also analyzed. The volume of receivables of each customer is capped in line with their credit ratings. Risk-mitigating measures, such as credit insurance, are utilized as appropriate. Nevertheless, defaults by isolated trading partners, even those with outstanding credit ratings, cannot be entirely ruled out, although rated as unlikely (further information can be found in "Credit risks" in the note "Management of financial risks" in the Notes to the Consolidated Financial Statements).

Counterparty risk is classified as a medium risk overall owing to the unlikely probability of occurrence with a potential critical negative effect.

Financial market opportunities and risks

As a result of our international business activities and global corporate structure, we are exposed to risks and opportunities from fluctuations in exchange rates. These result from financial transactions, operating receivables and liabilities, as well as forecast future cash flows from sales and costs in foreign currency. We use derivatives to manage and reduce the aforementioned risks and opportunities (further information can be found in the note "Derivative financial instruments" in the Notes to the Consolidated Financial Statements). Due to their possible occurrence with a potentially critical negative effect on the net assets, financial position, and results of operations, foreign exchange rate risks are rated as medium risk.

Variable interest and current financial liabilities are exposed to the risks and opportunities of interest rate fluctuations. These are also managed and reduced using derivatives. Interest rate risks have a potentially moderate negative impact, are considered unlikely, and pose low risks overall.

Risks of impairment of balance sheet items

The carrying amounts of individual balance sheet items are subject to the risk of changing market and business conditions and thus to changes in fair values as well. Necessary impairments could have a significant negative non-cash impact on earnings and affect the accounting ratios. This applies in particular to the high level of intangible assets including goodwill, which mainly derive from the purchase price allocations made in connection with past acquisitions (further information can be found in the note "Intangible assets" in the Notes to the Consolidated Financial Statements). All relevant risks were assessed during the preparation of the Consolidated Financial Statements and taken into account accordingly. We rate risks beyond this as unlikely with a critical negative impact. Therefore, this is seen as a medium risk.

Risks and opportunities from pension obligations

We have commitments in connection with pension obligations. The present value of defined benefit obligations can be significantly increased or reduced by changes in the relevant valuation parameters, for example the interest rate or future salary increases. Pension obligations are regularly assessed as part of annual actuarial reports. The obligations are covered by the pension provisions reported in the balance sheet based on the assumptions as of the balance sheet date. Some of these obligations are funded by plan assets (further information can be found in the note "Provisions for pensions and other post-employment benefits" in the Notes to the Consolidated Financial Statements). To the extent that pension obligations are covered by plan assets consisting of interest-

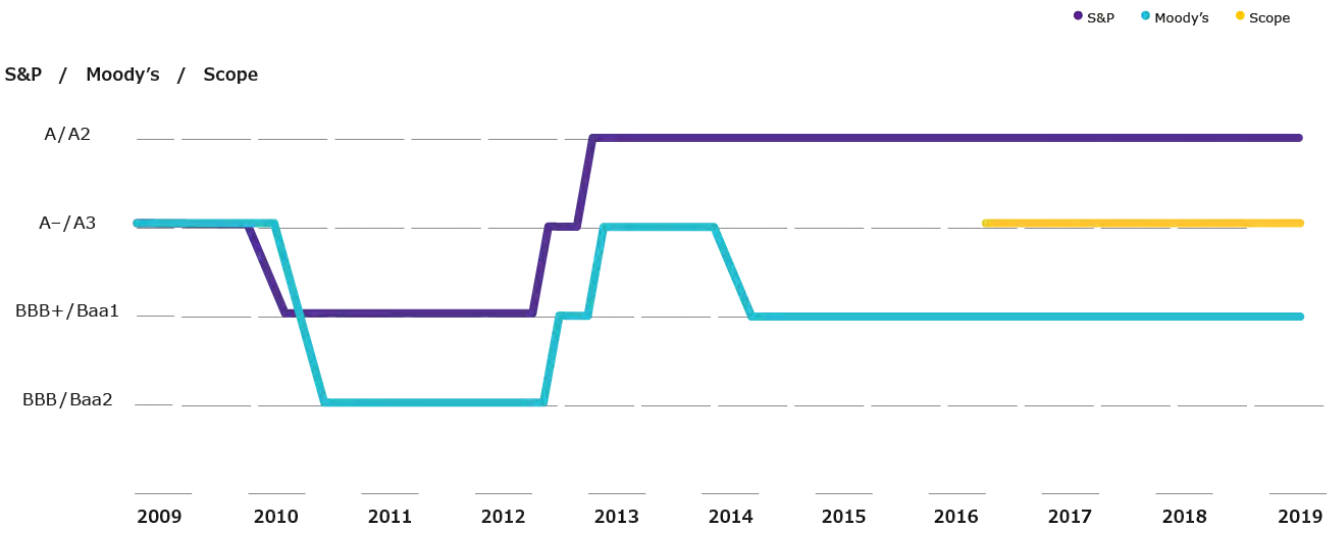
bearing securities, shares, real estate, and other financial assets, decreasing or negative returns on these assets can adversely affect the fair value of plan assets and thus result in further additions to pension provisions. By contrast, rising returns increase the value of plan assets, thereby resulting in excess cover of plan liabilities. We increase the opportunities of fluctuations in the market value of plan assets on the one hand and reduce the risks on the other by using a diversified investment strategy. The unlikely risk due to pension obligations could have moderate negative effects on the net assets, financial position, and results of operations, and is classified as low.

Assessment by independent rating agencies

The capital market uses the assessments published by rating agencies to help lenders assess the risks of a financial instrument used by Merck. We are currently rated by Standard & Poor's, Moody's, and Scope. Standard & Poor's has issued a long-term credit rating of A with a stable outlook, Moody's a rating of Baa1 with a stable outlook, and Scope a rating of A–, likewise with a stable outlook. In line with market procedures, our financing conditions are closely tied to our rating. The better a rating, the more favorably we can generally raise funds on the capital market or from banks.

REPORT ON RISKS AND OPPORTUNITIES

Overview of rating development



Legal risks

Generally, we strive to minimize and control our legal risks. To this end, we have taken the necessary precautions to identify threats and defend our rights where necessary.

Nevertheless, we are still exposed to risks from litigation or legal proceedings. In particular, these include risks in the areas of product liability, competition and antitrust law, pharmaceutical law, patent law, trademark law, data protection law, tax law, and environmental protection. As a research-based company, we have a valuable portfolio of industrial property rights, patents, and brands that could become the target of attacks and infringements. The outcome of future proceedings or those currently pending is difficult to foresee.

For instance, we are currently involved in litigation with Merck & Co. Inc., Kenilworth, NJ, United States (outside the United States and Canada: MSD), against whom we have filed lawsuits in various countries. This company has also sued us in the United States for trademark infringement, among other things.

Due to long statutes of limitations or in some cases the absence thereof, it is not possible to rule out that we will face third-party claims arising from the same issue despite the conclusion of legal proceedings. Court or official rulings or settlements can lead to expenses with a significant impact on our business and earnings.

Despite extensive precautionary measures, non-compliance with laws and regulations leading to related consequences can never be completely excluded.

Tax risks are reviewed regularly and systematically by Group Tax. Corresponding standards and guidelines are used in order to identify tax risks at an early stage as well as to review, evaluate, and correspondingly minimize them. Risk reduction measures are coordinated by Group Tax together with the subsidiaries abroad.

In our opinion, the lawsuits described below constitute the most significant legal risks. This should not be seen as an exhaustive list of all legal disputes currently ongoing.

Risks from product-related and patent law disputes

Merck is involved in a patent dispute with Biogen Inc., United States (Biogen), in the United States. Biogen claims that the sale of Rebif® in the United States infringes on a Biogen patent. The disputed patent was granted to Biogen in the United States in 2009. Subsequently, Biogen sued Merck and other pharmaceutical companies for infringement of this patent. Merck defended itself against all allegations and brought a countersuit claiming that the patent is invalid and not infringed by our actions. In the first instance, a jury recognized the invalidity of the patent. This jury verdict was overturned by the federal judge in the same instance in September 2018. For the time being, the patent is thus deemed to be legally valid and to have been infringed. Merck filed a complaint with the United States Court of Appeals for the Federal Circuit (second instance) against the first-instance ruling in October 2018. A decision is expected in the first half of 2020. In this context, Merck recognized provisions in a three-digit million euro amount. Cash outflow within the next twelve months is considered possible at present.

Nevertheless, potentially critical negative impacts of the litigation on the financial position cannot be ruled out.

In the Performance Materials business sector, Merck is involved in a legal dispute with JNC Corporation, Japan (JNC). JNC claims that by manufacturing and marketing certain liquid crystals mixtures, Merck has infringed JNC patents. JNC asserts its claims in court in two jurisdictions. Merck maintains that JNC's patent infringement assertion is invalid in three jurisdictions owing to relevant prior art and has filed the corresponding nullity actions. No final decisions have so far been reached in two jurisdictions. In one jurisdiction, the nullity action was concluded with legally binding effect in favor of Merck in 2019. In this jurisdiction, JNC refrained from filing a patent infringement claim. In view of this development, the provision was reduced in 2019. After the adjustment, the remaining provision for this matter amounts to a double-digit million euro amount. Cash outflow within the next twelve months is considered possible at present.

Nevertheless a potentially considerable impact of the legal dispute on the financial position cannot be ruled out.

Risks due to antitrust and other government proceedings

Raptiva®: In December 2011, the federal state of São Paulo, Brazil, sued Merck for damages because of alleged collusion between various pharmaceutical companies and an association of patients suffering from psoriasis and vitiligo. This collusion is alleged to have been intended to increase sales of the medicines from the companies involved to the detriment of patients and state coffers. Moreover, patients are also suing for damages in connection with the product Raptiva®. Merck has taken appropriate accounting measures for these issues, which relate to various legal cases. Risks in excess of this with a substantial negative effect on the net assets, financial position, and results of operations cannot be ruled out, but are considered unlikely. This is rated as a medium risk.

On July 6, 2017, Merck received notice from the European Commission (EU Commission) in connection with the antitrust review proceedings for the acquisition of Sigma-Aldrich, in which the EU Commission informed Merck of its preliminary conclusion that Merck and Sigma-Aldrich allegedly transmitted incorrect and/or misleading information within the scope of the acquisition of Sigma-Aldrich. The EU Commission received registration of the merger on April 21, 2015, and granted clearance on June 15, 2015, subject to the condition that Merck and Sigma-Aldrich divest parts of the European solvents and inorganic chemicals businesses of Sigma-Aldrich in order to resolve antitrust concerns. According to the preliminary viewpoint of the EU Commission, communicated in a letter dated July 6, 2017, Merck and Sigma-Aldrich withheld related important information about an innovation project. According to the EU Commission, the innovation project should have been included in the remedies package. At the present time, an EU

Commission administrative procedure is still pending that could lead to a fine being imposed by the EU Commission if the EU Commission considers its view to be proven. Merck is entitled to legal recourse should a fine be imposed. The ongoing investigations are limited to the examination of violations of EU merger control procedures and do not affect the validity of the EU Commission's decision to approve the merger. As the risk is considered to have a potential critical negative impact on the net assets and financial position, a provision has been set up.

Paroxetine: In connection with the divested generics business, Merck is subject to antitrust investigations by the British Competition and Market Authority (CMA) in the United Kingdom. In March 2013, the authorities informed Merck of the assumption that a settlement agreement entered into in 2002 between Generics (UK) Ltd. and several subsidiaries of GlaxoSmithKline plc, United Kingdom, in connection with the antidepressant drug paroxetine, violates British and European competition law. Merck, the then-owner of Generics (UK) Ltd., was allegedly involved in the negotiations for the settlement agreement and is therefore liable. The investigations into Generics (UK) Ltd. started in 2011, without this being known to Merck. On February 11, 2016, the CMA imposed a fine in this matter. Merck has taken legal action against this fine. Appropriate accounting measures have been taken. As things stand at present, a decision and outflow of resources are not expected within the next 12 months because the Appeal Tribunal has since submitted the relevant legal questions to the European Court of Justice (CJEU) for a preliminary ruling. This is currently classified as a medium risk with a moderate negative impact on the financial position.

Human resources risks

Our future growth is highly dependent on our innovative strength. Therefore, the expertise and engagement of employees in all sectors in which we operate are crucial to the success of the company. The markets relevant to the company are characterized by intensive competition for qualified specialists and by the challenge of being perceived by the public as an attractive employer. Fluctuation risks specific to countries and industries have to be identified ahead of time and specifically addressed in order to keep the skills and expertise critical to success and business within the company.

Recruiting and retaining specialists and talent is therefore one of the key priorities for the company and is managed through the targeted use of, for instance, employer branding initiatives, global talent and succession management processes, as well as competitive compensation packages. Nevertheless, employee-related risks that affect business activities are possible, even though their impact is difficult to assess. We rate this as a medium risk.

Information technology risks

We use a variety of IT systems and processes in order to optimally support our globalization. Trends in information technology offer various opportunities but also harbor risks.

Risks due to cybercrime and the failure of business-critical applications

Increasing international networking and the related possibility of IT system abuse are resulting in cybercrime risks for Merck, such as the failure of central IT systems, the disclosure or loss of the data integrity of confidential data from research and business activities, the manipulation of IT systems in process control, or an increased burden or adverse impact on IT systems as a result of virus attacks.

The Merck Group operates an information protection management system based on ISO 27001 comprising security guidelines as well as organizational and technical measures to prevent and address IT security incidents. Globally used IT applications form the basis for the contractual delivery of products and solutions. The failure of business-critical IT applications could therefore have a direct influence on our ability to deliver and the quality of our products. This also applies to the failure of a data center. To achieve the required service quality, we use a quality management system certified to ISO 9001 that also applies to the provision of IT. In addition, to reduce the risk of failure, we operate several redundantly designed data centers. Furthermore, insurance solutions for cybercrime offenses are in place at Group level.

Likewise, complications with the changeover of IT systems could negatively impact the earnings situation. Close monitoring of critical IT projects serves to mitigate this risk.

Despite the mitigating measures taken and functional continuity plans, the effects of cybercrime or the failure of business-critical IT applications and their influence on the net assets, financial position, and results of operations are considered high risks owing to likely and potentially critical negative impacts.

Environmental and safety risks

As a company with global production operations, we are exposed to risks of possible damage to people, goods, and our reputation. Audits, consulting and training on environmental protection, and occupational health and safety minimize these risks to people and the environment. In order to ensure the continuity of plant and equipment, we monitor these risks both at our own sites as well as at suppliers and contract manufacturers. By adhering to high technical standards, our rules of conduct, and all legal requirements in environmental protection and occupational health and safety, we ensure the preservation of goods and assets. We have taken sufficient appropriate accounting measures for the environmental risks known to us. Nevertheless, we classify these as a high risk since a critical negative impact on the financial position cannot be ruled out.

Risks due to the divestment, acquisition, and integration of companies and businesses

Irrespective of the fact that acquisitions made in the past have been successfully completed, the risk of conducting acquisition and integration exists for future transactions and for the current integration of Versum Materials. This includes, among other things, the inability to meet sales volume targets and higher integration costs than expected, as well as the failure to meet synergy goals. The divestment of companies and businesses can lead to liability vis-à-vis the buyer, or additional expenses, for instance through indemnity clauses and guarantee commitments or long-term supply contracts. Through strong due diligence processes and closely managed integration processes, we seek to reduce the probability of occurrence of this risk. Therefore, we classify this as a medium risk with an unlikely probability of occurrence and potentially critical negative effects on the net assets, financial position, and results of operations.

Overall view of the risk and opportunity situation and management assessment

The material individual risks in the businesses have been named in the report above, with business-related risks being the most significant alongside legal risks.

These risks include already the risks stemming from the recent developments regarding the Covid-19 pandemic. Most notably, the pandemic increases existing risks related to more restrictive regulatory requirements regarding drug pricing and reimbursement, the demand for our products, business interruptions at our production facilities, lack of availability of good quality materials or services, risks related to research and development, and negative macroeconomic developments.

With respect to high and medium risks, certain changes have occurred, as the assessment of the individual risks has of course shifted over the fiscal year due to changing external and internal conditions while the overall risk profile remained stable. Thanks to the risk reduction measures taken – such as the consistent implementation of management action (organizational responsibility and process improvements), existing insurance coverage, and accounting precautions – we were able to take counteraction, in particular against significant individual risks.

The overall risk of the Group, which is derived from the probability-weighted aggregation of the identified risks, leads to the assessment that we are not exposed to risks of a nature to threaten the existence of the Group as a going concern, or for which coverage and financing of the losses is questionable. We are confident that we will continue to successfully master the challenges arising from the above risks in the future as well. Our company also benefits from diversification through our different products and markets.

In our view, business-related opportunities offer the greatest potential. An important element here is the continuous expansion of our businesses. With the successful focusing and continued intensification of our research and development activities, we want to be able to continue to offer our customers innovative products and help shape markets. Moreover, we also consolidate our expertise in numerous alliances with industrial partners as well as various universities and international organizations. We are making targeted investments in future-oriented companies and start-ups via our Merck Ventures Investment Fund and our Accelerator programs. The topic of innovation is at the forefront of all our activities. Externally, this is becoming particularly apparent through our Innovation Center at Group headquarters in Darmstadt, which is to develop into a nucleus of creativity at Merck. The activities listed hold significant opportunities for us in the medium to long term, beyond the underlying forecast period.

We pursue the opportunities that arise and specify their expected effects in the forecast development of net sales, EBITDA pre, and business free cash flow. Furthermore, we will actively seek new opportunities, examine their implementation and drive them forward where appropriate. If opportunities arise in addition to the forecast developments, or these occur more quickly than anticipated, this could have correspondingly positive effects on our net assets, financial position, and results of operations.

Report on Expected Developments[1]

The following report provides a forecast for fiscal 2020 of the development of the Merck Group and its three business sectors: Healthcare, Life Science and Performance Materials.

On October 7, 2019, Merck completed the acquisition of Versum Materials, Inc. a supplier in the electronic materials segment for a purchase price for the acquisition of 100% of the company's shares of € 5.3 billion. For this reason, the effect of the Versum acquisition will be reported as a portfolio effect in the first three quarters of 2020. Likewise, the acquisition of Intermolecular Inc. closed on September 20, 2019. The purchase price for the acquisition of 100% of the company's shares was € 56 million. This transaction represents an equity value of approximately US$ 62 million. We do not expect it to have a material portfolio effect.

Forecast for the Merck Group

FORECAST FOR THE MERCK GROUP

€ million	**Actual results 2019**	Forecast for 2020	Key assumptions
Net sales	16,152	• Solid organic growth • Portfolio effect in the mid single-digit percentage range • Slightly negative foreign exchange effect of 0% to -3%	• Organic growth driven by Healthcare and Life Science; Performance Materials with slight organic growth • Positive portfolio effect in the mid single-digit percentage range, mainly resulting from the acquisition of Versum Materials • Foreign exchange effect due to emerging market currencies and the U.S. dollar
EBITDA pre	4,385	• Strong organic growth • Positive portfolio effect in the mid single-digit percentage range • Slightly negative foreign exchange effect of 0% to -3%	• Strong organic growth in Life Science supported by solid organic growth in Healthcare and Performance Materials with slight organic growth • Realization of synergies from the integration of Versum Materials in Performance Materials as planned • Foreign exchange effect due to emerging market currencies and the U.S. dollar
Business free cash flow	2,732	Percentage growth in the mid twenties range	Rise in EBITDA pre and positive effects from working capital; higher investments in property, plant, and equipment

Net sales

For the Merck Group, in 2020 we expect solid organic net sales growth in comparison with the previous year, driven mainly by our Healthcare and Life Science business sectors. We forecast slight organic growth for Performance Materials. In the first three quarters, the effect of the acquisition of Versum Materials will be reported as a portfolio effect, which we expect to be in the mid-single-digit percentage range. With regard to exchange rate developments, we continue to expect a volatile environment due to political and macroeconomic developments. Overall, we forecast a slightly unfavorable foreign exchange development of 0% to -3%

[1] Owing to the altered expectations in terms of the impact of the Covid-19 pandemic, this Report on Expected Developments was updated accordingly on May 12, 2020.

that can be attributed to the currencies of several growth markets, including China, and the development of the U.S. dollar. Our forecast for 2020 is based on an exchange rate of the euro against the U.S. dollar in the range of 1.11 to 1.16.

EBITDA pre

EBITDA pre is our key financial indicator to steer operating business. We forecast strong organic growth for fiscal 2020. This organic growth will be mainly attributable to the Healthcare and Life Science business sectors while also Performance Materials contributes with slight organic growth. The portfolio effect from the acquisition of Versum Materials is expected to be in the mid-single-digit percentage range and will lead to a slight improvement in the margin of the Merck Group.

The expected foreign exchange development is forecast to have a slightly negative effect in the percentage range of between 0% and -3% on Group EBITDA pre; it will be seen particularly in the Performance Materials and Healthcare businesses. The development of the U.S. dollar and of the currencies in several growth markets will have an adverse impact on earnings. These foreign exchange effects will be partly mitigated by currency hedging, although we do not hedge all emerging market currencies.

Business free cash flow

For business free cash flow, we expect growth rates in the mid-twenties percentage range in 2020. The development is attributable to the increase in EBITDA pre, which includes the contribution of Versum Materials, and positive effects from further improved working capital management. Higher investments in property, plant, and equipment will lower business free cash flow.

Forecast for the Healthcare business sector

FORECAST FOR THE HEALTHCARE BUSINESS SECTOR

€ million	**Actual results 2019**	Forecast for 2020	Key assumptions
Net sales	6,714	• Solid organic growth • Slightly negative foreign exchange effect	• Stable development of the base business in organic terms • Substantial growth contribution by our newly approved products, particularly Mavenclad® • Negative foreign exchange effect due to foreign exchange developments in several growth markets and of the U.S. dollar
EBITDA pre	1,922	• Solid organic growth • Moderate negative foreign exchange effect	• Expected substantial earnings contributions from our new products, especially Mavenclad® , offset negative mix effects associated with the projected decline in Rebif® sales • Marketing and selling expenses as well as research and development costs decrease in percent of sales due to systematic cost management and strict pipeline prioritization • Negative foreign exchange effect due to foreign exchange developments in several growth markets and of the U.S. dollar
Business free cash flow	1,252	Increase in the low double-digit teens percent range	• Rise in EBITDA pre • Improved management of working capital offsets higher investments in property, plant and equipment

Net sales

For the Healthcare business sector, we expect solid organic sales growth in 2020. We anticipate a stable development of base business, reflecting the continued competitive pressure and the associated decline in Rebif® sales. However, the Rebif® decline will be offset by continued positive growth contributions of products from the General Medicine & Endocrinology and Fertility franchises, largely attributable to growth markets. New regulations in China (volume-based procurement) have a slightly mitigating effect on

sales of products from the General Medicine & Endocrinology franchise, in particular. We expect our new products to contribute significantly to organic sales. For 2020, we forecast Mavenclad® and Bavencio® sales to show further substantial increases. Unfavorable foreign exchange developments in several growth markets and with respect to the U.S. dollar are expected to lead to a slightly negative foreign exchange effect.

EBITDA pre

For 2020, we expect EBITDA pre of the Healthcare business sector to see solid organic growth. The negative earnings effects resulting from the projected decline of Rebif® sales and the associated negative product mix effects in the base/core business should be more than offset by substantial earnings contributions from our new products, particularly Mavenclad®. In addition, we will continue our systematic cost management and strict pipeline prioritization. We therefore expect marketing and selling expenses as well as research and development costs to decline in percent of sales, with research and development costs remaining heavily dependent on the development of clinical data and further expected study results. In 2020, the upfront cash payment from the global strategic alliance with Pfizer for Bavencio® and Xalkori® and milestone payments will no longer be reflected in profit and loss. However, the upfront cash payment in the context of the global strategic alliance with GlaxoSmithKline plc (GSK) for the joint development and marketing of bintrafusp alfa will have a positive effect in the low triple digit Euro millions in fiscal 2020. The exact amount is dependent on the cost evolution and on reaching development milestones and will be recognized in other operating income. The forecast for Healthcare moreover continues to include effects from active portfolio management. But overall, the earnings contribution attributable to these effects will be significantly below the prior-year figure. Furthermore, we expect EBITDA pre to be moderately burdened by foreign exchange effects.

Business free cash flow

In 2020, we expect business free cash flow of the Healthcare business sector to show an increase in the low teens percentage range. The main drivers will be the expected rise in EBITDA pre and improvement of working capital.

Forecast for the Life Science business sector

FORECAST FOR THE LIFE SCIENCE BUSINESS SECTOR

€ million	**Actual results 2019**	Forecast for 2020	Key assumptions
Net sales	6,864	• Strong organic growth • Slightly negative foreign exchange effect	• All businesses contribute to growth • Process Solutions remains the main driver of growth, followed by Applied Solutions • Negative foreign exchange effect on account of the U.S. dollar and foreign exchange developments in several growth markets
EBITDA pre	2,129	• Strong and profitable organic earnings growth • Foreign exchange effect slightly negative	• Organic earnings growth on account of the expected sales growth and slight margin improvement • Negative foreign exchange effect due to the trend of exchange rates on several growth markets
Business free cash flow	1,375	Strong increase in the low to mid twenties percentage range	• Rise in EBITDA pre • Improved management of working capital • On the other hand, increase in capital spending on strategic projects

Net sales

For the Life Science business sector, we expect strong organic sales growth in 2020 compared to the prior year. All business units are forecast to make a contribution to the positive organic development. The Process Solutions business unit is again likely to remain the strongest driver of organic growth in 2020, followed by Applied Solutions. Moderate growth in the Research Solutions business unit should also contribute to the development of sales. We do not expect the acquisitions of FloDesign Sonics Inc. and BSSN Software GmbH to have a material portfolio effect. Due to the development of currencies in various growth markets and of the U.S. dollar, we project a slightly negative foreign exchange effect.

EBITDA pre

In 2020, the Life Science business sector is expected to show strong organic growth of EBITDA pre compared with the previous year. The persistently dynamic demand trend and a slight margin increase will also contribute to the organic growth in earnings. The foreign exchange impact on earnings in fiscal 2020 could be slightly negative, based on our estimates.

Business free cash flow

We expect business free cash flow of the Life Science business sector to see an increase in the low to mid-twenties percentage range. Higher EBITDA pre and positive effects from the improved management of working capital will be mitigated by higher capital spending on strategic projects .

Forecast for the Performance Materials business sector

FORECAST FOR THE PERFORMANCE MATERIALS BUSINESS SECTOR

€ million	**Actual results 2019**	Forecast for 2020	Key assumptions
Net sales	2,574	• Slight organic growth • Portfolio effect in the low to mid-thirties percentage range • Slightly negative foreign exchange effect	• Strong growth momentum in the Semiconductor Solutions business unit • Continued price decline in Liquid Crystals business, slightly mitigated by a volume increase • Slight growth of Surface Solutions • Portfolio effects due to Versum Materials in the low to mid-thirties percentage range, no material portfolio effect from Intermolecular • Negative foreign exchange effect due to the trend of exchange rates on several growth markets and of the U.S. dollar
EBITDA pre	803	• Slight organic growth • Portfolio effects in the low to mid-thirties percentage range • Slightly negative foreign exchange effect	• Growth in Semiconductor Solutions can offset price decline in Liquid Crystals supported by active cost management • Versum Materials earnings contribution in the low to mid-thirties percentage range leads to slight margin improvement • Planned realization of synergies of around € 25 million from the integration of Versum Materials • Negative foreign exchange effect due to the foreign exchange developments in several growth markets and of the U.S. dollar
Business free cash flow	641	Increase with growth rates in the low thirties percentage range	Rise in EBITDA pre including the contribution from Versum Materials, reduced by higher capital investments

Net sales

We forecast a slightly positive organic sales development for the Performance Materials business sector in fiscal 2020. In particular, we expect to see a strong growth dynamic in the Semiconductor Materials. We also anticipate slight organic growth for Surface Solutions compared to the previous year. The Liquid Crystals business will suffer from the continuing price decline due to the price pressure prevailing within the industry. The reduced volume growth versus the prior year will only be able to offset the negative price effects to a limited extent. For Versum Materials, we expect a portfolio effect in the low to mid-thirties percentage range in the first three quarters of 2020. Moreover, the acquisition of Intermolecular closed on September 20, 2019. We do not consider the resulting portfolio effect to be material. Due to the development of the U.S. dollar and of currencies in several growth markets, we expect a slightly negative foreign exchange effect.

EBITDA pre

For the year 2020 we are assuming moderate organic growth of EBITDA pre in the Performance Materials business sector. The price decline in liquid crystals will be offset by anticipated growth in Semiconductor Solutions and by active cost management. We estimate that the portfolio effect of Versum Materials will show total growth in the low to mid-thirties percentage range, which will improve the margin of the business slightly. This forecast includes the planned realization of synergies in the amount of around € 25 million. We expect a slightly negative foreign exchange effect that is attributable to the development of the U.S. dollar and of individual growth/emerging? market currencies.

Business free cash flow

For the Performance Materials business sector we forecast a rise in business free cash flow in the low thirties percentage range. The main driver will be the increase in EBITDA pre, essentially owing to the contribution from Versum Materials.

Corporate and Other

We expect Corporate and Other to be below the prior year in fiscal 2020. This is mainly due to a substantially lower burden from foreign currency hedging, which will partly offset opposing foreign exchange effects in the sectors.

Updated forecast for the Merck Group dated May 12, 2020

In the context of the global outbreak of the Covid-19 pandemic, in deviation from our previous forecast we assume a significant burden on global economic growth, which will affect all our businesses, particularly however Healthcare and Performance Materials. Due to the high level of uncertainty with respect to the further development of the Covid-19 pandemic, this outlook is being made with a considerably higher degree of uncertainty than normally. Since the dynamics of the pandemic vary regionally, we are presenting our assumptions in this respect as follows: For China, we assume that the Covid-19 pandemic reached its peak at the end of the first quarter and that a significant easing of the situation will set in as of the second quarter of 2020. For Europe and the United States, we do not expect the pandemic to peak until the second quarter, and currently expect that the outbreak will normalize by the end of the third quarter. Moreover, the current forecast does not assume that a second disease wave will occur in the named regions.
In deviation from the Report on Expected Developments dated February 14, 2020, we now expect a euro-U.S. dollar exchange rate in the range of 1.08 to 1.12. All further forecast assumptions – beyond the Covid-19 implications and the U.S. dollar exchange rate – are identical to those made in our original Report on Expected Developments. Taking into account the present state of knowledge, the forecast previously given is updated as follows:

€ million	Net sales	EBITDA pre	Business free cash flow
Merck Group	**~16,800 to 17,800** • Slight to moderate organic growth • Portfolio effect in the mid single-digit percentage range • Exchange rate effect -2% to +1%	**~4,350 to 4,850** • Stable organic development • Positive portfolio effect in the mid single-digit percentage range • Slightly adverse foreign exchange effect of 0% to -3%	**~2,650 to 3,250**
Healthcare	• Organic stable • Adverse portfolio effect in the mid double-digit million range • Neutral to moderately adverse foreign exchange effect	• Organic slightly negative • Slightly to moderately adverse foreign exchange effect	Moderate decline
Life Science	• Strong organic growth • Neutral to slightly adverse foreign exchange effect	• Strong organic growth • Neutral to moderately adverse foreign exchange effect	Increase in the low percentage teens range
Performance Materials	• Moderate to strong organic decline • Portfolio effect in the low to mid-thirties percentage range • Slightly positive foreign exchange effect	• Organic decline in the low to mid-teens percentage range • Portfolio effect in the low to mid-thirties percentage range • Moderately positive foreign exchange effect	Increase with growth rates in the low twenties percentage range
Corporate and Other	-	• Slightly higher than in 2019	-

Report in accordance with Section 315a (1) of the German Commercial Code (HGB)

The following information is provided in accordance with section 315a (1) of the German Commercial Code (HGB) and the explanatory report pursuant to section 176 (1) sentence 1 of the German Stock Corporation Act (AktG).

As of the balance sheet date, the company's subscribed capital is divided into 129,242,251 no-par value bearer shares plus one registered share. Each share therefore corresponds to € 1.30 of the share capital. The holder of the registered share is E. Merck Beteiligungen KG. It is entitled and obliged to appoint one-third of the members of the Supervisory Board representing the limited liability shareholders. If the holder of the registered share is a general partner, he or she has no such right of appointment. The transfer of the registered share requires the company's approval. The approval is granted at the sole discretion of the personally liable general partner with an equity interest, namely E. Merck KG.

Pursuant to the information on voting rights submitted to us in accordance with the German Securities Trading Act (WpHG), on December 31, 2019, no shareholders owned direct or indirect investments exceeding 10% of the voting rights.

According to the Articles of Association of Merck, the general partners not holding an equity interest who form the Executive Board are admitted by E. Merck KG with the consent of a simple majority of the other general partners. A person may be a general partner not holding an equity interest only if he or she is also a general partner of E. Merck KG. In addition, at the proposal of E. Merck KG and with the approval of all general partners not holding an equity interest, further persons who are not general partners not holding an equity interest may be appointed to the Executive Board.

The Articles of Association can be amended by a resolution at the Annual Meeting that requires the approval of the general partners. Notwithstanding any statutory provisions to the contrary, the resolutions of the General Meeting are adopted by a simple majority of the votes cast. Where the law requires a capital majority in addition to the voting majority, resolutions are adopted by a simple majority of the share capital represented in the vote. The Articles of Association of the company encompass authorized and contingent capital.

The Executive Board is authorized to increase the company's share capital with the approval of the Supervisory Board and of E. Merck KG once or repeatedly, up to and including April 27, 2022, by up to a total of € 56,521,124.19 by issuing new no-par value bearer shares against cash and/or non-cash contributions (Authorized Capital 2017). Limited liability shareholders shall be generally granted the statutory right to subscribe to the new shares. However, the Executive Board is authorized, with the approval of the Supervisory Board, to exclude the limited liability shareholders' subscription right, in full or in part, in case of a capital increase against cash contributions pursuant to or by analogous application of section 186 (3) sentence 4 AktG, if the issue price of the new shares is not substantially lower than the stock exchange price of the company's shares already listed and if the new shares which are issued under exclusion of the subscription right do not exceed a proportional amount of 10% of the share capital either at the time of the Authorized Capital 2017 taking effect or at the time of the Authorized Capital 2017 being utilized. This restriction to 10% of the share capital shall include the proportional amount of the share capital that is attributable to shares that are issued under exclusion of the subscription right or sold during the term of the Authorized Capital 2017, based on an authorization to issue new shares or sell own shares by direct or analogous application of section 186 (3) sentence 4 AktG. Further, this restriction shall also include the proportional amount of the share capital that is attributable to shares which may or must be issued in order to service bonds carrying a conversion or option right or a conversion or option obligation, if the bonds are issued during the term of the Authorized Capital 2017 under exclusion of the limited liability shareholders' subscription right by analogous application of section 186 (3) sentence 4 AktG.

It is likewise possible to exclude the subscription right of the limited liability shareholders with the approval of the Supervisory Board in the case of capital increases through non-cash contributions, particularly for the purpose of acquiring enterprises, parts of enterprises or interests in enterprises. In addition, with the approval of the Supervisory Board, the limited liability shareholders'

subscription rights can be excluded in order to enable E. Merck KG to exercise its right pursuant to article 32 (3) of the company's Articles of Association to participate in a capital increase by issuing shares or freely transferable share subscription rights.

It is likewise possible to exclude, with the approval of the Supervisory Board, the subscription right of the limited liability shareholders in order to enable E. Merck KG to exercise its right pursuant to article 33 of the Articles of Association to convert, in full or in part, its equity interest into share capital.

Moreover, with the approval of the Supervisory Board, the subscription right of the limited liability shareholders can be excluded if and to the extent this is necessary to grant the holders or creditors of conversion or option rights, and/or the holders or creditors of financing instruments carrying conversion or option obligations, which were or are issued by the company or by a domestic or foreign company in which the company directly or indirectly holds the majority of the votes and capital, a subscription right to the extent to which they would be entitled after the exercise of the conversion or option rights or after the performance of a conversion or option obligation.

Lastly, with the approval of the Supervisory Board, the subscription right of the limited liability shareholders can be excluded in order to exclude fractional amounts from the subscription right.

The sum of shares issued on the basis of the Authorized Capital 2017 under exclusion of the limited liability shareholders' subscription right must not exceed a proportional amount of 20% of the share capital, by taking into account other shares of the company which, during the term of the Authorized Capital 2017, are sold or issued under exclusion of the subscription right or are to be issued under bonds issued after April 28, 2017, under exclusion of the subscription right; this limitation shall apply both at the time of this authorization taking effect and at the time of this authorization being exercised.

To the extent that the subscription right is not excluded under the above provisions, it may also be granted to the limited liability shareholders by way of an indirect subscription right pursuant to section 186 (5) AktG or, in part, by way of a direct subscription right, and otherwise by way of an indirect subscription right pursuant to section 186 (5) AktG.

Furthermore, the Executive Board is authorized, with the approval of the Supervisory Board, to determine the additional details of the capital increase and its implementation, including the content of rights attached to the shares as well as the terms and conditions of the share issue.

The Articles of Association also encompass contingent capital. The share capital is contingently increased by up to € 66,406,298.40 divided into 51,081,768 shares (Contingent Capital I). The contingent capital increase serves to grant exchange rights to E. Merck KG in accordance with article 33 of the Articles of Association to enable the conversion of its equity interest. The shares carry dividend rights from the beginning of the fiscal year following the year in which the conversion option is exercised.

Moreover, the share capital is contingently increased by up to € 16,801,491.20 composed of up to 12,924,224 no par value bearer shares (Contingent Capital II). This increase in contingent capital is only to be implemented insofar as the bearers or creditors of option or conversion rights, or with an obligation to convert or exercise options on warrant bonds, option participation certificates, option participation bonds, convertible bonds, convertible participation certificates, or convertible participation bonds issued against contributions that are issued or guaranteed by the company or a subordinate Group company on the basis of the authorization resolution of the Annual General Meeting of April 27, 2018, to April 26, 2023, utilize their option or conversion rights, or to fulfill their conversion obligation or obligation to exercise options insofar as they are obliged to fulfill their conversion or option exercise obligation, or insofar as the company exercises an option, wholly or in part, of granting shares in the company instead of paying the sum of money due, and to the extent that in each case a cash settlement is not granted, or own shares or other forms of fulfillment are used. Each issue of new shares shall take place at the determined option or conversion price, pursuant to the aforementioned authorization resolution. The new shares participate in the profit from the beginning of the fiscal year in which they are created; insofar as this is legally permissible, the Executive Board may, with the approval of the Supervisory Board, and in deviation from section 60 (2) AktG, stipulate that the new shares also participate in the profit for a past fiscal year. The Executive Board is authorized, with the approval of the Supervisory Board and of E. Merck KG, to stipulate the further details of the implementation of the increase in contingent capital.

The company is not authorized to acquire its own shares.

The company has not entered into any material agreements subject to a change of control pursuant to a takeover offer nor has it entered into any compensation agreements with the members of the Executive Board or employees in the event of a takeover offer.

Additional Information on Merck KGaA in accordance with the German Commercial Code (HGB)[1]

The management report of Merck KGaA has been combined with the Group management report. The annual financial statements and the combined management report of the Merck Group and Merck KGaA for 2019 are being filed with the electronic German Federal Gazette (elektronischer Bundesanzeiger) and are available on the website of the German company register.

Merck KGaA, headquartered in Darmstadt, is the parent company of the Merck Group. In addition to its function as a holding company, Merck KGaA generates sales in the Healthcare, Life Science, and Performance Materials business sectors. The Healthcare business sector has been run in a separate company, Merck Healthcare KGaA, since April 1, 2019 (see "Effects of material company agreements on the net assets, financial position, and results of operations"). Merck KGaA bears a significant portion of the Group-wide research and development costs, and employs the majority of the 11,000-plus workforce in Darmstadt. Of that number, just under 3,000 employees of the Healthcare business sector have been employed at a separate company, Merck Healthcare KGaA, since April 1, 2019.

The financial statements of Merck KGaA have been prepared in accordance with the provisions of the German Commercial Code (HGB), as amended by the German Accounting Directive Implementation Act (BilRUG), and the German Stock Corporation Act (AktG). The full version of the annual financial statements of Merck KGaA together with the unqualified auditor's opinion has been submitted to the operator of the electronic Federal Gazette (elektronischer Bundesanzeiger), where they are published and forwarded to the company register.

Statement on Corporate Governance

The Statement of Corporate Governance according to section 289a of the German Commercial Code (HGB) is contained in the "Corporate Governance" section.

Effects of material company agreements on the net assets, financial position, and results of operations

End of the temporary business lease of the Healthcare business sector

As part of the strategic development of Merck KGaA, the existing operating activities of the Healthcare, Life Science, and Performance Materials business sectors within Merck KGaA together with the relevant assets and liabilities (hereinafter: "operating sectors") were spun off at their carrying values into three separate companies (hereinafter: "OpCo" or plural "OpCos") with the legal form of a GmbH or German limited liability corporation (operating spin-off). This operating spin-off is based on the spin-off and takeover agreement concluded between Merck KGaA and the OpCos in notarized form on March 2, 2018. Following approval by the 2018 Annual General Meeting, the operating spin-off took place with economic effect as of 0:00 hours on January 1, 2018.

Immediately after the spin-off took effect, all shares held by Merck KGaA in the respective OpCos were transferred to holding companies via a further spin-off (holding company spin-off), as a result of which the OpCos are each indirectly held by Merck KGaA via an intermediate holding company. The acquiring legal entities within the scope of the holding company spin-off were Merck Healthcare Holding GmbH for the business shares of Healthcare OpCo, Merck Life Science Holding GmbH for the business shares of Life Science OpCo, and Merck Performance Materials Holding GmbH for the business shares of Performance Materials OpCo

[1] Owing to the altered expectations as regards the impact of the Covid-19 pandemic, this 2020 forecast for Merck KGaA was updated accordingly on May 12, 2020.

(referred to individually as "HoldCo", independently of the sector, and jointly as "HoldCos"). To this end, Merck KGaA and the HoldCos signed a notarized spin-off and takeover agreement on March 2, 2018. The holding company spin-off took place with economic effect as of 0:00 hours on January 1, 2018.

Since the technical system requirements for the introduction of the sector-specific enterprise resource planning (ERP) systems as regards the OpCos were not in place at the time of the spin-off, the business activities spun off to the OpCos have been temporarily leased back by the relevant OpCos to Merck KGaA until sector-specific ERP systems have been introduced. For this purpose, also on March 2, 2018, Merck KGaA entered into a business leasing contract with each respective OpCo with economic effect as of 0:00 hours on January 1, 2018, to lease back all the operating business previously spun off to the OpCo. Under the terms of the respective business leasing contract, Merck KGaA leases the entire operation from the respective OpCo, as well as all fixed assets in this context; it acquires the current assets as well as certain liabilities and provisions at their carrying amounts under German commercial law. The business lease allowed the spin-off measures to be implemented for all OpCos with economic effect at a uniform time, 0:00 hours on January 1, 2018, while retaining the flexibility of transitioning the management of the relevant operating business in accordance with the sector-specific ERP introduction at an individual time to the OpCo in question in a targeted manner. On the basis of the business leasing contract, Merck KGaA will temporarily continue to operate the spun-off business as a leaseholder in its own name and for its own account. Once the relevant ERP systems have been introduced for the respective OpCo, the business lease with this OpCo will be terminated and the business previously leased out will pass to the OpCo.

The aforementioned spin-off and business leasing contracts form part of an overall entrepreneurial concept. They were submitted to the General Meeting of Merck KGaA for approval on April 27, 2018 (2018 Annual General Meeting) as a coherent restructuring measure, and were approved by it. The gradual implementation of the measures is due to be completed in 2020. In 2018, the Healthcare OpCo changed its legal form to that of a German corporation with general partners ("Kommanditgesellschaft auf Aktien") and has since been trading under the name of Merck Healthcare KGaA, Darmstadt.

The business leasing contract under which the Healthcare business sector was leased back to Merck KGaA was terminated with the agreement dated January 11, 2019, with economic effect as of 24:00 hours on March 31, 2019. The sector-specific ERP system for the Healthcare business sector was introduced as planned on April 1, 2019. As a result of the end of the business leasing contract, the leased objects allocated to the Healthcare business sector at the end of the lease – comprising current assets as well as certain liabilities and provisions, including the leased objects acquired or created by means of maintenance, replacement, and expansion investments – were transferred to Merck Healthcare KGaA at their carrying amounts under German commercial law and in a condition commensurate with their continued and proper operational use up to the date the business leasing contract ended. The carrying amounts of the debt exceeded the carrying amounts of assets, and so Merck KGaA made a settlement payment to Merck Healthcare KGaA. In addition, the licenses for the intangible assets and know-how leased to Merck KGaA came to an end.

The table below shows the assets and debt of Merck KGaA immediately before and after the end of the business lease and the transfer of the assets and debt to Merck Healthcare KGaA. As a result of the termination of the business lease, there were mainly lower sales, material, personnel and other operating expenses in fiscal year 2019.

€ million	Merck KGaA March 31, 2019	**Merck KGaA April 1, 2019**
ASSETS		
A. Fixed assets		
Intangible assets	237.0	237.0
Tangible assets	885.5	885.5
Financial assets	17,532.0	17,532.0
	18,654.5	**18,654.5**
B. Current assets		
Inventories	702.4	506.9
Trade accounts receivable	105.7	84.3
Other receivables and other assets	1,111.6	1,106.0
Cash and cash equivalents	2.0	2.0
	1,921.7	**1,699.2**
C. Prepaid expenses	58.9	58.9
Total ASSETS	**20,635.1**	**20,412.6**
EQUITY AND LIABILITIES		
A. Net equity		
Subscribed capital	168.0	168.0
General partner's equity	397.2	397.2
Capital reserves	3,813.7	3,813.7
Retained earnings	701.6	701.6
Profit carried forward E. Merck KG	60.8	60.8
Net retained profit: shareholders	138.6	138.6
	5,279.9	**5,279.9**
B. Provisions		
Provisions for pensions and other post-employment benefits	302.4	302.4
Other provisions	854.1	684.9
	1,156.5	**987.3**
C. Liabilities		
Financial liabilities	1,500.0	1,500.0
Trade accounts payable	365.2	273.4
Other liabilities	12,317.1	12,357.8
	14,182.3	**14,131.2**
D. Deferred income	16.4	14.2
Total EQUITY AND LIABILITIES	**20,635.1**	**20,412.6**

Business development

Merck KGaA's net sales decreased in 2019. The decline of € 1,140 million resulted primarily from the Healthcare and Performance Materials business sectors. The Healthcare business sector has been held in a separate company, Merck Healthcare KGaA, since April 1, 2019. On the other hand, net sales of the Life Science business sector rose, in particular.

			Change	
€ million	**2019**	2018	€ million	%
Healthcare	1,102	2,310	-1,208	-52.3
Life Science	987	780	207	26.5
Performance Materials	1,263	1,386	-123	-8.9
Other sales	293	309	-16	-5.2
Total	**3,645**	**4,785**	**-1,140**	**-23.8**

Sales of the Healthcare sector include product sales generated until the termination of the business lease as well as sales from intercompany cross-charges. Other sales mainly included intragroup cross-charging for IT services, trademarks, rent, and other administrative services.

The share of sales with other Group companies (Group sales) amounted to 92.0% in 2019 (2018: 93.6%).

			Change	
€ million	**2019**	2018	€ million	%
Group sales	3,355	4,477	-1,122	-25.1
Sales to third parties	290	308	-18	-5.8
Total	**3,645**	**4,785**	**-1,140**	**-23.8**

At 81.7% (2018: 86.7%), the share of exports in 2019 was below the previous year's level.

			Change	
€ million	**2019**	2018	€ million	%
Outside Germany	2,978	4,148	-1,170	-28.2
Germany	667	637	30	4.7
Total	**3,645**	**4,785**	**-1,140**	**-23.8**

The decline in net sales of the Healthcare business sector is attributable to the fact that its business has been continued in a separate company, Merck Healthcare KGaA, since April 1, 2019.

In the Performance Materials business sector, sales at the Display Solutions business unit declined year-on-year by -7.6%. Sales of the Surface Solutions business unit also declined, by -1.1%. All in all, a sharp increase in sales at Cosmetics and OLED was not enough to offset this decline. From a regional perspective, sales in Asia-Pacific and Europe fell.

Net sales of the Life Science business sector increased by a double-digit rate over the previous year's figure, mainly due to the Process Solutions business unit (+21%). The Research Solutions (+6.0%) and Applied Solutions (+6.9%) business units also posted higher sales year-on-year and contributed to growth. Sales growth was generated in the Europe, Asia-Pacific, and North America regions. By contrast, a slight fall was recorded in the Middle East and Africa regions.

RESULTS OF OPERATIONS

			Change	
€ million	**2019**	2018	€ million	%
Net sales	3,645	4,785	-1,140	-23.9
Other income	215	172	43	25.0
Cost of materials	-1,459	-1,776	317	-17.8
Personnel expenses	-1,128	-1,305	177	-13.6
Depreciation, amortization, and write-downs	-122	-112	-10	8.9
Other operating expenses	-1,382	-2,152	770	-35.8
Investment income/write-downs of financial assets	1,099	1,234	-135	-10.9
Financial result	-228	-262	34	-13.0
Profit before profit transfers and taxes	**641**	**584**	**56**	**9.6**
Profit transfers	-456	-454	-2	0.4
Taxes	-16	32	-48	-150.0
Profit after profit transfers and taxes	**169**	**162**	**7**	**4.3**

The increase in **other income** primarily resulted from cross-charges within the scope of the business lease. This was offset by lower income from the reversal of provisions and lower exchange rate gains.

The **cost of materials** fell overall, due to fact that the Healthcare business has been continued in a separate company, Merck Healthcare KGaA, since April 1, 2019. Owing to higher sales volume with declining prices in some cases, the cost of materials in relation to sales rose to 40.0% (2018: 37.1%).

The decline in **personnel expenses** was mainly attributable to the business transfer of about 3,000 employees from the Healthcare business sector to a separate company, the Merck Healthcare KGaA, since April 1, 2019.

Depreciation, amortization, and write-downs rose as a result of the investments made in 2018 and 2019.

The continuation of the Healthcare business sector in a separate company since April 1, 2019, led to a fall in **other operating expenses**, mainly in marketing, research and other external services and remuneration.

Investment income fell essentially on account of lower dividend payments in the Merck group. The profit transfers from subsidiaries decreased mainly due to a dividend received in the previous year from an intermediate holding company with a profit transfer agreement. In addition, one-off effects in one subsidiary further reduced the profit transfer. This was offset by higher profit transfers from other subsidiaries, particularly Merck Healthcare KGaA; see section “Effects of material company agreements on the net assets, financial position, and results of operations”.

The **financial result** increased mainly due to higher fair values of plan assets. This was offset by higher interest expense resulting from the financing for Versum, see Note (5) "Acquisitions and divestments" in the Notes to the Consolidated Financial Statements.

Net assets and financial position

ASSETS

			Change	
€ million	**Dec. 31, 2019**	Dec. 31, 2018	€ million	%
Fixed assets	**23,550**	**18,670**	**4,880**	**26.1**
Intangible assets	232	239	-7	-2.8
Tangible assets	860	899	-39	-4.3
Financial assets	22,458	17,532	4,926	28.1
Current assets	**1,726**	**2,336**	**-610**	**-26.1**
Inventories	567	725	-158	-21.8
Trade accounts receivable	186	315	-129	-41.0
Other receivables and other assets	973	1,293	-320	-24.8
Cash and cash equivalents	1	3	-2	-66.7
Prepaid expenses	**47**	**34**	**13**	**36.6**
	25,323	**21,040**	**4,283**	**20.4**

LIABILITIES

			Change	
€ million	**Dec. 31, 2019**	Dec. 31, 2018	€ million	%
Net equity	**5,338**	**5,329**	**9**	**0.2**
Provisions	**983**	**1,119**	**-136**	**-12.1**
Provisions for pensions and other post-employment benefits	379	288	92	31.9
Other provisions	605	832	-227	-27.3
Liabilities	**18,988**	**14,575**	**4,413**	**30.3**
Financial liabilities	3,000	1,500	1,500	100.0
Trade accounts payable	384	446	-62	-14.0
Other liabilities	15,605	12,629	2,976	23.6
Deferred income	**14**	**17**	**–3**	**–17.2**
	25,323	**21,040**	**4,283**	**20.4**

The change in net assets and in the financial position of Merck KGaA was mainly a result from capital and financing measures in connection with the acquisition of Versum. With a 20.4% increase in total assets, the equity ratio amounted to 21.1% (2018: 25.3%). The fall in the equity ratio is mainly attributable to the financing measures as part of the Versum acquisition.

The end of the business lease of the Healthcare business sector resulted in a decline in the assets and liabilities associated with this business sector (see "Effects of material company agreements on the net assets, financial position and results of operations").

Intragroup capital measures as part of the Versum acquisition resulted in an increase in financial assets.

Current assets (€ –610 million) decreased principally due to lower profit transfers compared with the previous year, mainly as a result of a dividend received in the previous year from an intermediate holding company with a profit transfer agreement. Moreover, inventories and trade accounts receivable fell in 2019 due to the continuation of the Healthcare business sector within Merck Healthcare KGaA as of April 1, 2019.

The drop in other provisions (€ –227 million) resulted primarily from the operating spin-off (see "Effects of material company agreements on the net assets, financial position and results of operations").

The increase in financial liabilities was due to the issue of bonds as part of the Versum acquisition.

The rise in other liabilities resulted mainly from intragroup financing measures in the wake of the Versum acquisition.

Research and development

In 2019, research and development spending on projects of Merck KGaA and of other Group companies totaled € 434 million (2018: € 923 million). A large portion was also incurred by companies outside the Merck Group. The decline of € 489 million (53.0%) was mainly attributable to the fact that the Healthcare business sector has been continued in a separate company, Merck Healthcare KGaA, since April 1, 2019. Further information can be found in the section "Research and Development" in the Management Report of the Group.

RESEARCH AND DEVELOPMENT EXPENSES

			Change	
€ million	**2019**	2018	€ million	%
Healthcare	132	604	-472	-78.1
Life Science	57	46	11	22.8
Performance Materials	244	260	-16	-6.3
Other R&D spending that cannot be allocated to individual business sectors	2	13	-11	-85.8
Total	**434**	**923**	**-489**	**-53.0**

The ratio of research and development spending to sales was 11.9% (2018: 19.3%). Overall, the average number of employees working in research and development was 1,678. Merck KGaA is one of the main research sites of the Merck Group, accounting for a share of 19.1% (2018: 41.6%) of total Group research and development spending. The decline is mainly attributable to the fact that the R&D activities of the research-intensive Healthcare business sector have been continued at the operating company, Merck Healthcare KGaA, since April 1, 2019.

Dividend

For 2019, we are proposing to the General Meeting the payment of a dividend of € 1.30 per share.

Personnel

As of December 31, 2019, Merck KGaA had 8,474 employees, representing a decrease over the previous year (2018: 11,133). The decline was mainly attributable to the fact that employees from the Healthcare business sector have been employed at a separate company, Merck Healthcare KGaA.

The average number of employees by functional area is as follows:

PERSONNEL

Average number of employees during the year	**2019**	2018
Production	3,164	3,756
Administration	3,143	3,213
Research	1,678	2,674
Logistics	620	671
Marketing and sales	510	590
Other	23	79
Total	**9,138**	**10,983**

Risks and opportunities

Merck KGaA is largely subject to the same opportunities and risks as the Merck Group. More information can be found in the Report on Risks and Opportunities.

Forecast for Merck KGaA

Deviations of actual business development in 2019 from the previously reported guidance

The combined management report for 2018 forecast a decline in net sales at the Healthcare business sector in 2019 due to the fact that the business lease would end and, related to that, its operating business would be continued in Merck Healthcare KGaA from April 1, 2019. A slight increase in net sales was forecast for the Life Science business sector, whereas a slight drop in net sales was expected for the Performance Materials business sector. A slight increase over the previous year was forecast for net income for the year.

In the Performance Materials business sector, sales at the Display Solutions business unit declined year over year by -7.6% und thus met the expectations from the management report 2018. Sales of the Surface Solutions business unit also declined, by -1.1%. All in all, a sharp increase in sales at the Cosmetics and OLED business units was not enough to offset this decline.

Net sales of the Life Science business sector increased by a double-digit rate over the previous year's figure and were thus above our forecast from the management report 2018, mainly due to the Process Solutions business unit (+21%). The Research Solutions (+6.0%) and Applied Solutions (+6.9%) business units also posted higher sales year-on-year and contributed to growth.

The continuation of the Healthcare business sector in Merck Healthcare KGaA led to a fall in the associated net sales and cost of materials and personnel, and other operating expenses at Merck KGaA as expected. Overall, the net income for the year was at a comparable level to the previous year.

Forecast 2020

For fiscal 2020, a significant decline in net sales is expected overall. This is due to the planned termination of the business leasing contracts with Merck Life Science Germany GmbH and Merck Performance Materials Germany GmbH as well as the resulting transfer of the Life Science and Performance Materials business sector's operating business.

As in 2018, the financing costs of the Sigma-Aldrich acquisition as well as the Versum acquisition in 2019 continue to adversely affect net income. Nevertheless, net income for the year is expected to be at a comparable level to 2019 due to the positive investment income and dividends from the subsidiaries.

Merck Financial Services GmbH, Darmstadt, will provide the company with sufficient financial resources and thus ensure liquidity.

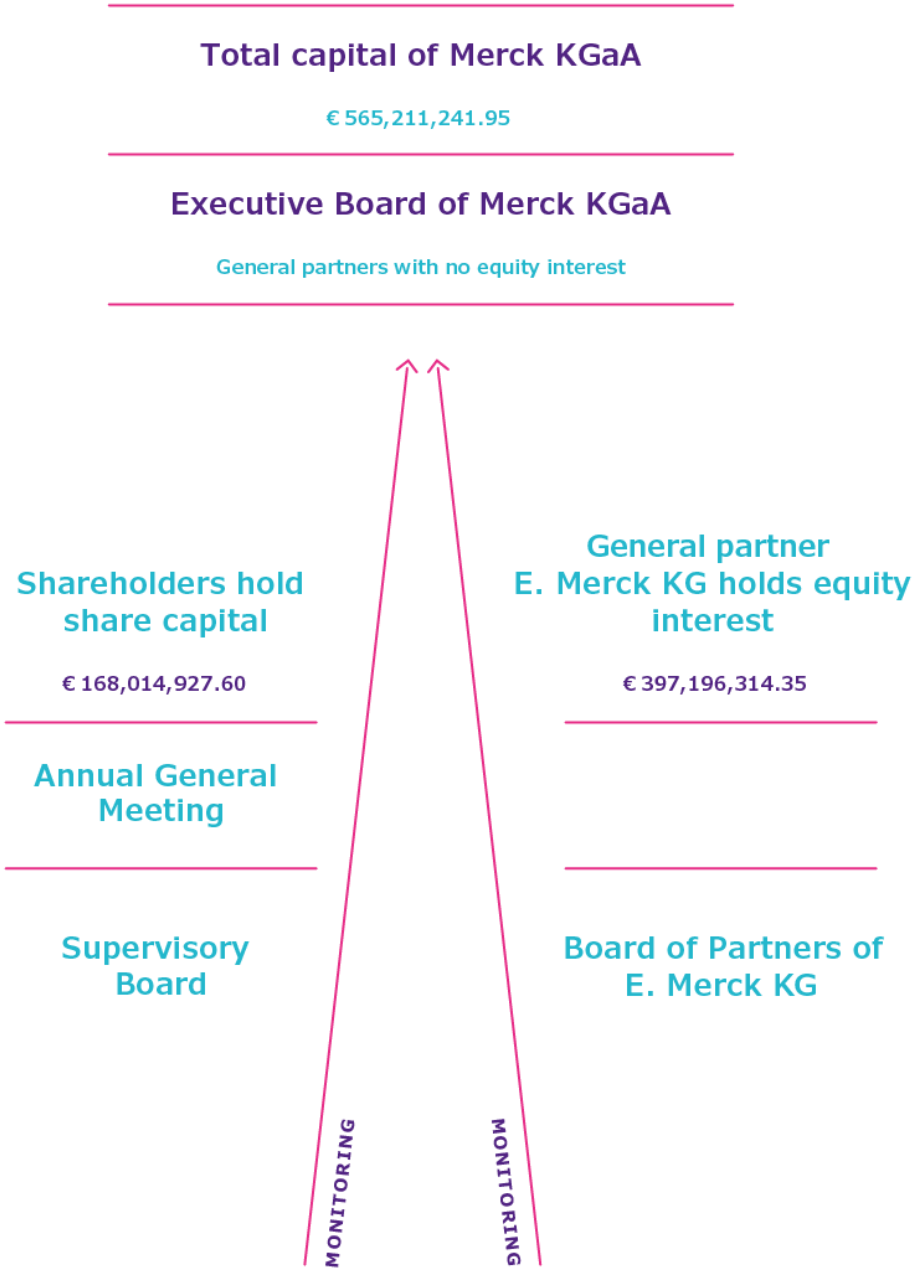
Currently no risks can be identified that may jeopardize the continued existence of the company.

Updated forecast for 2020 dated May 12, 2020

This combined management report was originally prepared on February 14, 2020 by the Executive Board of Merck KGaA.
Owing to the originally planned termination of the lease agreements with Merck Life Science Germany GmbH and Merck Performance Materials GmbH in fiscal 2020 as well as the resulting transfer of the operating businesses, a significant decline in net sales of Merck KGaA was forecast. As the project scheduling has meanwhile been updated, the successive implementation of the measures in fiscal 2020 is not likely to be completed. Taking into account this present state of knowledge, while simultaneously considering the development of the Covid-19 pandemic, the forecast previously given is updated as follows: Net sales for 2020 are now expected to be at a level comparable to 2019.
All further forecast assumptions are identical to those made in our original forecast.

CORPORATE GOVERNANCE

Capital Structure and Corporate Bodies of Merck KGaA



Further information can be found under "Merck KGaA" in the "Statement on Corporate Governance"

Statement on Corporate Governance including Compensation Report

The Statement on Corporate Governance contains the Declaration of Conformity, relevant information on practices within the company, and a description of the procedures of the corporate bodies, as well as targets for the percentage of positions held by women and the diversity policy.

Joint report of the Executive Board and the Supervisory Board including Declaration of Conformity

The German Corporate Governance Code is geared toward the conditions found in a German stock corporation ("Aktiengesellschaft" or "AG") and does not take into consideration the special characteristics of a corporation with general partners ("Kommanditgesellschaft auf Aktien" or "KGaA") such as Merck KGaA. Given the structural differences between an AG and a KGaA, several recommendations of the German Corporate Governance Code are to be applied to a KGaA only in a modified form. Major differences between the two legal forms exist in terms of liability and management. While, in the case of an AG, only the AG is liable as a legal entity, the general partners of a KGaA also have unlimited personal liability for the company's obligations (section 278 (1) of the German Stock Corporation Act (AktG)). At Merck KGaA, this pertains to both E. Merck KG – which pursuant to article 8 (5) of the Articles of Association is excluded from management and representation – as well as to the managing general partners, who together make up the Executive Board of Merck KGaA. The members of the Executive Board of Merck KGaA are therefore subject to unlimited personal liability. Unlike an AG, their executive authority is not conferred by the Supervisory Board, but rather by their status as general partners. Consequently, in addition to other responsibilities typical of the supervisory board of an AG (see description of the procedures of the Supervisory Board), the supervisory board of a KGaA does not have the authority to appoint the management board, draw up management board contracts, or specify compensation of the management board. This legal form also involves special features with regard to the General Meeting. For example, in a KGaA, many of the resolutions made require the consent of the general partners (section 285 (2) AktG), including in particular the adoption of the annual financial statements (section 286 (1) AktG).

Merck KGaA applies the German Corporate Governance Code analogously where these regulations are compatible with the legal form of a KGaA. In order to enable shareholders to compare the situation at other companies more easily, to a broad extent we base corporate governance on the conduct recommendations made by the Government Commission of the German Corporate Governance Code and forego having our own, equally permissible, code. The recommendations of the Code in the version dated February 7, 2017, the intent and meaning of which are applied, were complied with in the period between the last Declaration of Conformity issued on February 22, 2019, with two exceptions. In future, we aim to comply with the recommendations of the Code with two exceptions.

For a clearer understanding, the following gives a general explanation of the application of German company law at Merck KGaA with additional references to the General Meeting and shareholder rights.

Merck KGaA

The general partner E. Merck KG holds around 70% of the total capital of Merck KGaA (equity interest); the shareholders hold the remainder, which is divided into shares (share capital). E. Merck KG is excluded from the management of business activities. The general partners with no equity interest (Executive Board) manage the business activities. Nevertheless, due to its substantial capital investment and unlimited personal liability, E. Merck KG has a strong interest in the businesses of Merck KGaA operating efficiently in compliance with procedures. Merck KGaA's participation in the profit/loss of E. Merck KG in accordance with articles 26 et seq. of the Articles of Association further harmonizes the interests of the shareholders and of E. Merck KG. E. Merck KG appoints and dismisses the Executive Board. In addition, E. Merck KG has created bodies – complementing the expertise and activities of the Supervisory Board – to monitor and advise the Executive Board. This task applies primarily to the Board of Partners of E. Merck KG.

Based on the provisions of the German Stock Corporation Act, the Articles of Association of Merck KGaA and the rules of procedure of the various committees, Merck KGaA has a set of rules for the Executive Board and its supervision that meet the requirements of the German Corporate Governance Code. The investors, who bear the entrepreneurial risk, are protected as provided for by the German Corporate Governance Code.

The General Meeting of Merck KGaA

The 24th General Meeting of Merck KGaA was held on April 26, 2019, in Frankfurt am Main, Germany. At 66.96%, the proportion of share capital represented at the meeting was higher than in the previous year. In 2018, the proportion of share capital represented was 59.25%.

In particular, the Annual General Meeting passes resolutions concerning the approval of the annual financial statements, the appropriation of net retained profit, the approval of the actions of the Executive Board members and the Supervisory Board members, as well as the election of the auditor. Changes to the Articles of Association likewise require the adoption of a resolution by the General Meeting. The shareholders of Merck KGaA exercise their rights at the General Meeting. They may exercise their voting rights personally, through an authorized representative or through a proxy appointed by the company. The proxy is in attendance throughout the duration of the General Meeting. All the documents and information concerning upcoming General Meetings (including a summary explanation of shareholder rights) are also posted on our website. Moreover, the General Meeting is webcast live on the internet from its commencement until the end of the speech by the Chairman of the Executive Board. The introductory speeches by the Chairman of the Executive Board and the Chairman of the Supervisory Board are recorded in order to make them available to interested members of the public at any time after the meeting. In this way, we are satisfying the high transparency requirements of the Merck Group.

Declaration of Conformity

In accordance with section 161 AktG, applying the provisions of the German Corporate Governance Code correspondingly, the Executive Board and the Supervisory Board issued the following Declaration of Conformity with the recommendations of the Government Commission of the German Corporate Governance Code:

"Declaration of the Executive Board and the Supervisory Board of Merck KGaA on the recommendations of the Government Commission of the German Corporate Governance Code pursuant to section 161 of the German Stock Corporation Act (AktG). Since the last Declaration of Conformity on February 26, 2019, we have complied with the recommendations of the Government Commission of the German Corporate Governance Code in the version dated February 7, 2017, published in the official section of the German Federal Gazette, with the following exception: Merck KGaA had a D&O insurance policy for the members of its Supervisory Board that did not include a deductible in the amount recommended in accordance with section 3.8 (2) and 3.8 (3) of the German Corporate Governance Code. The powers of the Supervisory Board of Merck KGaA are more restricted than those of the supervisory board of a German stock corporation. Accordingly, the steering effect of a deductible that section 3.8 (2) and 3.8 (3) of the German Corporate Governance Code seeks to achieve is not obtained in the case of the Supervisory Board of Merck KGaA to the sought-for extent. Contrary to section 5.3.2 of the German Corporate Governance Code, the Supervisory Board has not established an audit committee. However, an audit committee does exist in the form of the Finance Committee of the Board of Partners of E. Merck KG, which to a large extent exercises the duties described in section 5.3.2 of the Code. Due to the relatively limited authority of the supervisory board of a KGaA in comparison with that of an AG, this therefore satisfies the requirements of the German Corporate Governance Code.

In view of future compliance with the current recommendations of the Government Commission of the German Corporate Governance Code, the Executive Board and the Supervisory Board declare the following: With the exception of the aforementioned deviations from sections 3.8 (2) and 3.8 (3) (D&O deductible) and 5.3.2 (audit committee), the company will comply with the recommendations of the Code in the version dated February 7, 2017."

Darmstadt, February 28, 2020

For the Executive Board

s. Stefan Oschmann

For the Supervisory Board

s. Wolfgang Büchele

Compensation report

(The compensation report is part of the notes to the audited consolidated financial statements.)

Compensation philosophy

As the world's oldest pharmaceutical and chemical company, Merck attaches great importance to responsible governance and entrepreneurship. This is also reflected by the compensation of the members of the Executive Board of Merck KGaA. Unlike management board members of stock corporations, they are not merely employed members of a corporate board. Rather, they are personally liable general partners of both Merck KGaA and the general partner E. Merck KG, and in this capacity they receive profit sharing from E. Merck KG. Owing to the legal form as a KGaA (corporation with general partners), the stipulations of the German Corporate Governance Code concerning the compensation of management board members of publicly listed German stock corporations as well as the individual disclosure thereof do not apply to the Executive Board members of Merck KGaA. Nevertheless, we have decided to comply with the requirements of the German Corporate Governance Code in the version dated February 7, 2017.

The compensation paid to the members of the Executive Board takes into account the responsibilities and duties of the individual Executive Board members, their status as personally liable partners, their individual performance, and the economic situation, as well as the performance and future prospects of the company.

Furthermore, Executive Board compensation orients towards the external peer environment of Merck KGaA, meaning in comparison with other German blue-chip companies as well as international competitors. The relationship between Executive Board compensation and the compensation of top management and the workforce as a whole continues to be taken into account, also in a multi-year assessment. The Personnel Committee regularly commissions an independent compensation consultant to review the appropriateness of the compensation.

The following principles are followed or taken into account when it comes to the specific structure of the compensation, the setting of individual compensation, the selection of the key performance indicators, and the structure of payout and allocation terms:

Regulatory requirements and principles of good corporate governance

The structure of the compensation system and the assessment of individual compensation are guided by the German Stock Corporation Act (AktG) and the German Corporate Governance Code in the version dated February 7, 2017. Within the regulatory framework conditions, the objective is to offer the Executive Board members a competitive compensation package in line with market practice.

Long-term Group strategy

The execution of the long-term Group strategy is promoted through the selection of appropriate, ambitious key performance indicators for performance-related compensation. Against this background, our performance-related compensation components (profit sharing and Merck Long-Term Incentive Plan) orient toward the key performance indicators of the Group.

Long-term interests of our shareholders

The long-term interests of our shareholders are taken into account through a significantly high amount of variable, performance-related compensation as a proportion of total compensation as well as the compensation system's strong focus on the share price. The performance of the Executive Board members should be properly recognized, with the failure to meet targets leading to a noticeable reduction in performance-related compensation.

In our company, unlike publicly listed German stock corporations, it is not the Supervisory Board, but the Board of Partners of E. Merck KG that decides on the amount and composition of compensation received by our Executive Board members. The Board of Partners has assigned this task to its Personnel Committee. The Personnel Committee is thus primarily responsible for the followings topics as they relate to our Executive Board and the compensation of its members:

- Structure and examination of the performance-independent and performance-related compensation elements
- Contract terms of members of the Executive Board
- Assumption of honorary offices, board positions, or other sideline activities
- Distribution of responsibilities among Executive Board members
- Granting of loans and salary advances

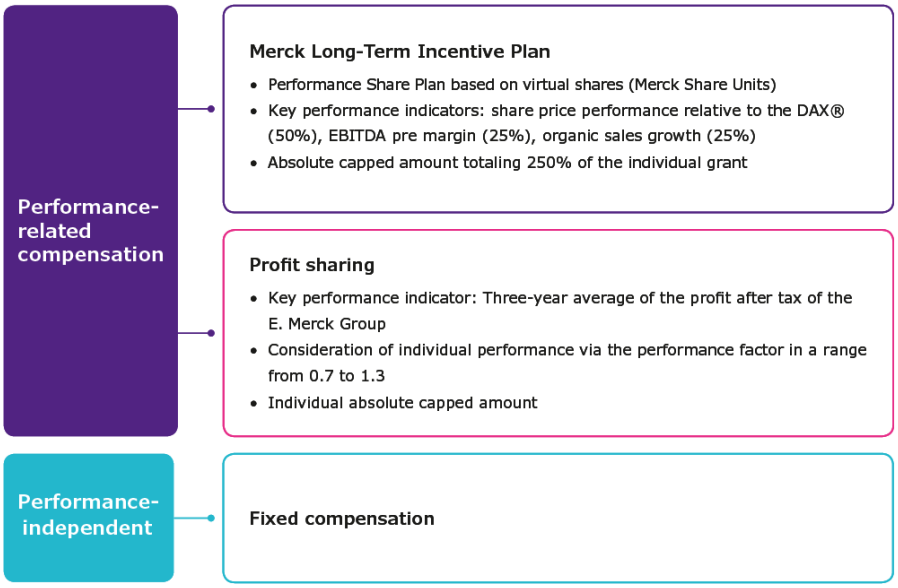
Taking the suggestions of our shareholders into account, the compensation system was further revised with the help of an independent compensation consultant with effect from fiscal 2018, while taking account of the regulatory requirements and the internal corporate strategy. In April 2018, the compensation system was submitted to the General Meeting for approval and accepted by 98.9% of the votes cast.

Our compensation system for the Executive Board will be revised again in 2020 in view of another round of regulatory changes resulting from the entry into force of the German Act Implementing the Second Shareholder Rights Directive (ARUG II) and the German Corporate Governance Code reform. The revised compensation system is expected to be submitted to the Annual General Meeting for approval in 2021. All mentions of the German Corporate Governance Code in this Compensation Report refer to the version dated February 7, 2017.

Overview of the structure and the components of the compensation system

The compensation system for the Executive Board basically comprises the three main components of fixed compensation, profit sharing, and the Merck Long-Term Incentive Plan. It is complemented by contributions to the company pension plan as well as additional benefits. The components of the compensation system are as follows:

COMPENSATION ELEMENTS AND COMPENSATION STRUCTURE[1]



[1] Excluding additional benefits and company pension.

Performance-independent compensation and additional benefits

Fixed compensation

The fixed compensation received by the members of the Executive Board comprises fixed and non-performance related amounts that are paid in the form of 12 equivalent monthly installments.

Additional benefits

In addition, the members of the Executive Board receive non-performance-related additional benefits. These consist mainly of contributions to insurance policies, personal security expenses, and a company car, which they may use privately.

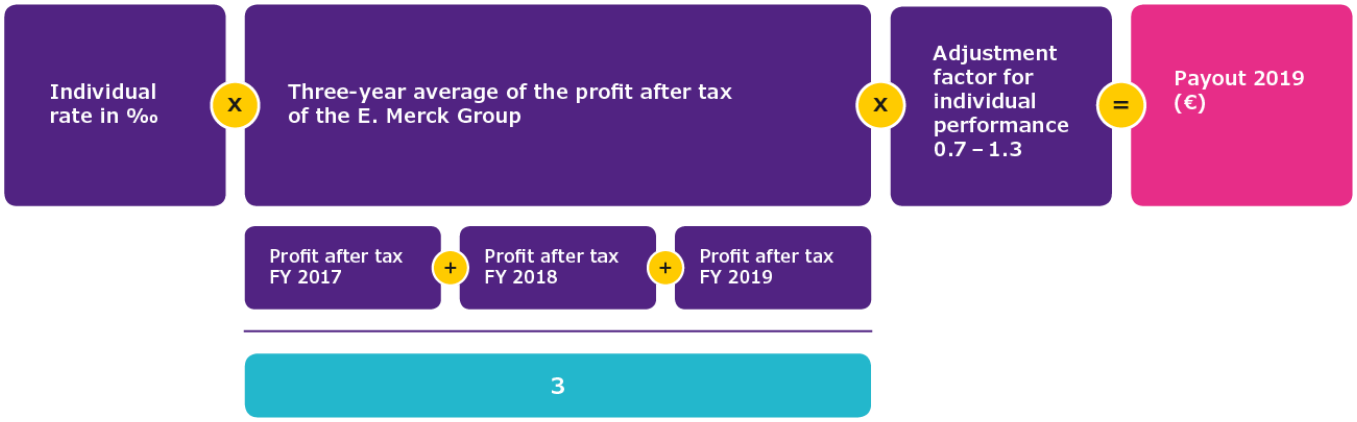
Performance-related compensation

Performance-related compensation comprises profit sharing as well as the Merck Long-Term Incentive Plan. Both performance-related compensation components are based on multi-year steering parameters. The regulatory requirements of the German Stock Corporation Act and the German Corporate Governance Code are taken into account, and particular recognition is given for sustainable corporate development.

PROFIT SHARING

Key performance indicator	Three-year average of the profit after tax of the E. Merck Group
Cycle	Three years
Limit	Individual absolute capped amount

As part of profit sharing, at the end of a fiscal year the members of the Executive Board receive an individual per mille rate of the three-year average of profit after tax of the E. Merck Group. The current and the two preceding fiscal years are included in the calculation. The use of profit after tax as the key performance indicator, which also serves as the basis for dividend payments, ensures very close alignment with the shareholder interests. The amount of the individual per mille profit-sharing rate is staggered at intervals. Through staggering, the achievement of an average profit after tax of more than € 1 billion is more strongly incentivized than amounts below € 1 billion. However, insofar as the average profit after tax is more than € 1.5 billion, the amount greater than € 1.5 billion is not taken into account when determining the profit-sharing payment. To appropriately take into account the individual performance of the Executive Board members, since fiscal 2017 the Personnel Committee has been able to adjust the payment by applying a factor ranging from 0.7 to 1.3. The performance factor makes it possible to recognize superb performance of a member of the Executive Board by multiplying profit sharing by a value greater than 1.0 up to 1.3. Similarly, multiplying by a value less than 1.0 down to 0.7 can lower profit sharing if the case calls for it. The maximum profit-sharing payment is capped individually.



Effective fiscal year 2018, the Personnel Committee abolished one-time payments to members of the Executive Board as part of performance-related compensation. This adjustment measure serves primarily to take into account our international shareholder structure.

Moreover, the Personnel Committee resolved to define criteria applicable to the adjustment of profit sharing, for applying the factor in a range of between 0.7 and 1.3. Insofar as the adjustment increases or decreases the profit sharing of a member of the Executive Board, this is to be published in the Compensation Report.

Adjustment criteria for increasing profit sharing could include the following:

- Extraordinary success in connection with M&A activities of the Merck Group;
- Extraordinary success in the sustainable strategic, technical, product-related, or structural further development or reorganization of the Merck Group;
- Extraordinary performance in the execution of especially important projects or the achievement of other exceptionally important objectives in the area of responsibility;
- Extraordinary performance leading to a clear over-achievement of targets for relevant key performance indicators in the area of responsibility;
- Extraordinary contributions to the aspirations and targets of the Merck Group's stakeholders (for example, employee satisfaction, customer satisfaction, Corporate Social Responsibility, implementation of diversity requirements).

Adjustment criteria for lowering profit sharing could include the following:

- Violations of internal rules and guidelines (for example, the Merck Code of Conduct), legislation, or other binding external requirements in the area of responsibility;
- Significant breaches of duty of care within the meaning of section 93 AktG, or other grossly non-compliant or unethical behavior;
- Behaviors or actions that are contradictory to our company values;
- Failure to implement particularly important projects or to reach other exceptionally important targets in the area of responsibility;
- Clear failure to achieve targets for relevant key performance indicators in the area of responsibility.

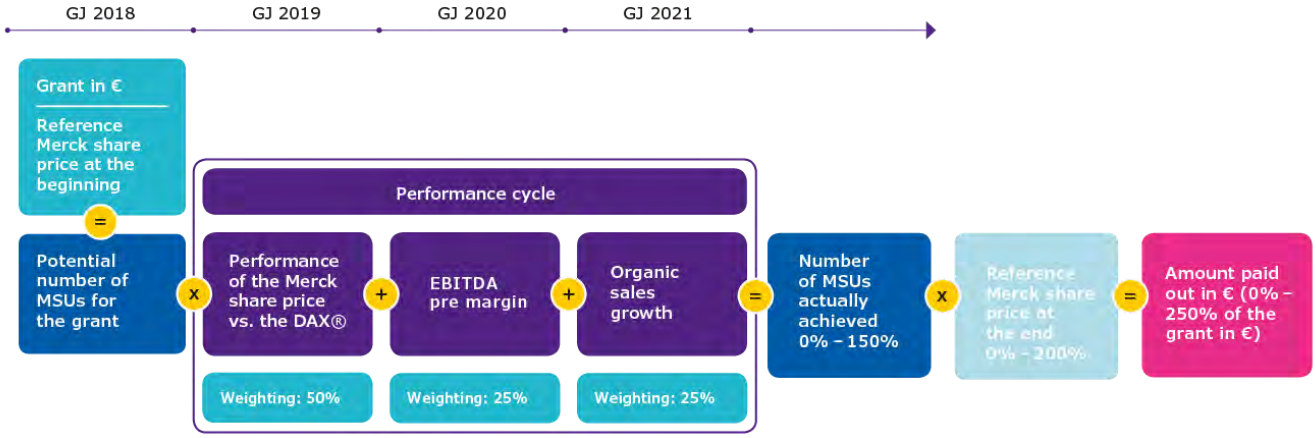
MERCK LONG-TERM INCENTIVE PLAN (LTIP)

Key performance indicators	• Share price performance relative to the DAX® (50% weighting) • EBITDA pre margin (25% weighting) • Organic sales growth (25% weighting)
Cycle	Three years
Limit	Absolute capped amount totaling 250% of the individual grant
Reference price (share price for conversion into numbers or for payment)	Average closing price of Merck shares in Xetra® trading during the last 60 trading days prior to the beginning or the end of the performance cycle

The Long-Term Incentive Plan is based on a three-year future-oriented performance cycle. As part of the Long-Term Incentive Plan, the members of the Executive Board are eligible to receive a certain number of virtual shares – Merck Share Units (MSUs). The number of MSUs is calculated as follows:

At the beginning of the performance cycle, for each Executive Board member the Personnel Committee sets an individual grant in euros. This grant is then divided by the definitive reference share price at the beginning of the performance cycle, resulting in the number of MSUs they could be eligible to receive. The final number of MSUs that are actually allocated to the Executive Board members after the performance cycle has expired depends on the development of three weighted key performance indicators over the three-year performance cycle:

a) the performance of the Merck share price compared with the performance of the DAX® with a weighting of 50%,
b) EBITDA pre margin, as a proportion of a defined target value with a weighting of 25%, and
c) the organic sales growth of the Merck Group as a proportion of a defined target value with a weighting of 25%.



The Merck Long-Term Incentive Plan thus links two key performance indicators derived from the strategy with an external, relative key performance indicator. On the one hand, this creates an incentive to achieve strategic objectives. On the other hand, the strong share price orientation takes into account the company's long-term development prospects and the expectations of our shareholders. To prevent distortions as a result of exceptional factors as well as to directly reflect the performance of the Executive Board members, the EBITDA pre margin is used.

Depending on the performance of the key performance indicators, after the three-year performance cycle, between 0% and 150% of the provisionally promised MSUs are finally allocated. The value of these MSUs is paid out to the Executive Board in the year after the three-year performance cycle has ended. For this, the final allocated number of MSUs is multiplied by the definitive reference share price at the end of the performance cycle. The maximum increase in the share price is limited to 200% of the reference price at the beginning of the performance cycle, thus limiting participation in external effects that contribute to share price increases. Apart from setting a limit on the final number of allocated MSUs and on the applicable share price increase, the overall Merck Long-Term Incentive Plan payment is limited to 250% of the individual grant. If targets are clearly missed, it is also possible that absolutely no payment is made from the Merck Long-Term Incentive Plan (0%).

Clawback provision

Through their status as personally liable general partners of Merck KGaA and E. Merck KG, the Executive Board members bear a unique entrepreneurial responsibility. This is also reflected by the penalty criteria set forth in profit sharing and by the German statutory regulations on liability for damages stipulated in section 93 AktG.

In order to take even greater account of the prominent position of entrepreneurial responsibility in compensation, a clawback provision was included in the Long-Term Incentive Plan, effective January 1, 2018, allowing amounts allocated from the Long-Term Incentive Plan but not yet paid out to be retained. Cases in which the clawback provision may be applied include violations of internal rules and regulations (Merck Code of Conduct), legislation, other binding external requirements in the area of responsibility, significant breaches of duty of care within the meaning of section 93 AktG, and other grossly non-compliant or unethical behavior or actions that are contradictory to our company values.

To further increase the transparency of the Executive Board compensation system, the performance corridor for the key performance indicators used in the Merck Long-Term Incentive Plan will subsequently be disclosed. However, the company will

continue to refrain from publishing this performance corridor in advance as this could permit market-related and competitively relevant conclusions to be drawn about strategic objectives.

Share Ownership Guideline

A Share Ownership Guideline was introduced in 2017. This obligates the Executive Board members, for the duration of their employment relationship, to permanently hold Merck shares in an amount equal to 100% of their annual gross fixed compensation. Owing to his position as Chairman of the Executive Board, Stefan Oschmann is obligated to hold a higher amount, that is at least 200% of his annual gross fixed compensation, in Merck shares. The duty to provide evidence of the complete number of shares must be met no later than on expiration of four years after having joined the Executive Board or after the introduction of the rule. The Share Ownership Guideline promotes even stronger alignment between the interests of the Executive Board members and those of our shareholders, and it additionally raises the entrepreneurial responsibility of the Executive Board members. Moreover, the introduction of the Share Ownership Guideline takes into account the widespread practice of share ownership among management and executive board members in international peer comparisons.

Overall compensation limit

Compensation is capped with respect to its performance-related compensation elements of profit sharing and the Merck Long-Term Incentive Plan, as well as having an overall cap. The maximum limits are presented in the following table.

€ thousand	Fixed compensation	Maximum profit-sharing limit	Maximum limit Merck Long-Term Incentive Plan	Maximum limit overall compensation[1]
Member of the Executive Board				
Stefan Oschmann	1,400	4,810	5,638	9,800
Udit Batra	1,100	3,640	4,263	8,000
Kai Beckmann	1,100	3,120	3,825	8,000
Belén Garijo	1,100	3,900	4,675	8,000
Marcus Kuhnert	942	3,120	3,300	8,000

[1] Excluding additional benefits and company pension.

Pension entitlements

Effective January 1, 2017, for the Executive Board members Kai Beckmann, Belén Garijo and Marcus Kuhnert, the individual contractual pension agreements were changed from defined-benefit to defined-contribution pension obligations, maintaining the direct commitment modality[1]. A defined-contribution pension agreement is also in place with Udit Batra. Within the scope of these defined-contribution pension obligations, every year an amount of € 400,000 is paid into a benefit account and interest is paid on this at standard market interest rates. Once the respective Executive Board members reach the contractually agreed age limit and are no longer employed by E. Merck KG, the amount in the benefit account is paid out either in ten annual installments or as a one-time payment. The balance in the benefit account is disbursed as a one-time payment, possibly topped up by additional contributions (maximally ten contributions, up to the age of 60) in the event of permanent disability, or in the event of death to surviving dependents. The vested amount from the former defined-benefit pension agreement was credited to the benefit account when the changeover took place.

Walter Galinat received a performance-related pension entitlement until his departure on September 30, 2018. Stefan Oschmann continues to receive such a pension provision. The old-age pension is determined in accordance with a certain percentage of pensionable compensation. The percentages can be found in the table below. The individual contractual pension obligations grant Stefan Oschmann and Walter Galinat entitlement to a lifelong old-age pension or surviving dependents' pension in the event of reaching the individual contractually agreed age limit, permanent disability, or death. As an alternative to an old-age pension, the promised pension may be paid out as a one-time amount calculated on the basis of actuarial principles once the age limit stipulated in the relevant contract has been reached.

[1] For accounting purposes, this corresponds to a defined-benefit obligation within the meaning of International Accounting Standard (IAS) 19.8.

Moreover, surviving dependents of the two Executive Board members receive a surviving dependents' pension. For spouses, this amounts to 60% of the pension entitlement. Dependent children are entitled to either a half-orphan's or an orphan's pension maximally until the age of 25.

The contribution amounts or pensionable compensation and the percentage obligation as well as the pension provisions and service costs, are listed in the following tables:

DEFINED-CONTRIBUTION OBLIGATIONS

		IFRSs			
	Contribution level	Service cost of pension obligations earned in the current year		Present value of the defined-contribution pension obligation as of Dec. 31	
€ thousand		2018	**2019**	2018	**2019**
Member of the Executive Board					
Udit Batra	400	400	**393**	990	**1,406**
Kai Beckmann	400	395	**392**	4,402	**4,867**
Belén Garijo	400	394	**391**	4,637	**5,119**
Marcus Kuhnert	400	421	**414**	2,958	**3,419**
Total	**1,600**	**1,610**	**1,590**	**12,987**	**14,811**

DEFINED-BENEFIT OBLIGATIONS

			IFRSs			
	Pensionable compensation	Percentage entitlement	Service cost of pension obligations earned in the current year		Present value of the defined-benefit pension obligation as of Dec. 31	
€ thousand			2018	**2019**	2018	**2019**
Member of the Executive Board						
Stefan Oschmann[1]	800	66	1,369	**1,372**	10,955	**14,524**
Walter Galinat (left on: September 30, 2018)	490	65	166	**-**	7,025	**-**

[1] The percentage entitlement increases until retirement by two percentage points per year of service up to 70%.

Benefits in the event of termination of duties as an Executive Board member

In the event of the early termination of the employment relationship, without notice for good cause, the employment contracts of the Executive Board members stipulate a cap on severance pay in accordance with the recommendations of the German Corporate Governance Code. Pursuant to this, payments in connection with the termination of an Executive Board member's duties shall not exceed twice the annual total compensation, or constitute compensation for more than the remaining term of the employment contract (severance cap). If an Executive Board member's duties prematurely end due to the termination of the employment contract either by the company or the Executive Board member before the performance cycle of an open tranche in the Merck LongTerm Incentive Plan expires, the obligations resulting from the plan are no longer applicable.

The employment contracts of Stefan Oschmann, Kai Beckmann, and Udit Batra each contain a postcontractual noncompetition clause. During a twoyear period, an amount totaling 50% of the contractual average benefits received by the Executive Board member in question within the last twelve months prior to their departure is provided as compensation for each year of the period of the noncompetition clause. During the period of the noncompetition clause, other employment income and pension payments will

be credited against this compensation. Within certain time limits, E. Merck KG has the possibility to dispense with adherence to the noncompetition clause with the consequence that the obligation to make the compensation payments shall no longer exist. The contracts of the Executive Board members further provide for the continued payment of fixed compensation to surviving dependents for a limited period of time in the event of death. Above and beyond existing pension obligations, no further obligations exist in the event of the termination of the contractual relationships of the Executive Board members.

Loans and advances

The members of the Executive Board did not receive any advances or loans in fiscal 2019.

Payments to former Executive Board members and their surviving dependents

Payments to former members of the Executive Board or their surviving dependents are made for a limited period of time and represent continued payment of fixed compensation in the event of death, as well as pension payments. In fiscal 2019, these amounted to € 13,448 thousand (2018: € 13,763 thousand). Pension provisions for 2019 come to € 163,617 thousand (2018: € 155,950 thousand).

Miscellaneous

The total compensation of the Executive Board of Merck KGaA includes both the compensation received from E. Merck KG as well as possibly also from subsidiaries consolidated in the Group financial statements. Should members of the Executive Board be held liable for financial losses while executing their duties, under certain circumstances this liability risk is covered by a D&O insurance policy from Merck KGaA. The D&O insurance policy has a deductible in accordance with the legal requirements and the recommendations of the German Corporate Governance Code.

Performance-related compensation in 2019

The compensation system for our Executive Board is geared to suitably rewarding the performance of Executive Board members in terms of sustainable corporate development and the creation of shareholder value, whereas the failure to meet targets leads to a noticeable decrease in performancerelated compensation. In response to the suggestions from our shareholders and to further increase the transparency of the Executive Board compensation system, the following tables present the average individual profit-sharing rates and the performance corridors for the key performance indicators used in the Merck LongTerm Incentive Plan.

Profit sharing

As part of profit sharing, at the end of a fiscal year the members of the Executive Board receive an individual per mille rate of the three-year average of profit after tax of the E. Merck Group. The current and the two preceding years are relevant here.

Key performance indicator (€ million)	2016	2017	2018	**2019**
Profit after tax of the E. Merck Group	1,559	2,549	3,324	1,255
Three-year average profit after tax of the E. Merck Group (2016–2018)		2,477		–
Three-year average profit after tax of the E. Merck Group (2017–2019)	–		2,376	

The amount of the individual per mille profit-sharing rates is staggered at intervals. This staggering incentivizes the achievement of an average profit after tax of more than € 1 billion more strongly than amounts below € 1 billion. However, insofar as the average profit after tax is more than € 1.5 billion, the amount greater than € 1.5 billion is not taken into account when determining the profit-sharing payment. The average profit-sharing rates in per mille for the members of the Executive Board in 2019 were as follows:

Member of the Executive Board	**Average profit-sharing rate in per mill in 2019**	**Performance factor for individual performance 2019**
Stefan Oschmann	2.96	1.3
Udit Batra	1.72	1
Kai Beckmann	1.47	1
Belén Garijo	1.84	1
Marcus Kuhnert	1.40	1

The amount of profit-sharing for Stefan Oschmann was increased by a factor of 1.3. The following positive criterion was used to justify the increase in profit participation:

- Extraordinary success in connection with M&A activities of the Merck Group;
- Extraordinary success in the sustainable strategic, technical, product-related, and structural further development of the Merck Group.

Stefan Oschmann met these positive criteria in fiscal 2019 on account of the following achievements:

- Strategic decision and capital allocation in favor of the acquisition of Versum Materials to strengthen business diversity at Merck and the future viability of the Performance Materials business sector:
- The takeover should make Merck into a leading provider of electronic materials for the semiconductor and display industries.
- Portfolio was supplemented by complementary product groups and services and sustained safeguarding of competitiveness through innovative materials.
- Strategic and tactical decision-maker and active negotiation partner in the acquisition process; crucial responsibility for the success of the acquisition through the strategic transformation of a hostile into a friendly takeover process in an international context.
- Role as messenger for acceptance of the two companies and intercultural integration subsequent to the acquisition.

Merck Long-Term Incentive Plan

Until the beginning of fiscal 2017, payment from the Merck Long-Term Incentive Plan was based on the achievement of specific targets with respect to the development of the Merck share price compared with the DAX® as well as the development of the EBITDA pre margin during the three-year performance cycle. Since fiscal year 2017, organic sales growth of the Merck Group has been included as an additional key performance indicator. The tables below show the target values that lead to 100% target achievement relative to the respective key performance indicator. Below the lower target corridor limit, target achievement for the respective key performance indicator is 0%. Above the upper target corridor limit, target achievement no longer increases.

Key performance indicator[1]	Lower target corridor limit	Target	Upper target corridor limit	Actually achieved value Merck LTIP tranche 2015	Target achievement Merck LTIP tranche 2015
Share price performance relative to the DAX® (external key performance indicator)	–20%	0%	50%	–16.1%	19.5%
EBITDA pre margin (internal key performance indicator)	25%	28%	31%	29%	116.7%

[1] The key performance indicator organic sales growth became a component of the Merck Long-Term Incentive Plan in 2017 and is therefore not relevant for target achievement of the tranche in fiscal 2015.

Key performance indicator[1]	Lower target corridor limit	Target	Upper target corridor limit	Actually achieved value Merck LTIP tranche 2016	Target achievement Merck LTIP tranche 2016
Share price performance relative to the DAX® (external key performance indicator)	–20%	0%	50%	0.7%	100.7%
EBITDA pre margin (internal key performance indicator)	24%	27%	30%	28.1%	118.4%

[1] The key performance indicator organic sales growth became a component of the Merck Long-Term Incentive Plan in 2017 and is therefore not relevant for target achievement of the tranche in fiscal 2016.

Total compensation

According to the German Commercial Code (HGB), the total compensation of the members of the Executive Board of Merck KGaA, broken down by performance-related and performance-independent compensation components, is as follows:

		Performance-independent components		Performance-related components				Total	Expense recorded for the period for share-based compensation[3]
		Fixed compensation	Additional benefits	Profit sharing (without long-term incentive effect)	Merck Long-Term Incentive Plan (with long-term incentive effect)				
		(€ thousand)	**(€ thousand)**	**(€ thousand)**	**Grant value (€ thousand)**	**Number of MSUs[1]**	**Time value[2] (€ thousand)**	**(€ thousand)**	**(€ thousand)**
Member of the Executive Board									
Stefan Oschmann	2019	1,400	721	4,810	2,255	24,054	1,520	8,451	1,859
	2018	1,300	186	3,700	2,255	24,584	1,426	6,612	3,536
Udit Batra	2019	1,100	7	2,800	1,705	18,187	1,149	5,056	1,368
	2018	1,000	38	2,800	1,705	18,588	1,078	4,916	2,791
Kai Beckmann	2019	1,100	30	2,400	1,530	16,320	1,031	4,561	1,202
	2018	1,000	81	2,400	1,430	15,590	904	4,385	2,387
Walter Galinat (left on: September 30, 2018)	2019	–	–	–	–	–	–	–	–
	2018	600	26	2,200	1,320	14,391	835	3,661	2,051
Belén Garijo	2019	1,100	49	3,000	1,870	19,947	1,260	5,409	1,541
	2018	1,100	66	3,900	1,870	20,386	1,183	6,249	2,969
Marcus Kuhnert	2019	942	26	2,284	1,320	14,080	890	4,142	1,088
	2018	900	26	2,200	1,320	14,391	835	3,961	2,203
Total	**2019**	**5,642**	**833**	**15,294**	**8,680**	**92,588**	**5,850**	**27,619**	**7,058**
	2018	**5,900**	**423**	**17,200**	**9,900**	**107,930**	**6,261**	**29,784**	**15,937**

[1] Number of potential MSUs subject to target achievement. The actual number of MSUs to be granted after the expiration of the three-year performance cycle may deviate from this.

[2] Time value on the date of the grant (date of the legally binding entitlement). The amount of a payment is thus not predefined. Payment is subject to target achievement and is made on a specified date after the expiration of the three-year performance cycle. The time value of the obligations was calculated using a Monte Carlo simulation based on the previously described KPIs. The expected volatilities are based on the implicit volatility of Merck shares and the DAX® in accordance with the remaining term of the LTIP tranche. The dividend payments incorporated into the valuation model are based on medium-term dividend expectations.

[3] In accordance with IFRSs, the expense recorded for 2019 includes the values for the 2017, 2018, and 2019 LTIP tranches. In accordance with IFRSs, the expense recorded for 2018 includes the values for the 2016, 2017, and 2018 LTIP tranches.

Information in accordance with the requirements of the German Corporate Governance Code

In accordance with the requirements of the German Corporate Governance Code, the following tables present the compensation granted for 2018, including additional benefits, contributions to the company pension plan, and the achievable minimum and maximum values of the variable compensation components, as well as the allocation of the respective compensation components for the fiscal year.

BENEFITS GRANTED FOR THE FISCAL YEAR

	Stefan Oschmann				Udit Batra			
	Chairman of the Executive Board				Member of the Executive Board			
Benefits granted (€ thousand)	2018	**2019**	**2019 (min.)**	**2019 (max.)**	2018	**2019**	**2019 (min.)**	**2019 (max.)**
Fixed compensation	1,300	1,400	1,400	1,400	1,000	1,100	1,100	1,100
Additional benefits	186	721	721	721	38	7	7	7
Total	**1,486**	**2,121**	**2,121**	**2,121**	**1,038**	**1,107**	**1,107**	**1,107**
Profit sharing	3,700	4,810	–	4,810	2,800	2,800	–	3,640
Multi-year variable compensation								
LTI 2018 (2018 to 2020)	1,426	–	–	–	1,078		–	–
LTI 2019 (2019 to 2021)	–	1,520	–	5,638	–	1,149	–	4,263
Total	**6,612**	**8,451**	**2,121**	**12,569**	**4,916**	**5,056**	**1,107**	**9,010**
Service cost	1,369	1,372	1,372	1,372	400	393	393	393
Total compensation	**7,981**	**9,823**	**3,493**	**13,941**	**5,316**	**5,449**	**1,500**	**9,403**

	Kai Beckmann				Walter Galinat			
	Member of the Executive Board				Member of the Executive Board (left on: September 30, 2018)			
Benefits granted (€ thousand)	2018	**2019**	**2019 (min.)**	**2019 (max.)**	2018	**2019**	**2019 (min.)**	**2019 (max.)**
Fixed compensation	1,000	1,100	1,100	1,100	600	–	–	–
Additional benefits	81	30	30	30	26	–	–	–
Total	**1,081**	**1,130**	**1,130**	**1,130**	**626**	**–**	**–**	**–**
Profit sharing	2,400	2,400	–	3,120	2,200	–	–	–
Multi-year variable compensation								
LTI 2018 (2018 to 2020)	904	–	–	–	835	–	–	–
LTI 2019 (2019 to 2021)	–	1,031	–	3,825	–	–	–	–
Total	**4,385**	**4,561**	**1,130**	**8,075**	**3,661**	**–**	**–**	**–**
Service cost	395	392	392	392	166	–	–	–
Total compensation	**4,780**	**4,953**	**1,522**	**8,467**	**3,827**	**–**	**–**	**–**

	Belén Garijo				Marcus Kuhnert			
	Member of the Executive Board				Member of the Executive Board			
Benefits granted (€ thousand)	2018	**2019**	**2019 (min.)**	**2019 (max.)**	2018	**2019**	**2019 (min.)**	**2019 (max.)**
Fixed compensation	1,100	1,100	1,100	1,100	900	942	942	942
Additional benefits	66	49	49	49	26	26	26	26
Total	**1,166**	**1,149**	**1,149**	**1,149**	**926**	**968**	**968**	**968**
Profit sharing	3,900	3,000	–	3,900	2,200	2,284	–	3,120
Multi-year variable compensation								
LTI 2018 (2018 to 2020)	1,183	–	–	–	835	–	–	–
LTI 2019 (2019 to 2021)	–	1,260	–	4,675	–	890	–	3,300
Total	**6,249**	**5,409**	**1,149**	**9,724**	**3,961**	**4,142**	**968**	**7,388**
Service cost	394	391	391	391	421	414	414	414
Total compensation	**6,643**	**5,800**	**1,540**	**10,115**	**4,382**	**4,556**	**1,382**	**7,802**

ALLOCATION FOR THE FISCAL YEAR

	Stefan Oschmann		Udit Batra		Kai Beckmann	
	Chairman of the Executive Board		Member of the Executive Board		Member of the Executive Board	
Allocation (€ thousand)	2018	**2019**	**2018**	**2019**	2018	**2019**
Fixed compensation	1,300	1,400	1,000	1,100	1,000	1,100
Additional benefits	186	721	38	7	81	30
Total	**1,486**	**2,121**	**1,038**	**1,107**	**1,081**	**1,130**
Profit sharing	3,700	4,810	2,800	2,800	2,400	2,400
Multi-year variable compensation						
LTI 2015 (2015 to 2017)	599	–	326	–	599	–
LTI 2016 (2016 to 2018)	–	2,261	–	1,708	–	1,617
Total	**5,785**	**9,192**	**4,164**	**5,615**	**4,080**	**5,147**
Service cost	1,369	1,372	400	393	395	392
Total compensation	**7,154**	**10,564**	**4,564**	**6,008**	**4,475**	**5,539**

	Walter Galinat		Belén Garijo		Marcus Kuhnert	
	Member of the Executive Board (left on: September 30, 2018)		Member of the Executive Board		Member of the Executive Board	
Allocation (€ thousand)	2018	**2019**	2018	**2019**	2018	**2019**
Fixed compensation	600	–	1,100	1,100	900	942
Additional benefits	26	–	66	49	26	26
Total	**626**	**–**	**1,166**	**1,149**	**926**	**968**
Profit sharing	2,200	–	3,900	3,000	2,200	2,284
Multi-year variable compensation						
LTI 2015 (2015 to 2017)	105	–	599	–	599	–
LTI 2016 (2016 to 2018)	–	1,192	–	1,922	–	1,492
Total	**2,931**	**1,192**	**5,665**	**6,071**	**3,725**	**4,744**
Service cost	166	–	394	391	421	414
Total compensation	**3,097**	**1,192**	**6,059**	**6,462**	**4,146**	**5,158**

Compensation for the Supervisory Board members of Merck KGaA

The compensation of the Supervisory Board members is defined by article 20 of the Articles of Association of Merck KGaA. The members of the Supervisory Board receive fixed compensation of € 47,000 per year. The Chairman receives double and the Vice Chairman receives one and a half times this amount. Moreover, the members receive additional compensation of € 750 per meeting. The individual values are presented in the following table:

	Fixed compensation		Compensation for meeting attendance		Total compensation	
€	**2019**	2018	**2019**	2018	**2019**	2018
Wolfgang Büchele (Chairman)	94,000.00	94,000.00	3,750.00	3,000.00	97,750.00	97,000.00
Michael Fletterich (Vice Chairman)	70,500.00	70,500.00	3,750.00	2,250.00	74,250.00	72,750.00
Crocifissa Attardo (until April 26, 2019)	14,936.99	47,000.00	750.00	3,000.00	15,686.99	50,000.00
Mechthild Auge (until April 26, 2019)	14,936.99	47,000.00	750.00	3,000.00	15,686.99	50,000.00
Gabriele Eismann	47,000.00	47,000.00	3,750.00	3,000.00	50,750.00	50,000.00
Edeltraud Glänzer	47,000.00	47,000.00	3,000.0	3,000.00	50,000.00	50,000.00
Jürgen Glaser (since April 26, 2019)	32,191.78	-	3,000.00	-	35,191.78	-
Michaela Freifrau von Glenck (until April 26, 2019)	14,936.99	47,000.00	750.00	3,000.00	15,686.99	50,000.00
Sascha Held (since April 26, 2019)	32,191.78	-	3,000.00	-	35,191.78	-
Siegfried Karjetta (until April 26, 2019)	14,936.99	47,000.00	750.00	3,000.00	15,686.99	50,000.00
Michael Kleinemann (since April 26, 2019)	32,191.78	-	2,250.00	-	34,441.78	-
Renate Koehler (since April 26, 2019)	32,191.78	-	3,000.00	-	35,191.78	-
Anne Lange (since April 26, 2019)	32,191.78	-	2,250.00	-	34,441.78	-
Albrecht Merck (until April 26, 2019)	14,936.99	47,000.00	750.00	3,000.00	15,686.99	50,000.00
Peter Emanuel Merck (since April 26, 2019)	32,191.78	-	3,000.00	-	35,191.78	-
Dietmar Oeter	47,000.00	47,000.00	3,750.00	3,000.00	50,750.00	50,000.00
Alexander Putz (until April 26, 2019)	14,936.99	47,000.00	750.00	3,000.00	15,686.99	50,000.00
Christian Raabe (since April 26, 2019)	32,191.78	-	3,000.00	-	35,191.78	-
Helene von Roeder (since April 26, 2019)	32,191.78	-	3,000.00	-	35,191.78	-
Helga Rübsamen-Schaeff	47,000.00	47,000.00	3,000.00	3,000.00	50,000.00	50,000.00
Gregor Schulz (until April 26, 2019)	14,936.99	47,000.00	750.00	3,000.00	15,686.99	50,000.00
Theo Siegert (until April 26, 2019)	14,936,99	47,000.00	750.00	2,250.00	15,686,99	49,250.00
Daniel Thelen (since April 26, 2019)	32,191.78	-	3000.00	-	35,191.78	-
Simon Thelen (since April 26, 2019)	32,191.78	-	3,000.00	-	35,191.78	-
Tobias Thelen (until April 26, 2019)	14,936.99	47,000.00	750.00	3,000.00	15,686.99…	50,000.00
Veit Ulshöfer (until April 26, 2019)	14,936.99	47,000.00	750.00	3,000.00	15,686.99	50,000.00
Total	**823,787.70**	**822,500.00**	**57,000.00**	**46,500.00**	**880,787.70**	**869,000.00**

As a member of the corporate bodies of E. Merck KG, Supervisory Board member Wolfgang Büchele received an additional payment of € 140,000 for performing this function in 2019 (2018: € 140,000).
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Michaela Freifrau von Glenck received an additional payment of € 5,699. for performing this function in 2019 (2018: € 80,000).
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Siegfried Karjetta received an additional payment of € 10,137 for performing this function in 2019 (2018: € 140,000).
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Albrecht Merck received an additional payment of € 82,959 for performing this function in 2019 (2018: € 120,000).
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Helga Rübsamen-Schaeff received an additional payment of € 150,000 for performing this function in 2019 (2018: € 150,000).
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Gregor Schulz received an additional payment of € 10,356 for performing this function in 2019 (2018: € 140,000).
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Theo Siegert received an additional payment of € 11,096. for performing this function in 2019 (2018: € 150,000).
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Tobias Thelen received an additional payment of € 84,438 for performing this function in 2019 (2018: € 140,000).
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Peter Emanuel Merck received an additional payment of € 80,000 for performing this function in 2019.
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Daniel Thelen received an additional payment of € 130,246 for performing this function in 2019.
As a member of the corporate bodies of E. Merck KG, Supervisory Board member Simon Thelen received an additional payment of € 100,000 for performing this function in 2019.

Ownership, purchase, or sale of shares in the company by members of the Executive Board and the Supervisory Board

As of December 31, 2019, the members of the Executive Board and of the Supervisory Board held less than 1% of the issued shares of Merck KGaA. Transactions executed by members of the Executive Board and of the Supervisory Board are disclosed on the Merck website at www.merckgroup.com/en/investors/corporate-governance/directors-dealings.html.

Information on corporate governance practices

Reporting

It is Merck KGaA's objective to provide the latest information to all shareholders, media, financial analysts, and interested members of the public, while creating the greatest possible transparency. For this reason, Merck uses a wide range of communication platforms to engage in a timely dialogue with all interested parties about the situation of the company and business changes. Merck's principles include providing factually correct, comprehensive, and fair information.

Information subject to disclosure requirements, as well as information that is not, can be accessed worldwide on the Merck KGaA website (www.merckgroup.com), which is the company's most important publication platform. Apart from a detailed financial calendar, quarterly statements and/or quarterly and half-year financial reports covering the past three years are available here in German and English. In addition, in line with the legal requirements, ad hoc announcements are published on the website. These contain information on circumstances and facts that could impact the Merck share price.

Regular press conferences, investor meetings on the occasion of investor conferences, and road shows offer another platform for dialogue. The company presentations prepared for this purpose are also available on the Merck KGaA website. In addition, the Investor Relations team is always available to private and institutional investors who wish to receive further information. To ensure the greatest possible transparency, all documents concerning the General Meeting are available on the company website. Additionally, some parts of the General Meeting are webcast live on the internet.

Dealing with insider information

Dealing properly with insider information is very important to us. Our Insider Committee examines the existence of insider information, ensures compliance with legal obligations, and prepares any necessary measures. The members of the Insider Committee are appointed by the Executive Board; at least two members work in Group Legal & Compliance. The Insider Committee meets at regular intervals, yet also meets when circumstances require. The Chief Financial Officer is vested with the authority to make the final decision on handling potential insider information.

In order to ensure a high level of protection for insider information, the Executive Board issued internal insider guidelines applicable throughout the Merck Group worldwide. The guidelines inform employees about their responsibilities under insider trading laws and give clear instructions for compliant behavior. In addition, they describe the function of the Insider Committee in detail. Moreover, our Code of Conduct, which is binding on all employees, also contains an explicit, detailed reference to the ban on using insider information. Within the scope of obligatory training courses on the Code of Conduct as well as specific training courses on insider law, all employees are instructed on the stipulations of insider trading.

Accounting and audits of financial statements

Merck KGaA prepares its consolidated financial statements and combined management report in accordance with International Financial Reporting Standards (IFRSs), as applicable in the EU, as well as the supplementary rules applicable under section 315e (1) of the German Commercial Code (HGB) and as stipulated by our Articles of Association. The consolidated financial statements and the combined management report are prepared by the Executive Board and examined by an auditor, taking into account the generally accepted standards for the audit of financial statements promulgated by the Institute of Public Auditors in Germany (Institut der Wirtschaftsprüfer, IDW).

The Supervisory Board commissioned KPMG AG Wirtschaftsprüfungsgesellschaft, Berlin, to audit the consolidated financial statements and the combined management report for 2019. Moreover, the Supervisory Board agreed with KPMG AG

Wirtschaftsprüfungsgesellschaft, Berlin, that the auditor shall inform the Supervisory Board without delay of any grounds for disqualification or bias occurring during the audit if these cannot be immediately rectified. Additionally, the auditor shall immediately report to the Supervisory Board any findings and issues which emerge during the audit that have a direct bearing upon the tasks of the Supervisory Board. The auditor shall inform the Supervisory Board or note in the audit report any circumstances determined during the audit that would render inaccurate the Declaration of Conformity made by the Executive Board and the Supervisory Board. It has also been agreed with the auditor that in order to assess whether the Executive Board has fulfilled its obligations in accordance with section 91 (2) of the German Stock Corporation Act (AktG), the audit will also cover the company's early warning risk identification system. Moreover, the auditor is required to examine and evaluate the accounting-relevant internal control system insofar as this is necessary and appropriate for assessing the accuracy of financial reporting.

Since 1995, KPMG AG Wirtschaftsprüfungsgesellschaft, Berlin, has been the audit firm for the statutory audit of the annual financial statements and consolidated financial statements of Merck KGaA. The auditor responsible for auditing the consolidated financial statements changes regularly in accordance with the statutory requirements. Bodo Rackwitz is currently leading the audit engagement and has been the auditor in charge of the engagement since fiscal 2015. The Supervisory Board had KPMG AG Wirtschaftsprüfungsgesellschaft, Berlin, provide a statement regarding the scope of the business, financial, personal, and other relationships between KPMG AG Wirtschaftsprüfungsgesellschaft, Berlin, its bodies and head auditors, and Merck KGaA, its Group companies and the members of their bodies (independence declaration). The statement also covers the scope of the services provided by KPMG AG Wirtschaftsprüfungsgesellschaft, Berlin, in the previous fiscal year as well as the services (other than auditing services) that are contracted for the upcoming year (especially consultancy services) for Merck KGaA and its subsidiaries. Having examined the declaration, the Supervisory Board has found no grounds to doubt the independence of KPMG AG Wirtschaftsprüfungsgesellschaft, Berlin. Neither party identified any conflicts of interest.

Due to the requirement to change auditors at regular intervals, Merck KGaA must appoint a new auditor (different than the current one) no later than for fiscal 2024. In fiscal 2019, the Supervisory Board of Merck KGaA therefore decided to prepare a public request for tender for the audit of the annual financial statements and consolidated financial statements of Merck KGaA and to voluntarily change auditors for the fiscal 2023 audit, earlier than required.

Further reports

The combined management report of Merck KGaA and the Merck Group does not contain a non-financial declaration. Instead, we issue a separate combined non-financial (Group) report in accordance with sections 289b–289e and 315b–315c HGB. This is available effective April 14, 2020, as an online version on our website at www.merckgroup.com/en/cr-report/2019. It is integrated into the 2019 Corporate Responsibility Report in accordance with DRS 20 subsection 252 (b). We have compiled an overview of the information contained in the combined non-financial (Group) declaration at www.merckgroup.com/nfr19.

Values and compliance

Based on a corporate culture that places the fundamental company values – courage, achievement, responsibility, respect, integrity, and transparency – at the center of our entrepreneurial actions, the Code of Conduct (www.merckgroup.com/company/responsibility/en/regulations-and-guidelines/code-of-conduct.pdf) helps those involved in the business process to implement the values when dealing with one another on a daily basis.

With its Code of Conduct, a revised version of which was issued in mid-2017, Merck has established a set of rules and regulations intended to help our employees to act responsibly and to make the right decisions in their daily work.

The Code of Conduct explains the company principles for dealings with business associates, shareholders, colleagues, and employees, and within the scope of our responsibility for society. Therefore, it supports all employees in acting ethically – not only in their dealings with one another, but also outside the company. The Code of Conduct is thus the main set of rules of our compliance program. In the newly published version, Merck has aligned its Code of Conduct even more closely with the Merck values. Additionally, it has expanded the Code of Conduct to include further important topics such as data privacy, healthcare compliance, and bioethics. To Merck, compliance means observing legal and company-internal regulations and the basic ethical principles anchored in the company values. With the Code of Conduct and the various unit-specific ethical compliance rules, the values are integrated into daily work and business practice. The Code of Conduct is binding on all employees, both at headquarters and in the subsidiaries. We also expect our business associates worldwide to accept these principles or to have their own

comparable principles. While supplier management ensures compliant behavior of suppliers, global business partner risk management encompasses the relations with sales-related business associates such as distributors and wholesalers.

The Compliance department monitors observance of the Code of Conduct with support from corresponding monitoring and training programs throughout the Group. All employees are called upon to report potential compliance violations to their supervisor, Legal, HR, or other relevant departments. Merck created the position of Group Compliance Officer in 2002. This employee is responsible for setting up, maintaining, and further developing our global compliance program. By taking appropriate measures, the Group Compliance Officer and his team, including regional compliance officers, help to lower the risk of serious legal violations of, for instance, antitrust law, anticorruption rules, or legal regulations and requirements of industry codes in the healthcare sector. Responsibility for money laundering prevention was added in 2018, with Compliance coordinating the necessary organizational measures, including training.

In 2014, we began appointing compliance officers for the various business sectors. In particular, they are responsible for business-specific compliance input, and they evaluate sector-specific risks that are incorporated in the design of the Compliance program.

A further focal area of the Compliance program is ensuring legally and ethically correct dealings with medical professionals and adhering to the transparency requirements. Since October 2013, the Group Compliance Officer has agreed on extensive measures with the affected areas of the company in order to establish an internal framework of rules as well as the corresponding processes for approving and documenting interactions with experts that ensure correct publication. We of course also ensure compliance with the respectively valid data protection regulations.

The role of the Group Compliance Officer is reflected in the subsidiaries, which ensure via country representatives that compliance measures are implemented in the countries. Since 2013, Compliance tasks in the countries and on a regional basis have largely been performed by full-time compliance officers. As a result, a higher level of compliance expertise is based locally and the increasing tasks in all business sectors are taken into account. At the same time, the management structure was streamlined and the reporting lines for the countries were consolidated regionally. Since the end of 2016, the compliance officers in the countries have been reporting to the dedicated compliance officers for the respective business sectors (Healthcare, Life Science, and Performance Materials). A separate responsibility was also created for Group functions. Regular regional compliance meetings are held to promote the exchange of information within the Compliance organization.

Newcomer training seminars were introduced in 2010 for newly appointed compliance officers. These seminars serve to build up compliance expertise and strengthen cooperation within the Compliance organization. This Group-wide network is used to steer the global compliance program. Within the Group Compliance function in Darmstadt, a team is occupied with continuously further developing the compliance program and shaping company-internal compliance guidelines. The Compliance organization is also involved in the relevant due diligence processes for the incorporation of new business units as well as possible divestments and acquisitions, and the subsequent integration of companies. Within the scope of the global compliance program, a high degree of importance is attached to regular compliance seminars of the Merck Compliance Training Plan, which are conducted as web-based training courses and classroom sessions. By presenting various training topics, particularly on the Code of Conduct, corruption, antitrust and competition law, as well as healthcare compliance and data privacy, they serve to sensitize employees and management to the consequences of compliance violations and to show ways of avoiding them. Since Merck set up a central SpeakUp line, our employees and individuals outside of our company have been able to report compliance violations by telephone or via a web-based application in their respective language. The SpeakUp line is available 24 hours a day, free of charge. Case numbers enable anonymous, two-way communication. The reports received are individually reviewed. If a compliance violation exists, corresponding corrective action is taken based on concrete action plans. If necessary, disciplinary measures are taken. These can range from a simple warning up to the dismissal of the employee who violated a compliance rule. In 2010, Merck set up a Compliance Case Committee to guide these processes. The Compliance Case Committee consists of senior members from various Group governance functions; they are involved in reviewing compliance violations and introducing countermeasures. The joint work in the Compliance Case Committee enables processes between the various Group functions to be optimally coordinated and designed efficiently.

Further significant elements of the Compliance program include requirements on locally identifying and assessing risks as well as reporting these, both within the subsidiary and to the Group functions. In 2019, we introduced a revised compliance risk management system for this purpose and supplemented it with a control component. The Compliance Office regularly reviews and assesses the implementation status of the Compliance program at the subsidiaries. In cooperation with Group Internal Auditing, the Compliance Office regularly reviews the implementation of Group-wide compliance measures at the subsidiaries. The audits

regularly focus on the local compliance structure, the compliance measures taken, and the existence of corresponding compliance guidelines and processes.

The Compliance Office reports regularly to the Executive Board and the Supervisory Board, informing them of the status of compliance activities (including training status), compliance risks, and serious compliance violations.

The Executive Board informs the supervisory bodies at least once a year about the key compliance issues.

Data protection

The Data Protection team at Merck is integrated into the Group's Compliance organization. As required by law, this department operates independently. The department regularly prepares data protection updates and produces a comprehensive data protection report at regular intervals as part of our broader compliance reporting efforts. In addition to the Group's central Data Protection Officer, many sites worldwide also have local Data Protection Officers.

Specific guidelines have been put in place to ensure that data protection processes comply with the relevant regulations. The "Policy for Data Protection and Personal Data Privacy" defines the standards according to which data is processed, stored, used, and transmitted at Merck. This enables us to provide a high level of protection for the data of our employees, contract partners, customers, and suppliers as well as the data of patients and participants in clinical trials. A central IT tool was also installed that establishes a common source for data protection processes at Merck. For instance, these include questions regarding data protection, the documentation of data processing activities, and reports of possible violations of data protection guidelines. Our understanding of data protection throughout the Group is based on European legislation, including the provisions of the EU's General Data Protection Regulation (EU GDPR) in force since May 2018. We also comply with local data protection regulations.

Risk and opportunity management

The Executive Board, the Supervisory Board, and the Finance Committee are regularly informed about the current risk portfolio of the Group and the individual companies. More detailed information can be found in the Report on Risks and Opportunities.

Avoidance of conflicts of interest

Within the framework of their work, all Executive Board and Supervisory Board members of Merck KGaA are exclusively committed to the interests of the company and neither pursue personal interests nor grant unjustified advantages to third parties.

Before an Executive Board member takes on honorary offices, board positions, or other sideline activities, this must be approved by the Personnel Committee of the Board of Partners of E. Merck KG. The Chairman of the Executive Board, Stefan Oschmann, and the Chief Financial Officer, Marcus Kuhnert, are both members of the Executive Board of E. Merck KG. This does not, however, create conflicts of interest.

In its report to the General Meeting, the Supervisory Board discloses any conflicts of interest involving its members and how they were dealt with. Consultancy agreements as well as other service and work contracts of a Supervisory Board member with Merck require the approval of the Supervisory Board. In fiscal 2019, there were neither conflicts of interest, nor consultancy agreements or other service or work contracts, with Merck KGaA involving Supervisory Board members.

Adherence to environmental and safety standards

At Merck, closed-loop thinking guides the way in which we address environmental protection issues. To this end, we integrate precautionary measures into our process, procedural, and product development planning. Our Environment, Health and Safety Policy, with its principles and strategies, implements the guidelines formulated by the national and international associations of the chemical industry in the Responsible Care guidelines. The Responsible Care Global Charter, developed by the International Council of Chemical Associations (ICCA) in 2014, puts even more emphasis than before on overall responsibility for products, supply chains, and the community. Merck signed this expanded version of Responsible Care Global Charter for the entire Group in the same year. It is currently being implemented by Merck at an international level. We report our ecological, economic and social performance transparently in accordance with the internationally recognized principles of the Global Reporting Initiative (GRI), taking into account the requirements of the German Sustainability Code and the principles of the UN Global Compact. One of our major climate protection objectives is to achieve a 20% reduction in our greenhouse gas emissions by 2020, measured against the 2006 baseline.

Many guidelines specify how the sites and employees of the Merck Group are to observe the principles in their daily work. The Group function Environment, Health, Safety, Security, Quality steers these global activities and ensures compliance with statutory requirements, internal standards, and business needs throughout the entire Group. In this way, Group-wide risks are minimized and continuous improvement is promoted in the areas of environment, health, safety, security, and quality. Corporate Responsibility reports are also published at regular intervals.

Procedures of the Executive Board, Supervisory Board, Board of Partners, and its Committees

Members of the Executive Board of Merck KGaA

Information on memberships of statutory supervisory boards and comparable German and foreign supervisory bodies (section 285 No. 10 HGB in conjunction with section 125 (1) sentence 5 AktG).

Member	Memberships of (a) statutory supervisory boards and (b) comparable German and foreign supervisory bodies of corporations
Stefan Oschmann Munich, Chairman	No board positions
Udit Batra Wellesley (Massachusetts, United States), CEO Life Science	(b) – EMD Millipore Corporation, Billerica, Massachusetts, United States (President)
Kai Beckmann Darmstadt, CEO Performance Materials	(a) – Bundesdruckerei GmbH, Berlin
Belén Garijo Frankfurt am Main, CEO Healthcare	(b) – Banco Bilbao Vizcaya Argentaria S. A., Bilbao, Spain – L'Oréal S. A., Clichy, France
Marcus Kuhnert Königstein, Chief Financial Officer	No board positions

The general partners with no equity interest (Executive Board) manage the business activities in accordance with the laws, the Articles of Association, and the rules of procedure. They are appointed by E. Merck KG in accordance with the consent of a simple majority of the other general partners. The members of the Executive Board are jointly responsible for the entire management of the company. Certain tasks are assigned to individual Executive Board members based on a responsibility distribution plan. Each Executive Board member promptly informs the other members of any important actions or operations in his or her respective business area. Among other things, the Executive Board is responsible for preparing the annual financial statements of Merck KGaA and of the Merck Group as well as for approving the quarterly and half-year financial statements of the Merck Group. In addition, the Executive Board ensures that all legal provisions, official regulations, and the company's internal policies are abided by, and works to achieve compliance with them by all the companies of the Merck Group. A Group-wide guideline defines in detail which transactions require prior approval by the Executive Board.

The Executive Board provides the Supervisory Board with regular, up-to-date, and comprehensive reports about all company-relevant issues concerning strategy, planning, business developments, the risk situation, risk management, and compliance. The rules of procedure of the Executive Board and of the Supervisory Board, as well as a Supervisory Board resolution, regulate further details on the information and reporting duties of the Executive Board vis-à-vis the Supervisory Board.

The Executive Board informs the Board of Partners and the Supervisory Board at least quarterly of the progress of business and the situation of the company. In addition, the Executive Board informs the aforementioned boards at least annually of the company's annual plans and strategic considerations.

The Executive Board passes its resolutions in meetings that are normally held once a month.

Supervisory Board

The Supervisory Board has 16 members. In fiscal 2019 up to the end of the Annual General Meeting on April 26, 2019, the Supervisory Board was composed as follows:

Member	Memberships of (a) further statutory supervisory boards and (b) comparable German and foreign supervisory bodies of corporations
Wolfgang Büchele Römerberg, Chairman of Exyte AG, Stuttgart	(a) – Gelita AG, Eberbach (Chairman) (b) – E. Merck KG, Darmstadt[1] – Kemira Oyj, Helsinki, Finland
Michael Fletterich Gernsheim, Chairman of the Merck Joint Works Council	No board positions
Crocifissa Attardo Darmstadt, full-time member of the Merck Joint Works Council	(b) – Merck BKK (rotating chairperson)
Mechthild Auge Wehrheim, full-time member of the Merck Joint Works Council	No board positions
Gabriele Eismann Seeheim-Jugenheim, Senior Product Manager	No board positions
Edeltraud Glänzer Hanover, Vice Chairperson of IG Bergbau, Chemie, Energie (IG BCE), Hanover	(a) – B. Braun Melsungen AG, Melsungen – Evonik Industries AG, Essen (Vice Chairperson)
Michaela Freifrau von Glenck Zurich, retired teacher	No board positions
Siegfried Karjetta[2] Darmstadt, physician	(b) – E. Merck KG, Darmstadt[1]
Albrecht Merck Schriesheim, Commercial Director of the Castel Peter Winery, Bad Dürkheim	(b) – E. Merck KG, Darmstadt[1]
Dietmar Oeter Seeheim-Jugenheim, Vice President Corporate Quality Assurance	No board positions
Alexander Putz Michelstadt, full-time member of the Merck Joint Works Council	No board positions
Helga Rübsamen-Schaeff Langenburg, Chairperson of the Advisory Board of AiCuris Antiinfective Cures GmbH, Wuppertal	(a) – 4SC AG, Martinsried – Bonn University Hospital, Bonn (b) – E. Merck KG, Darmstadt[1]
Gregor Schulz Umkirch, pediatrician	(b) – E. Merck KG, Darmstadt[1]
Theo Siegert Düsseldorf, Managing Partner of de Haen Carstanjen & Söhne KG, Düsseldorf	(a) – Henkel AG & Co. KGaA, Düsseldorf (b) – E. Merck KG, Darmstadt[1] – DKSH Holding Ltd., Zurich, Switzerland
Tobias Thelen[2] Munich, Managing Partner of Altmann Analytik GmbH & Co. KG, Munich	(b) – E. Merck KG, Darmstadt[1]
Veit Ulshöfer Sachsenheim, Global Head of Research and Bioinformatics	No board positions

[1] Internal board position.

[2] Members appointed according to article 6 (5) of the Articles of Association.

As of the end of the Annual General Meeting on April 26, 2019, the composition of the Supervisory Board is now as follows:

Member	Memberships of (a) further statutory supervisory boards and (b) comparable German and foreign supervisory bodies of corporations	Member of the Supervisory Board since
Wolfgang Büchele Römerberg, Chairman of Exyte AG, Stuttgart	(a) – Gelita AG, Eberbach (Chairman) (b) – E. Merck KG, Darmstadt[1] – Wegmann Unternehmens-Holding GmbH & Co. KG, Fürstenfeldbruck – Kemira Oyj, Helsinki, Finland	July 1, 2009
Michael Fletterich Gernsheim, Chairman of the Merck Joint Works Council	No board positions	July 1, 1998
Gabriele Eismann Seeheim-Jugenheim, Senior Product Manager	No board positions	May 9, 2014
Jürgen Glaser Bingen, Regional Director of the German Mining, Chemical, and Energy Industrial Union (IG BCE), Darmstadt	(a) – SIRONA Dental Systems GmbH – HFC Prestige Service Germany GmbH (Vice Chairman) (b) – Merck BKK	April 26, 2019
Edeltraud Glänzer Hanover, Chairperson of the Board of Directors at the August-Schmitt-Stiftung, Bochum	(a) – B. Braun Melsungen AG, Melsungen – Evonik Industries AG, Essen (Vice Chairperson)	March 28, 2008
Sascha Held Riedstadt, full-time member of the Merck Joint Works Council	No board positions	April 26, 2019
Michael Kleinemeier Heidelberg, Member of the Executive Board of SAP SE, Walldorf, SAP Digital Business Services	(b) – E. Merck KG, Darmstadt[1]	April 26, 2019
Renate Koehler Darmstadt, pharmacist and Manager of Engel-Apotheke pharmacy, Darmstadt	No board positions	April 26, 2019
Anne Lange Riedstadt, full-time member of the Merck Joint Works Council	No board positions	April 26, 2019
Peter Emanuel Merck[2] Hamburg, Managing Partner of Golf-Lounge GmbH, Hamburg	No board positions	April 26, 2019
Dietmar Oeter Seeheim-Jugenheim, Vice President Corporate Quality Assurance	No board positions	May 9, 2014
Christian Raabe Höchst, IT Business Partner	No board positions	April 26, 2019
Helene von Roeder Frankfurt am Main, Member of the Executive Board (CFO) of Vonovia SE, Bochum	(b) – E. Merck KG, Darmstadt[1] – Vonovia Finance B.V., Amsterdam, Netherlands – AVW Versicherungsmakler GmbH, Hamburg – Victoria Park AB, Malmö, Sweden – Hembla AB, Stockholm, Sweden	April 26, 2019
Helga Rübsamen-Schaeff Langenburg, Chairperson of the Advisory Board of AiCuris Antiinfective Cures GmbH, Wuppertal	(a) – 4SC AG, Martinsried – Bonn University Hospital, Bonn (b) – E. Merck KG, Darmstadt[1]	May 9, 2014
Daniel Thelen Cologne, Head of Infrastructure Development for western region at DB Netz AG, Frankfurt am Main/Duisburg	(b) – E. Merck KG, Darmstadt[1]	April 26, 2019
Simon Thelen[2] Cologne, Chief Physician for Hand Surgery at the Clinic for Trauma and Hand Surgery, University Hospital Düsseldorf	(a) – Merck Healthcare KGaA[1] (b) – E. Merck KG, Darmstadt[1]	April 26, 2019

[1] Internal board position.

[2] Members appointed according to article 6 (5) of the Articles of Association.

The Supervisory Board performs a monitoring function. It supervises the Executive Board's management of the company. In comparison with the supervisory board of a German stock corporation, the role of the supervisory board of a corporation with general partners (KGaA) is limited. This is due to the fact that the members of the Executive Board are personally liable partners and therefore are themselves responsible for the management of the company. In particular, the Supervisory Board is not responsible for appointing and dismissing general partners or for regulating the terms and conditions of their contracts. This is the responsibility of E. Merck KG. Nor does the Supervisory Board have the authority to issue rules of procedure for the Executive Board, or a catalog of business transactions requiring approval. This authority likewise belongs to E. Merck KG (article 13 (3) sentence 1 and (4) sentence 1 of the Articles of Association).

However, the fact that the Supervisory Board has no possibilities to directly influence the Executive Board restricts neither its information rights nor audit duties. The Supervisory Board must monitor the Executive Board in terms of legality, regularity, usefulness, and economic efficiency. In particular, the Supervisory Board has the duty to examine the reports provided by the Executive Board. This includes regular reports on the intended business policy, as well as other fundamental issues pertaining to corporate planning, especially financial, investment and HR planning; the profitability of the Merck Group; the progress of business; the risk situation; risk management (including compliance); and the internal auditing system. In addition, by means of consultation with the Executive Board, it creates the basis for supervision of the management of the company by the Supervisory Board in accordance with section 111 (1) AktG.

The Supervisory Board examines the annual financial statements as well as the consolidated financial statements and the combined management report, taking into account in each case the reports of the auditor. Moreover, the Supervisory Board discusses the quarterly statements and the half-year financial report, taking into account in the latter case the report of the auditor on the audit review of the abridged financial statements and the interim management report of the Group. The adoption of the annual financial statements is not the responsibility of the Supervisory Board, but of the General Meeting. The Supervisory Board normally meets four times a year. Further meetings may be convened if requested by a member of either the Supervisory Board or the Executive Board. As a rule, resolutions of the Supervisory Board are passed at meetings. At the instruction of the chairman, in exceptional cases a resolution may be passed by other means, details of which are given in the rules of procedure.

The members of the Board of Partners of E. Merck KG and of the Supervisory Board may be convened to a joint meeting if so agreed by the chairpersons of the two boards.

The rules of procedure prescribe that the Supervisory Board may form committees. The Supervisory Board has formed a Nomination Committee comprising three shareholder representatives. Its members are Wolfgang Büchele, Helga Rübsamen-Schaeff, and Simon Thelen. The Nomination Committee is responsible for proposing to the Supervisory Board suitable candidates for its proposal to the Annual General Meeting. Apart from legal requirements and the recommendations of the German Corporate Governance Code, the "Objectives of the Supervisory Board with respect to its composition," "Profile of skills and expertise," and the "Diversity Policy" are to be taken into consideration as well. Owing to the aforementioned limited authority, and since a corresponding need has not yet arisen, the Supervisory Board currently has no further committees.

The German Stock Corporation Act prescribes that the Supervisory Board of a publicly listed company must have at least one member who has professional expertise in accounting or auditing. Helene von Roeder satisfies these requirements and is furthermore the Chairperson of the Finance Committee of the Board of Partners of E. Merck KG. A further provision of the German Stock Corporation Act requires that the members of the Supervisory Board be collectively familiar with the sector in which their company operates. This requirement is specifically addressed in the Supervisory Board's profile of skills and expertise, which stipulates that the Supervisory Board have at least four members that possess such knowledge of the sector. We currently meet this requirement (see also "Objectives of the Supervisory Board with respect to Its Composition and Profile of Skills and Expertise").

Board of Partners of E. Merck KG

Some of the responsibilities that lie with the supervisory board of a German stock corporation are fulfilled at Merck by E. Merck KG. This applies primarily to the Board of Partners of E. Merck KG. Therefore, the Board of Partners as well as the composition and procedures of its committees are described in the following.

The Board of Partners has nine members. In fiscal 2019 up to January 27, 2019, the Board of Partners was composed as follows:

Member	Memberships of (a) statutory supervisory boards and (b) comparable German and foreign supervisory bodies of corporations
Johannes Baillou Vienna, Austria, Vice Chairman of the Executive Board and General Partner of E. Merck KG, Chairman	No board positions
Frank Stangenberg-Haverkamp Darmstadt, Chairman of the Executive Board and General Partner of E. Merck KG, Vice Chairman	(b) – Fortas GmbH, Rösrath (Chairman) – Oras Invest Ltd, Helsinki, Finland – Travel Asset Group Ltd., London, United Kingdom (Chairman)
Wolfgang Büchele Römerberg, Chairman of Exyte AG, Stuttgart	(a) – Merck KGaA, Darmstadt – Gelita AG, Eberbach (Chairman) (b) – Kemira Oyj, Helsinki, Finland
Siegfried Karjetta Darmstadt, physician	(a) – Merck KGaA, Darmstadt
Albrecht Merck Schriesheim, Commercial Director of the Castel Peter Winery, Bad Dürkheim	(a) – Merck KGaA, Darmstadt
Helga Rübsamen-Schaeff Langenburg, Chairperson of the Advisory Board of AiCuris Antiinfective Cures GmbH, Wuppertal	(a) – Merck KGaA, Darmstadt – 4SC AG, Martinsried – Bonn University Hospital, Bonn
Gregor Schulz Umkirch, pediatrician	(a) – Merck KGaA, Darmstadt
Theo Siegert Düsseldorf, Managing Partner of de Haen Carstanjen & Söhne KG, Düsseldorf	(a) – Merck KGaA, Darmstadt – Henkel AG & Co. KGaA, Düsseldorf (b) – DKSH Holding Ltd., Zurich, Switzerland
Tobias Thelen Munich, Managing Partner of Altmann Analytik GmbH & Co. KG, Munich	(a) – Merck KGaA, Darmstadt

On January 27, 2019, a new election of the Board of Partners was held. Its composition is now as follows:

Member	Memberships of (a) statutory supervisory boards and (b) comparable German and foreign supervisory bodies of corporations
Johannes Baillou Vienna, Austria, Vice Chairman of the Executive Board and General Partner of E. Merck KG, Chairman	No board positions
Frank Stangenberg-Haverkamp Darmstadt, Chairman of the Executive Board and General Partner of E. Merck KG, Vice Chairman	(b) – Fortas GmbH, Rösrath (Chairman) – Oras Invest Ltd, Helsinki, Finland – Travel Asset Group Ltd., London, United Kingdom (Chairman)
Wolfgang Büchele Römerberg, Chairman of Exyte AG, Stuttgart	(a) – Merck KGaA, Darmstadt – Gelita AG, Eberbach (Chairman) (b) – Wegmann Unternehmens-Holding GmbH & Co. KG, Fürstenfeldbruck – Kemira Oyj, Helsinki, Finland
Helga Rübsamen-Schaeff Langenburg, Chairperson of the Advisory Board of AiCuris Antiinfective Cures GmbH, Wuppertal	(a) – Merck KGaA, Darmstadt – 4SC AG, Martinsried – Bonn University Hospital, Bonn
Michael Kleinemeier Heidelberg, Member of the Executive Board of SAP SE, Walldorf	No board positions
Katharina Kraft Mannheim, Senior Strategy Manager at BASF SE, Ludwigshafen	No board positions
Helene von Roeder Frankfurt am Main, Member of the Executive Board of Vonovia SE, Bochum	(b) – AVW Versicherungsmakler GmbH, Hamburg – Vonovia Finance B.V., Amsterdam, Netherlands – Victoria Park AB, Malmö, Sweden – Hembla AB, Stockholm, Sweden
Daniel Thelen Cologne, Head of Infrastructure Development for western region at DB Netz AG, Frankfurt am Main	No board positions
Simon Thelen Cologne, Chief Physician for Hand Surgery at the Clinic for Trauma and Hand Surgery, University Hospital Düsseldorf	(a) – Merck Healthcare KGaA

The Board of Partners supervises the Executive Board in its management of the company. It informs itself about the business matters of Merck KGaA and may inspect and examine the company's accounts, other business documents, and assets for this purpose. According to article 13 (4) of the Articles of Association of Merck KGaA, the Executive Board requires the approval of E. Merck KG for transactions that are beyond the scope of the Group's ordinary business activities. For such transactions, approval must first be obtained from the Board of Partners of E. Merck KG. The Board of Partners convenes as and when necessary; however, it normally meets four times a year. The members of the Executive Board of Merck KGaA are invited to all meetings of the Board of Partners, unless the Board of Partners resolves otherwise in individual cases. The members of the Board of Partners may convene a joint meeting with the Supervisory Board of Merck KGaA if so agreed by the chairpersons of the two boards.

The Board of Partners may delegate the performance of individual duties to committees. Currently, the Board of Partners has three committees in place: the Personnel Committee, the Finance Committee, and the Research and Development Committee.

Personnel Committee

The Personnel Committee has four members: Johannes Baillou (Chair), Wolfgang Büchele, Michael Kleinemeier, and Frank StangenbergHaverkamp. The Personnel Committee meets at least twice a year. Further meetings are convened as and when necessary. Meetings of the Personnel Committee are attended by the Chairman of the Executive Board of Merck KGaA unless the Committee decides otherwise. The Personnel Committee is responsible for, among other things, the following decisions concerning members and former members of the Executive Board: contents of and entry into employment contracts and pension contracts; granting of loans and advance payments; changes to the compensation structure and adaptation of compensation; approval for taking on honorary offices, board positions, and other sideline activities; and division of responsibilities within the Executive Board

of Merck KGaA. The Personnel Committee passes its resolutions by a simple majority; in matters concerning the Chairman of the Executive Board, unanimity is required. The Chairman of the Committee regularly informs the Board of Partners of its activities.

Finance Committee

The Finance Committee has four members: Helene von Roeder (Chair), Johannes Baillou, Wolfgang Büchele, and Daniel Thelen. The Finance Committee holds at least four meetings a year, at least one of which is a joint meeting with the auditor of Merck KGaA. Further meetings are convened as and when necessary. Meetings of the Finance Committee are attended by the Chief Financial Officer of Merck KGaA. Other members of the Executive Board of Merck KGaA may attend the meetings upon request of the Finance Committee. These meetings regularly include the Chairman of the Executive Board. The Finance Committee is responsible for, among other things, analyzing and discussing the annual financial statements, the consolidated financial statements, and the respective reports of the auditor, as well as the half-year financial report (including the report of the auditors for the audit review of the abridged financial statements and interim management report contained in the half-year report) and the quarterly statements. The Finance Committee also reviews the performance of the auditing firm, particularly the auditor in charge of the engagement. Moreover, the Finance Committee recommends to the Chairman of the Supervisory Board annual audit focuses for the auditors of the annual financial statements. It also recommends to the Supervisory Board an auditor for the annual financial statements as well as auditors for the audit review of the abridged financial statements and interim management report contained in the half-year financial report for the Supervisory Board's corresponding suggestion to the General Meeting. In addition, the Finance Committee is concerned with the net assets, financial position, results of operations, and liquidity of Merck, as well as accounting, internal auditing, risk management, and compliance issues. Upon request of the Board of Partners, the Finance Committee examines investment projects that must be approved by the Board of Partners and provides recommendations pertaining thereto. It passes its resolutions with a simple majority. The Committee Chairman regularly informs the Board of Partners of the activities of the Finance Committee.

Research and Development Committee

The Research and Development Committee has four members: Helga RübsamenSchaeff (Chair), Johannes Baillou, Katharina Kraft, and Simon Thelen. The Research and Development Committee is convened as and when necessary, but holds at least two meetings a year. Meetings of the Research and Development Committee are attended by members of the Executive Board of Merck KGaA upon request of the Committee. These meetings regularly include the Chairman of the Executive Board as well as the CEO Healthcare, the CEO Life Science, and the CEO Performance Materials. The Research and Development Committee is responsible, among other things, for reviewing and discussing the research activities of the Healthcare and Life Science/Performance Materials business sectors. It passes its resolutions with a simple majority. The Chairperson of the Committee reports to the Board of Partners on the insights gained from the meetings held.

Stipulations to promote the percentage of management positions held by women pursuant to section 76 (4) and section 111 (5) of the German Stock Corporation Act (AktG)

Stipulations pursuant to section 76 (4) AktG (target for the percentage of positions held by women on the two upper management levels below the Executive Board)

We foster diversity within the company, which also includes ensuring a balance of genders in management. To this end, we pursue both voluntary and statutory objectives, and we work continuously and sustainably on achieving them. On December 15, 2016, the Executive Board of Merck KGaA set the new targets for the percentage of positions held by women on the two management levels of Merck KGaA below the Executive Board as follows:

- First management level of Merck KGaA below the Executive Board: 21% of positions held by women
- Second management level of Merck KGaA below the Executive Board: 26% of positions held by women

The deadline set for reaching the new targets is December 31, 2021. The first management level comprises all managers of Merck KGaA with a direct reporting line to the Executive Board of Merck KGaA or who belong to the global executive group. The second

management level comprises all managers of Merck KGaA who report to managers with a direct reporting line to the Executive Board of Merck KGaA or the global executive group. In addition, as a global company with correspondingly aligned global (leadership) structures, Merck continues to pursue a (voluntary) global target of maintaining the proportion of leadership positions held by women (managers, experts, and project managers in roles 4 and above)[1] at a stable level of 30% in the period until 2021.

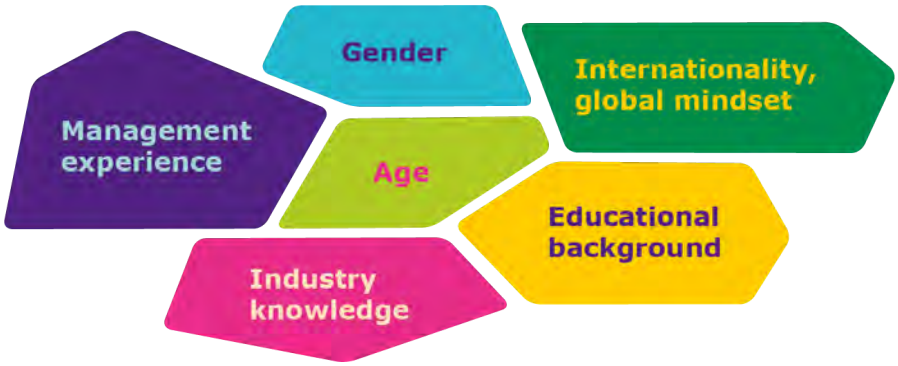
Stipulations pursuant to section 111 (5) AktG (target for the percentage of positions on the Supervisory Board held by women)

Pursuant to section 111 (5) AktG, the Supervisory Board of companies that are listed or subject to co-determination stipulates binding targets for the percentage of positions on the Supervisory Board and on the Management Board held by women. However, for Merck KGaA, stipulations pursuant to section 111 (5) AktG need not be set for the following reasons: the statutory target of 30% pursuant to section 96 (2) AktG is already applied to the Supervisory Board of Merck KGaA; this eliminates the obligation to stipulate a further target for the percentage of positions held by women on the Supervisory Board (see section 111 (5) sentence 5 AktG). The obligation to stipulate a target for the percentage of positions held by women on the Management Board pursuant to section 111 (5) AktG is not applicable to the legal form of a corporation with general partners (Kommanditgesellschaft auf Aktien), as a corporation with general partners neither has a management board comparable to that of a stock corporation, nor does the Supervisory Board have personnel authority over the Executive Board. Instead, the Executive Board of Merck KGaA consists of personally liable general partners (see also the description of Supervisory Board procedures).

Diversity policy pursuant to section 289f (2) No. 6 of the German Commercial Code (HGB)

Merck is pursuing a Group-wide, global diversity program. At Merck, diversity stands for a culture of inclusion, mutual esteem, and respect. To demonstrate this open and dynamic company culture, we promote diversity throughout the Group – and do so at all levels, including the Executive Board and Supervisory Board.

We believe that a diverse workforce boosts the innovative strength of the Merck Group and contributes materially to our business success. That is why we are furthering a culture of diversity independent of age, gender, disability, ethnic or cultural background, religion, industry experience, and educational background. The diversity policy to strategically steer the topics of diversity and inclusion at Merck thus focuses on the following key criteria:



Our Group-wide diversity policy encompasses both voluntary as well as legally defined objectives that we continuously and sustainably work to achieve. In this context, it should be noted that with respect to the Executive Board of Merck KGaA, many rules can only be applied correspondingly. This is because the Executive Board comprises personally liable general partners of Merck KGaA and is not a management board with employed members of a corporate body (for details, please also see the "Joint Report of the Executive Board and the Supervisory Board").

In addition to the aspects presented in the following, reference is made to the objectives of the Supervisory Board with respect to its composition and the profile of skills and expertise of the Supervisory Board (see the information on the "Objectives of the Supervisory Board with respect to its composition and profile of skills and expertise"). The statements made there are part of the diversity policy for the Supervisory Board presented here.

Age

Our boards are to have a balanced age structure. This permits future-oriented and consistent succession planning and is a key element of sustainable company management and monitoring. Our diversity policy aims for an age range of at least ten years between the youngest and the oldest member of the respective board.

In their current composition, both boards meet this objective. The age range of the Executive Board is 15 years; that of the Supervisory Board is 30 years. In addition, maximum age limits apply to both boards: for the Supervisory Board please see the information regarding the "Objectives of the Supervisory Board with respect to its composition, and profile of skills and expertise"; for Executive Board members, a maximum age of 70 applies.

Gender

Gender diversity also plays a crucial role since it enables us to benefit from a larger talent pool, and allows us as a company to develop a better understanding of important customer groups. We have set ourselves the (global) strategic objective of maintaining the proportion of women in leadership positions (managers, experts, and project managers in role 4 and higher)[1] at a stable level of 30% by 2021 (please also refer to the description under "Diversity and Management").

Additionally, Merck continues to pursue representation of both genders as an objective for the Executive Board. With Ms. Belén Garijo as CEO Healthcare, a woman is currently responsible for a business sector at Merck that contributed 42% to our Group sales in 2019. The statutory target of 30% pursuant to section 96 (2) AktG is already applied to the Supervisory Board of Merck KGaA. We consider further targets to be dispensable here.

Internationality and global mindset

As a science and technology company with global operations and major markets on five continents with around 56,000 employees at locations in 66 countries[2], internationality and the associated global mindset is one of our key success factors. According to our diversity policy, the Executive Board's internationality derives from leadership experience or national origin, relative to our key sales markets or those locations that are organizationally and culturally relevant to our employee development efforts. For both criteria, Europe, North America, and Asia-Pacific are currently the key regions. The Executive Board meets this objective with management experience in the named regions, for instance in the following countries: France, Spain, Switzerland, the United States, Singapore, Malaysia, and Australia. More than one-third of the Executive Board members are not German citizens.

Management experience

The key prerequisites for high-performance leadership teams are both the diversity of the individual competency profiles and a balance between a Group-internal and external management perspective. Therefore, as a whole the Executive Board must have in-depth knowledge and experience in the following key areas of importance to the company: strategy and planning, finance and accounting, sales and operations, human resources, and legal and compliance, as well as information technology. In addition, for the composition of the Executive Board it is important to ensure a good balance of members from within and outside the company. Our diversity policy seeks to derive inspiration and innovation from outside the company and to identify the latest trends of relevance to the core businesses of the company, while ensuring sustainability and continuity in line with our corporate culture. We have therefore set ourselves the global objective of filling two-thirds of our leadership positions with candidates from within the company.

The current Executive Board fulfills both of the aforementioned objectives: all required aspects of the competency profile are covered by at least one member of the Executive Board. Likewise, three members of the Executive Board possess multiple years of experience working within the Merck Group prior to their appointment to the Executive Board.

[1] Merck also has employees at sites that are not fully consolidated subsidiaries. These figures refer to all people directly employed by Merck and therefore may deviate from figures in the financial section of this report.

[2] Each country with at least one active employee is considered one country.

Industry experience

To efficiently lead and manage the Group, the Executive Board must have in-depth knowledge of the key industries and business sectors that the company operates in. In accordance with the diversity policy, there should be at least one member of the Executive Board with in-depth expertise of Healthcare, Life Science, or Performance Materials, respectively.

Currently, the Executive Board has the full breadth of the sector-specific experience required.

Educational background

In order to translate the tremendous innovative potential of a science and technology company into sustainable business success, interdisciplinary educational backgrounds are a key element of our diversity policy both for the Executive Board and for the Supervisory Board. The current composition of both boards illustrates this interdisciplinary aspect to a very high degree.

The members of the Executive Board contribute knowledge of various fields including veterinary medicine, economic sciences, medicine (pharmacology), chemistry, and information technology. In addition, all members of the Executive Board hold a university degree and a doctorate from a German or foreign university.

Moreover, the members of the Supervisory Board have a background in one or more of the following fields of specialization: chemistry, biochemistry, pharmaceutics, mathematics, law, human medicine, business administration and economics, physics, education, and computer sciences, among others.

Seven Supervisory Board members are university graduates and hold doctorates.

Report of the Supervisory Board

The Supervisory Board again properly executed its duties in 2019 in accordance with the law as well as the company's Articles of Association and rules of procedure. In particular, the Supervisory Board monitored the work of the Executive Board diligently and regularly.

Cooperation with the Executive Board

The cooperation with the Executive Board was characterized by intensive, trustworthy exchange. During fiscal 2019, the Executive Board provided the Supervisory Board with regular written and verbal reports on the business development of Merck KGaA and the Merck Group. In particular, the Supervisory Board was informed about the market and sales situation of the company against the background of macroeconomic development, and the financial position of the company and its subsidiaries, along with their earnings development and corporate planning. Within the scope of quarterly reporting, the sales and operating results were presented for the Merck Group as a whole, and broken down by business sector. Aside from the Supervisory Board meetings, the Chairman of the Supervisory Board also maintained, and continues to maintain, a regular exchange of information with the Chairman of the Executive Board.

Key topics of the Supervisory Board meetings

Four Supervisory Board meetings were held in fiscal 2019. At these meetings, the Supervisory Board intensely discussed the reports of the Executive Board as well as, together with the Executive Board, company developments and strategic issues.

At the meeting held on February 26, 2019, the Executive Board first intensively addressed the annual financial statements and consolidated financial statements for 2018, the combined management report, the audit report of the auditor on the separate non-financial (Group) report for fiscal 2018, and the proposal for the appropriation of the net retained profit. The auditor explained the audit reports including the focus areas of the audit. The Executive Board and the Head of Accounting reported on the financial statements. Furthermore, the Supervisory Board resolved upon the report and the objectives of the Supervisory Board with respect to its composition and the profile of skills and expertise, the Declaration of Conformity with the German Corporate Governance Code, and the Statement on Corporate Governance, which simultaneously includes the joint report on Corporate Governance of the Executive Board and Supervisory Board. The Supervisory Board also approved the proposals to be made to the Annual General Meeting including the proposals for electing new Supervisory Board members. The Executive Board reported on business performance in 2018 and presented the plans for fiscal 2019.

The Supervisory Board also took note of the written risk report as well as the report from Group Internal Auditing for 2018. In addition, the Supervisory Board discussed the mandatory change of auditor and resolved to prepare the public request for tender.

The meeting held on May 9, 2019, focused on current business developments in the first quarter of 2019 and the acquisition of Versum Materials. The report of the Research and Development Committee of the Board of Partners of E. Merck KG for Life Science/Performance Materials was a further focus of the meeting. The Supervisory Board also dealt with the Compliance and Data Protection Report for 2018.

At its meeting on July 31, 2019, the Supervisory Board focused intensively on the report of the Executive Board on business performance in the second quarter of 2019. In addition, the auditor explained the half-year financial report. Risk management within the company was a further topic. The Head of Risk Management presented the status report for the first half of 2019. No risks that could threaten the continued existence of the company were identified. Moreover, the list of permitted non-audit services was updated and an external audit of the non-financial declaration was resolved upon. The Executive Board also reported on the status of the "Tolso" project, a restructuring project in the Life Science business sector.

At its fourth meeting on November 8, 2019, the Supervisory Board dealt with the report of the Executive Board on the third quarter of 2019. Additional topics of focus were the 2019 status reports of Group Internal Auditing, status reports on compliance and data

protection, and the report of the Research and Development Committee for Healthcare. Furthermore, the Group Executive Conference and the strategy of the Performance Materials business sector were discussed. A resolution on preparing for the mandatory change of auditor for Merck KGaA for fiscal 2023 audit was adopted.

Annual financial statements

The annual financial statements of Merck KGaA, the consolidated financial statements of the Merck Group, and the combined management report for Merck KGaA and the Merck Group, including the accounts, were audited by KPMG AG Wirtschaftsprüfungsgesellschaft, Berlin.

The auditors issued an unqualified audit opinion on the annual financial statements of Merck KGaA in accordance with German Auditing Standards. The audit opinion for the annual financial statements contained the following key audit matters, i.e. those matters that, in the professional judgment of the auditor, were of most significance in the audit of the annual financial statements:

- Impairment testing of interests in associates
- Recognition and measurement of provisions for tax liabilities
- Balance sheet effects of the termination of the business lease agreement with Merck Healthcare KGaA

For the consolidated financial statements prepared in accordance with International Financial Reporting Standards and for the combined management report, the auditors issued the unqualified auditor's report reproduced in the Annual Report of the Merck Group. The audit opinion for the consolidated financial statements contained the following audit topics of special importance:

- The acquisition of Versum Materials Inc.
- Recognition and measurement of income tax liabilities and deferred tax liabilities
- Goodwill impairment tests

In addition, the auditor audited the calculation of Merck KGaA's participation in the profit of E. Merck KG in accordance with article 27 (2) of the Articles of Association, as well as the separate combined non-financial (Group) report. The annual financial statements of Merck KGaA, the consolidated financial statements of the Merck Group, the combined management report for Merck KGaA and the Merck Group, the proposal of the Executive Board for the appropriation of net retained profit, and the separate combined non-financial (Group) report were submitted to the Supervisory Board together with the auditor's report.

In accordance with article 14 (2) of the Articles of Association, the Supervisory Board also examined the annual financial statements of Merck KGaA, the proposal for the appropriation of net retained profit, and the auditor's report presented in accordance with article 27 (2) of the Articles of Association.

It also examined the consolidated financial statements of the Merck Group as well as the combined management report for Merck KGaA and the Merck Group, and took note of the auditor's report of KPMG AG Wirtschaftsprüfungsgesellschaft, Berlin. It focused particularly on the aforementioned key audit matters of particular importance in the audit opinion, on the resulting risks for the financial statements, the approach adopted during the audit as described, and the conclusions drawn by the auditor. Furthermore, the Supervisory Board also examined the separate combined non-financial (Group) report and the memorandum on a limited assurance engagement prepared by the auditor on behalf of the Supervisory Board. The discussion of the relevant agenda item at the Supervisory Board's meeting on February 28, 2020, as well as at the meeting on May 13, 2020 to approve the financial statements was also attended by the auditors who sign the audit opinion on the annual financial statements of Merck KGaA and the consolidated financial statements of the Merck Group as well as the separate combined non-financial (Group) report. Furthermore, at this meeting, the auditors reported on their audit. The Supervisory Board took note of and approved the results of the audit. On completion of its examination, the Supervisory Board raised no objections and thus approved the annual financial statements for Merck KGaA, the consolidated financial statements of the Merck Group, the combined management report of Merck KGaA and the Merck Group prepared by the Executive Board, the report presented by the auditor in accordance with article 27 (2) of the Articles of Association, and the separate non-financial (Group) report. The Supervisory Board gave its consent to the proposal of the Executive Board for the appropriation of net retained profit after conducting its own review.

Corporate governance and Declaration of Conformity

Corporate governance is a topic of high priority for the Supervisory Board. In its own estimation, the Supervisory Board has an adequate number of independent members. There were no conflicts of interest, as defined by the German Corporate Governance Code, involving Supervisory Board members during the year under review. In fiscal 2019, the Chairman of the Supervisory Board was prepared to hold talks with investors on topics pertaining to the Supervisory Board as appropriate, and remains willing to do so. The Supervisory Board will carry out its next self-assessment in fiscal 2020 on account of this year's election and resulting new composition of the Supervisory Board.

After discussing corporate governance issues in detail, the Executive Board and the Supervisory Board on February 3, 2020 adopted the updated Declaration of Conformity and issued it jointly on February 3, 2020, in accordance with section 161 AktG. The statement is permanently available on the website of Merck KGaA (www.merckgroup.com/en/investors/corporate-governance/reports.html). More information about corporate governance at Merck KGaA, including the compensation of the Executive Board and Supervisory Board, is given in the Statement on Corporate Governance of the Annual Report.

Committees

Apart from the Nomination Committee, the Supervisory Board of Merck KGaA currently has no further committees on account of the special features that apply to the Supervisory Board of a corporation with general partners (KGaA) under German company law, and because a corresponding need for this has not emerged to date. The members of the Nomination Committee, which existed until April 26, 2019, did not convene in fiscal 2019. No report is required on the work of other committees.

Personnel matters

With the exception of Helga Rübsamen-Schaeff, who was excused and absent from the meeting on May 9, 2019; Michael Kleinemeier, who was excused and absent from the meeting on May 9, 2019; and Anne Lange, who was excused and absent from the meeting on July 31, 2019, all Supervisory Board members attended all meetings of the Supervisory Board. The composition of the Supervisory Board changed as follows in 2019: Wolfgang Büchele, Michael Kleinemeier, Renate Koehler, Helene von Roeder, Helga Rübsamen-Schaeff, and Daniel Thelen were elected to the Supervisory Board as representatives of the limited liability shareholders by the Annual General Meeting on April 26, 2019. Peter Emanuel Merck and Simon Thelen were appointed to the Supervisory Board. Furthermore, Gabriele Eismann, Michael Fletterich, Edeltraud Glänzer, Jürgen Glaser, Sascha Held, Anne Lange, Dietmar Oeter, and Christian Raabe were elected to the Supervisory Board as employee representatives at the Delegates' Meeting on April 11, 2019, for a term starting at the end of the Annual General Meeting on April 26, 2019. The members of the Supervisory Board were inducted by Merck KGaA with onboarding activities and continuing education on topics such as corporate governance, the internal organization, and applicable regulations and legal requirements.

Darmstadt, February 28, 2020 / May 13, 2020

The Supervisory Board of Merck KGaA

Wolfgang Büchele

Chairman

Objectives of the Supervisory Board with respect to its Composition and Profile of Skills and Expertise

Initial situation

According to section 5.4.1 of the German Corporate Governance Code in the version dated February 7, 2017, the Supervisory Board shall specify concrete objectives regarding its composition as well as prepare a profile of skills and expertise for the entire board. Within the scope of the company-specific situation, the composition of the Supervisory Board shall appropriately reflect the international activities of the enterprise, potential conflicts of interest, the number of independent Supervisory Board members, an age limit to be specified for the members of the Supervisory Board, a regular limit to be specified for the length of Supervisory Board membership, and diversity.

General notes on the composition of the Supervisory Board

The Supervisory Board of Merck KGaA currently comprises 16 members, eight of whom represent the shareholders and a further eight who represent the employees. The eight employee representative members are elected by employee delegates pursuant to the provisions of the German Co-determination Act (Mitbestimmungsgesetz, MitbestG). These consist of six company employees, including a senior executive, as well as two union representatives. The Supervisory Board has no statutory proposal right with respect to electing the delegates or employee representatives. Two of the eight shareholder representatives are specified by a delegation right of E. Merck Beteiligungen KG. The Supervisory Board likewise has no statutory proposal right with respect to exercising this delegation right. The other six shareholder representatives are elected by the General Meeting. In accordance with section 124 (3) sentence 1 AktG, the Supervisory Board shall propose to the General Meeting Supervisory Board members for election. These proposals require a majority of the votes of the shareholder representative members of the Supervisory Board. The next scheduled election to the Supervisory Board shall take place at the 2024 Annual General Meeting. The General Meeting is not required to follow the election proposals. The appointment objectives and competency requirements that the Supervisory Board sets forth below therefore do not represent requirements to be met by those eligible to elect or to delegate members. Instead, they are intended to express the objectives pursued by the Supervisory Board in office with regard to its advisory and monitoring functions.

For the Supervisory Board of Merck KGaA, professional qualifications and personal expertise are the two most important prerequisites for appointments to seats on the Supervisory Board. When proposing Supervisory Board candidates for election or delegation, the Supervisory Board will always give top priority to these prerequisites, which are essential for fulfilling its legal duties. Overall, the Supervisory Board's policy is to optimally meet its monitoring and advisory duties by having diversity among its members. Diversity includes, in particular, internationality as well as different experience backgrounds and career paths. The proportion of women on the Supervisory Board is also considered to be an aspect of diversity. When preparing proposals for election or delegation to the Supervisory Board, the Supervisory Board shall consider in each case to what extent different, complementary specialist skills; professional and life experience; and an appropriate representation of both genders benefits the work of the Supervisory Board. Additionally, the Supervisory Board shall support the Executive Board in its efforts to increase diversity within the company.

Objectives of the Supervisory Board with respect to its composition

According to section 5.4.1 (2) of the German Corporate Governance Code in the version dated February 7, 2017, the Supervisory Board specified the following objectives regarding its composition, and reports below on their status of implementation.

Internationality

The Supervisory Board shall have at least three members with business experience in the main sales markets of Merck KGaA. Currently, the main sales markets of Merck KGaA are Europe, America, and Asia-Pacific. The present composition of the Supervisory Board satisfies this objective. More than three Supervisory Board members have entrepreneurial experience in a wide range of European countries. More than three Supervisory Board members have experience in management positions in companies that operate globally.

Women on the Supervisory Board

Six women are currently members of the Supervisory Board of Merck KGaA. Accordingly, women make up 37.5% of the Supervisory Board. When nominating candidates for election to the Supervisory Board or making proposals for delegations, the Supervisory Board shall examine whether the percentage of women can be increased by suitable candidates. The Supervisory Board considers the 37.5% share of female members to be satisfactory at the present time. This is due to the percentage of women in leadership positions at Merck and in consideration of the composition of the supervisory boards of other companies of comparable size.

Number of independent members, no material conflicts of interest

The Supervisory Board shall have an appropriate number of independent shareholder representatives as members. Assuming that the status of being an employee representative per se does not justify doubts with respect to the independence criteria within the meaning of section 5.4.2 of the German Corporate Governance Code, as a rule all employee representatives shall be independent within the meaning of the Code. In any case, at least four of the shareholder representatives on the Supervisory Board shall be independent. According to the Articles of Association of Merck KGaA, six members representing the shareholders are to be elected by the General Meeting, and two members are to be delegated. Taking this and the special ownership structure of Merck KGaA into account, the Supervisory Board considers four shareholder representatives to be an appropriate number of independent members. In the Supervisory Board's estimation, the objectives concerning independent members are met at the present time. The Supervisory Board considers the following members to be independent: Wolfgang Büchele, Michael Kleinemeier, Renate Koehler, Peter Emanuel Merck, Helene von Roeder, Helga Rübsamen-Schaeff, Daniel Thelen, Simon Thelen, Micheal Fletterich, Gabriele Eismann, Jürgen Glaser, Edeltraud Glänzer, Sascha Held, Anne Lange, Dietmar Oeter and Christian Raabe. In particular, the Supervisory Board does not believe that membership of the Board of Partners of E. Merck KG conflicts with independence. The Board of Partners exists complementary to the competencies and the activities of the Supervisory Board. It is not to be expected that this will lead to material and not merely temporary conflicts of interest. It should also be taken into account that due to its substantial capital investment and unlimited personal liability, E. Merck KG has a strong interest in the businesses of Merck KGaA operating efficiently and in compliance with procedures, counteracting from the outset conflicts of interest between E. Merck KG and Merck KGaA and thus also corresponding conflicts of interest between the members of the respective corporate boards. Moreover, no one shall be proposed for election to the Supervisory Board who simultaneously serves on a board of or advises a major competitor of the company, or who, owing to another function, such as advisor to major contract partners of the company, could potentially become involved in a conflict of interest. No Supervisory Board member serves on a board of or advises a major competitor. No Supervisory Board member performs a function that could lead to a lasting conflict of interest.

Age limit

As a rule, the members of the Supervisory Board shall not exceed the age of 75. This objective is met at the present time.

Regular limit on the length of Supervisory Board membership

The objective of the Supervisory Board regarding its composition is that, as a rule, all members belong to the board for an uninterrupted period of no more than 15 years (corresponding to three regular terms of office). With one exception, this objective is also met at the present time.

Profile of skills and expertise

Additionally, in accordance with section 5.4.1 (2) of the German Corporate Governance Code, the Supervisory Board has prepared a profile of skills and expertise and reports on the status of implementation below.

In-depth knowledge of the fields relevant to the company

The Supervisory Board shall have at least four members with in-depth knowledge of and experience in fields that are important to the company, including at least one expert for the Healthcare and Life Science/Performance Materials sectors, respectively. This requirement is met at the present time. At present, the Supervisory Board has more than four members who have in-depth knowledge of and experience in the Healthcare and Life Science/Performance Materials sectors. More than four Supervisory Board members also have executive experience in companies that also or specifically operate in the Healthcare and/or Life Science/Performance Materials sectors.

Management experience

The Supervisory Board shall have at least three members who have experience in managing or supervising a medium- or large-sized company. The Supervisory Board has more than three members who have the corresponding experience. They include supervisory board members who were or still are members of the management or executive board at relevant companies, as well as supervisory board members who have gained experience in supervisory bodies of German or foreign companies of this size.

Knowledge of business administration

The Supervisory Board shall have at least four members who have in-depth knowledge of business administration. This requirement is met at the present time.

Experience in other supervisory or control bodies

Lastly, the Supervisory Board shall have at least four members who have experience as members of other supervisory or control bodies (whereby possible membership of the Board of Partners of E. Merck KG is not taken into account). This requirement is also met at the present time.

CONSOLIDATED FINANCIAL STATEMENTS

Consolidated Income Statement[1]

€ million	Note	**2019**	2018
Net sales	11	**16,152**	**14,836**
Cost of sales	12	-6,006	-5,382
Gross profit		**10,145**	**9,454**
Marketing and selling expenses	13	-4,576	-4,396
Administration expenses		-1,154	-1,183
Research and development costs	14	-2,268	-2,227
Impairment losses and reversals of impairment losses on financial assets (net)	42	-8	27
Other operating income	15	715	627
Other operating expenses	16	-735	-575
Operating result (EBIT)[2]		**2,120**	**1,727**
Finance income	40	97	77
Finance costs	40	-481	-343
Profit before income tax		**1,735**	**1,461**
Income tax	17	-440	-368
Profit after tax from continuing operations		**1,296**	**1,093**
Profit after tax from discontinued operation	5	**28**	**2,303**
Profit after tax		**1,324**	**3,396**
thereof: attributable to Merck KGaA shareholders (net income)		1,320	3,374
thereof: attributable to non-controlling interests	34	3	22
Earnings per share (in €)	8		
Basic		3.04	7.76
from continuing operations		2.97	2.51
from discontinued operation		0.07	5.25
Diluted		3.04	7.76
from continuing operations		2.97	2.51
from discontinued operation		0.07	5.25

[1] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes".

[2] Not defined by International Financial Reporting Standards (IFRSs).

Consolidated Statement of Comprehensive Income

€ million	Note	2019	2018
Profit after tax		**1,324**	**3,396**
Items of other comprehensive income that will not be reclassified to profit or loss in subsequent periods			
Net defined benefit liability	32		
Changes in remeasurement		-488	-34
Tax effect		100	-7
Changes recognized in equity		**-388**	**-41**
Equity instruments			
Fair value adjustments		76	29
Tax effect		–	-1
Changes recognized in equity		**76**	**29**
		-312	**-13**
Items of other comprehensive income that may be reclassified to profit or loss in subsequent periods			
Debt instruments			
Fair value adjustments		–	1
Reclassification to profit or loss		–	–
Tax effect		–	–
Changes recognized in equity		**–**	**1**
Cash flow hedge reserve	39		
Fair value adjustments		-15	-71
Reclassification to profit or loss		-20	52
Reclassification to assets		60	–
Tax effect		-16	12
Changes recognized in equity		**9**	**-7**
Cost of cash flow hedge reserve	39		
Fair value adjustments		11	-47
Reclassification to profit or loss		-8	5
Reclassification to assets		21	–
Tax effect		-24	10
Changes recognized in equity		**–**	**-32**
Currency translation difference			
Changes taken directly to equity		349	626
Reclassification to profit or loss		-6	-7
Changes recognized in equity		**344**	**619**
		353	**581**
Other comprehensive income		**41**	**568**
Comprehensive income		**1,365**	**3,964**
thereof: attributable to Merck KGaA shareholders		1,359	3,943
thereof: attributable to non-controlling interests	34	6	22
Comprehensive income		**1,365**	**3,964**
thereof: from continuing operations		1,337	1,634
thereof: from discontinued operation		28	2,330

Consolidated Balance Sheet[1]

€ million	Note	**Dec. 31, 2019**	Dec. 31, 2018
Non-current assets			
Goodwill	18	17,141	13,764
Other intangible assets	19	9,175	7,237
Property, plant and equipment	20	6,213	4,811
Other non-current financial assets	36	738	656
Other non-current receivables	24	22	17
Other non-current non-financial assets	22	97	76
Deferred tax assets	17	1,421	1,091
		34,808	**27,652**
Current assets			
Inventories	23	3,342	2,764
Trade and other current receivables	24	3,488	3,226
Contract assets	25	156	52
Other current financial assets	36	57	29
Other current non-financial assets	22	591	536
Income tax receivables	17	589	460
Cash and cash equivalents	35	781	2,170
		9,003	**9,236**
Total assets		**43,811**	**36,888**
Total Equity	34		
Equity capital		565	565
Capital reserves		3,814	3,814
Retained earnings		11,507	11,192
Gains/losses recognized in equity		1,980	1,629
Equity attributable to Merck KGaA shareholders		**17,865**	**17,200**
Non-controlling interests		48	33
		17,914	**17,233**
Non-current liabilities			
Provisions for pensions and other post-employment benefits	32	2,957	2,336
Other non-current provisions	26	490	780
Non-current financial debt	37	8,644	6,681
Other non-current financial liabilities	38	43	33
Other non-current non-financial liabilities	28	93	19
Deferred tax liabilities	17	1,828	1,288
		14,056	**11,138**
Current liabilities			
Current provisions	26	933	600
Current financial debt	37	4,550	2,215
Other current financial liabilities	38	1,127	1,077
Trade and other current payables	29	2,054	1,766
Refund liabilities	11	565	472
Income tax liabilities	17	1,402	1,176
Other current non-financial liabilities	28	1,211	1,211
		11,842	**8,517**
Total equity and liabilities		**43,811**	**36,888**

[1] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes".

Consolidated Cash Flow Statement

€ million	Note	**2019**	2018
Profit after tax		**1,324**	**3,396**
Depreciation/amortization/impairment losses/reversals of impairment losses		1,944	1,812
Changes in inventories		-324	-172
Changes in trade accounts receivable		-47	-109
Changes in trade accounts payable/refund liabilities		201	104
Changes in provisions		153	199
Changes in other assets and liabilities		-391	-288
Neutralization of gains/losses on disposal of fixed assets and other disposals		-57	-2,733
Other non-cash income and expenses		53	11
Net cash flows from operating activities	9	**2,856**	**2,219**
thereof: from discontinued operation	5	–	24
Payments for investments in intangible assets		-208	-106
Proceeds from the disposal of intangible assets		23	67
Payments for investments in property, plant and equipment		-813	-910
Proceeds from the disposal of property, plant and equipment		31	31
Payments for investments in financial assets		-196	-75
Payments for acquisitions less acquired cash and cash equivalents (net)		-5,020	–
Proceeds from the disposal of other financial assets		140	55
Payments for the acquisition of non-financial assets		-500	–
Proceeds from the disposal of non-financial assets		501	–
Payments for the disposal of assets held for sale		-130	–
Proceeds from the disposal of assets held for sale less transferred cash and cash equivalents		20	3,129
Net cash flows from investing activities	10	**-6,153**	**2,191**
thereof: from discontinued operation	5	-129	3,042
Dividend payments to Merck KGaA shareholders		-162	-162
Dividend payments to non-controlling interests		-12	-13
Profit withdrawal by E. Merck KG		-515	-593
Proceeds from new borrowings of financial debt from E. Merck KG		406	375
Repayment of financial debt to E. Merck KG		-418	-319
Repayment of bonds		-1,290	-323
Proceeds from the issuance of bonds		3,482	–
Payments from new borrowings of other current and non-current financial debt		1,193	32
Repayment of other current and non-current financial debt		-782	-1,821
Net cash flows from financing activities	41	**1,902**	**-2,825**
thereof: from discontinued operation	5	–	5
Changes in cash and cash equivalents		**-1,395**	**1,586**
Changes in cash and cash equivalents due to currency translation		5	-5
Cash and cash equivalents as of January 1		2,170	589
Cash and cash equivalents as of December 31 (consolidated balance sheet)	35	**781**	**2,170**

Consolidated Statement of Changes in Equity

For details see Note (34) "Equity."

		Comprehensive income						
€ million	**Jan. 1, 2019**	Profit after tax	Gains/losses recognized in equity	Dividend payments	Profit transfer to/from E. Merck KG including changes in reserves	Transactions with no change of control	Change in scope of consolidation/Other	**Dec. 31, 2019**
Equity capital	**565**	**–**	**–**	**–**	**–**	**–**	**–**	**565**
General partner's equity	397	–	–	–	–	–	–	397
Subscribed capital	168	–	–	–	–	–	–	168
Capital reserves	**3,814**	**–**	**–**	**–**	**–**	**–**	**–**	**3,814**
Retained earnings	**11,192**	**1,320**	**-312**	**-162**	**-510**	**–**	**-21**	**11,507**
Retained earnings/ net retained profit	12,525	1,320	–	-162	-510	–	-16	13,158
Remeasurement of defined benefit plans	-1,340	–	-388	–	–	–	-2	-1,729
Fair value reserve for equity instruments	7	–	76	–	–	–	-4	79
Gains/losses recognized in equity	**1,629**	**–**	**350**	**–**	**–**	**–**	**–**	**1,980**
Fair value reserve for debt instruments	-1	–	–	–	–	–	–	-1
Cash flow hedge reserve	-128	–	9	–	–	–	–	-118
Cost of cash flow hedge reserve	-33	–	–	–	–	–	–	-33
Currency translation difference	1,790	–	341	–	–	–	–	2,131
Equity attributable to Merck KGaA shareholders	**17,200**	**1,320**	**39**	**-162**	**-510**	**–**	**-21**	**17,865**
Non-controlling interests	33	3	2	-12	–	–	21	48
Total equity	**17,233**	**1,324**	**41**	**-173**	**-510**	**–**	**–**	**17,914**

€ million	**Jan. 1, 2018**	**Comprehensive income** Profit after tax	Gains/losses recognized in equity	Dividend payments	Profit transfer to/from E. Merck KG including changes in reserves	Transactions with no change of control	Changes in scope of consolidation/other	**Dec. 31, 2018**
Equity capital	**565**	**–**	**–**	**–**	**–**	**–**	**–**	**565**
General partner's equity	397	–	–	–	–	–	–	397
Subscribed capital	168	–	–	–	–	–	–	168
Capital reserves	**3,814**	**–**	**–**	**–**	**–**	**–**	**–**	**3,814**
Retained earnings	**8,566**	**3,374**	**-12**	**-162**	**-515**	**-55**	**-3**	**11,192**
Retained earnings/net retained profit	9,930	3,374	–	-162	-515	-55	-46	12,525
Remeasurement of defined benefit plans	-1,358	–	-41	–	–	–	59	-1,340
Fair value reserve for equity instruments	-6	–	29	–	–	–	-16	7
Gains/losses recognized in equity	**1,048**	**–**	**581**	**–**	**–**	**–**	**–**	**1,629**
Fair value reserve for debt instruments	-1	–	–	–	–	–	–	-1
Cash flow hedge reserve	-121	–	-7	–	–	–	–	-128
Cost of cash flow hedge reserve	-1	–	-32	–	–	–	–	-33
Currency translation difference	1,171	–	619	–	–	–	–	1,790
Equity attributable to Merck KGaA shareholders	**13,992**	**3,374**	**569**	**-162**	**-515**	**-55**	**-3**	**17,200**
Non-controlling interests	63	22	-1	-13	–	55	-93	33
Total equity	**14,055**	**3,396**	**568**	**-175**	**-515**	**–**	**-96**	**17,233**

Notes to the Consolidated Financial Statements[1]

General Disclosures

(1) Company information

The accompanying consolidated financial statements for the year ended December 31, 2019, were prepared for MERCK Kommanditgesellschaft auf Aktien (Merck KGaA), Darmstadt, registered under HRB 6164 with the Commercial Register of Darmstadt. The ultimate parent company of the Group is the parent company of Merck KGaA, E. Merck Kommanditgesellschaft (E. Merck KG), Darmstadt. The consolidated financial statements of E. Merck KG can be accessed at www.bundesanzeiger.de.

(2) Reporting principles

These consolidated financial statements have been prepared in accordance with the International Financial Reporting Standards (IFRS and IAS) in force on the reporting date as issued by the International Accounting Standards Board (IASB) and announcements by the IFRS Interpretations Committee (IFRIC and SIC) and as adopted by the European Union, as well as the additionally applicable provisions of section 315e of the German Commercial Code (HGB). The fiscal year corresponds to the calendar year. These financial statements have been prepared in euros, the reporting currency. The figures reported in the consolidated financial statements have been rounded, which may lead to individual values not adding up to the totals presented.

The accounting and measurement policies used in the consolidated financial statements are presented in the following Notes and are marked there.

Regulations binding for the first time as of fiscal 2019 and other presentation changes

The following regulations are binding as of fiscal 2019:

- IFRS 16 "Leases"
- IFRIC 23 "Uncertainty over Income Tax Treatments"
- Amendment to IAS 19 "Employee Benefits"
- Amendment to IAS 28 "Investments in Associates and Joint Ventures"
- Amendment to IFRS 9 "Financial Instruments"
- Annual Improvements to IFRSs 2015–2017 Cycle

Please refer to Note (45) "Effects from new accounting standards and other presentation changes" for further details on first-time application effects of IFRS 16. Other presentation changes affecting the presentation of functional costs in the consolidated income statement and the consolidated balance sheet classification are described there.

The first-time application of IFRIC 23 did not have an impact on the consolidated financial statements because the accounting of uncertainties over income tax already corresponded to this provision in terms of both measurement and presentation.

[1] Owing to the impact of the Covid-19 pandemic, Note (4) Subsequent Events and Note (50) Information on preparation and approval have been supplemented accordingly.

The other new regulations applicable for the first time in fiscal 2019 did not have a material impact on the consolidated financial statements.

Regulations binding as of fiscal 2020

The following regulations are binding as of fiscal 2020:

- Amendment to IAS 1 "Presentation of Financial Statements"
- Amendment to IAS 8 "Accounting Policies, Changes in Accounting Estimates and Errors"
- Amendment to IAS 39 "Financial Instruments: Recognition and Measurement"
- Amendment to IFRS 7 "Financial Instruments: Disclosures"
- Amendment to IFRS 9 "Financial Instruments"
- Amendments to References in the Conceptual Framework in International Financial Reporting Standards

We did not opt for early application of any of these standards. These regulations are not expected to have a material effect on the consolidated financial statements.

Standards published but not yet endorsed by the European Union

As of the balance sheet date, the following standards were published by the International Accounting Standards Board, but not yet endorsed by the European Union:

- IFRS 17 "Insurance Contracts"
- Amendment to IFRS 3 "Business Combinations"

From today's perspective, the new rules, if endorsed, are not expected to have any material effects on the consolidated financial statements.

Accounting and measurement policies – currency translation

Functional currency
To a predominant extent, the subsidiaries of Merck KGaA conduct their business independently so that the functional currency is normally the respective local currency.
Some subsidiaries, particularly in the Performance Materials business sector, use the U.S. dollar as a functional currency in deviation from the local currency.

Transactions in non-functional currency
When the financial statements of consolidated companies are prepared, business transactions that are conducted in currencies other than the functional currency are translated using the exchange rate on the date of the transaction.

Translation of financial statements into the reporting currency (euro)
The financial statements of consolidated companies prepared in foreign currencies are translated into the reporting currency, euros. In this process, assets and liabilities are measured at the closing rate, and income and expenses are measured at average rates. Any currency translation differences arising during consolidation of Group companies are recognized in equity.

Hyperinflation
Argentina's economy has been classified as hyperinflationary in accordance with IAS 29 "Financial Reporting in Hyperinflationary Economies". Accordingly, Merck's business activities in Argentina are no longer disclosed at historical cost but are presented adjusted for inflation. For this purpose, Merck uses a combination of the wholesale index IPIM (Índice de precios internos al por mayor) and the consumer price index IPC (Índice de precios al consumidor). The index applied as of the balance sheet date stood at 3,722.0 (December 31, 2018: 2,462.1 / January 1, 2018: 1,656.6).

Exchange rates of most significant currencies
The exchange rates of the most significant currencies in these consolidated financial statements were as follows:

	Average rate		Closing rate	
€1 =	**2019**	2018	**Dec. 31, 2019**	Dec. 31, 2018
Chinese renminbi (CNY)	7.740	7.815	7.803	7.869
Japanese yen (JPY)	122.314	130.372	121.765	126.131
Swiss franc (CHF)	1.112	1.153	1.086	1.128
South Korean won (KRW)	1,300.959	1,294.331	1,295.177	1,271.164
Taiwan dollar (TWD)	34.578	35.544	33.608	34.958
U.S. dollar (USD)	1.121	1.181	1.121	1.144

(3) Discretionary decisions and sources of estimation uncertainty

The preparation of the consolidated financial statements requires Merck to make discretionary decisions and assumptions as well as estimates to a certain extent. The discretionary scope and estimation uncertainty are assessed in a Merck-specific manner. For example, significant discretion exists if extensive assumptions have to be made as part of the recognition or measurement of accounting matters. Estimation uncertainty is measured by the reliability and availability of historical experience and external data. The accounting matters with the most significant discretionary decisions, and the most comprehensive assumptions relating to the future and sources of estimation uncertainty, are described below:

Accounting matter	**Carrying amount as of Dec. 31, 2019 in € million**	IFRSs	Discretionary scope/estimation uncertainty	Sensitivity analysis	Note
Goodwill	17,141			yes	18
Determination of recoverable amount		IAS 36	high		
Other intangible assets	9,175			yes	5, 19
Identification and measurement of intangible assets within the scope of business combinations		IFRS 3	high	yes	
In-licensing of intangible assets		IAS 38	medium		
Determination of amortization		IAS 38	medium		
Identification of impairments or reversal of impairments		IAS 36	medium		
Property, plant and equipment	6,213			no	20
Determination of depreciation		IAS 16	medium		
Identification of impairments or reversal of impairments		IAS 36	medium		
Leases					21
Recognition and measurement of lease arrangements	557	IFRS 16	medium	yes	
Inventories	3,342			no	23
Identification of impairments or reversal of impairments		IAS 2	medium		
Trade and other receivables	3,488			yes	24, 42
Determination of loss allowance		IFRS 9	medium		
Other financial assets				yes	36, 43
Determination of fair values of contingent considerations	258	IFRS 13	high		
Determination of fair values of equity instruments	399	IFRS 9, IFRS 13	medium		
Provisions for pensions and other post-employment benefits				yes	32
Determination of present value of defined-benefit obligations	-5,644	IAS 19	medium		
Other provisions and contingent liabilities	-1,424			no	26, 27, 33
Recognition and measurement of other provisions and contingent liabilities		IAS 37	high		
Determination of fair values of share-based payment programs		IFRS 2	medium		
Collaboration agreements				yes	6
Classification of joint arrangements		IFRS 11	medium		
Revenue recognition for upfront and milestone payments in collaboration agreements		–	medium		
Revenue recognition				no	11
Measurement of sales deductions and refund liabilities	-565	IFRS 15	medium		
Income tax				no	17
Recognition and measurement of income tax liabilities	-1,402	IAS 12	high		
Recognition and measurement of deferred taxes from temporary differences		IAS 12	medium		
Recognition of deferred tax assets from tax loss carryforwards	27	IAS 12	high		
Assets held for sale				no	5
Date on which assets and liabilities are classified as "held for sale"		IFRS 5	medium		

(4) Subsequent events

Subsequent to the balance sheet date, no events of special importance occurred that could have a material impact on the net assets, financial position or results of operations.

Addendum dated May 12, 2020

These consolidated financial statements were originally prepared on February 14, 2020 by the Executive Board of Merck KGaA. The rapid development of Covid-19 into a global pandemic implies the following consequences for the net assets, financial position and results of operations of the Merck Group, which were not expected based on the information available on the date of preparation, namely February 14, 2020.

As a result of the Covid-19 pandemic, the net assets, financial position and results of operations could be lowered in the remainder of fiscal 2020 particularly as a result of the absence of customer orders, temporary plant closures and supply chain restrictions. In addition, deteriorations in the credit ratings of customers triggered by the Covid-19 pandemic could make it necessary to increase the allowances for trade receivables. Additional burdens stemming from the Covid-19 pandemic could also result from necessary impairments of non-financial assets as well as the deterioration of refinancing conditions in the capital market.

The aforementioned developments presented as an addendum to the financial statements prepared on February 14, 2020 have led to corresponding changes to the Report on Risks and Opportunities as well as on the Report on Expected Development that were made in the relevant chapters of the combined management report and accordingly identified as subsequent changes. The annual financial statements of Merck KGaA were changed on May 12, 2020 owing to the aforementioned impacts of the Covid-19 pandemic since these developments represent a transaction of particular significance which is to be classified as a value-relevant event within the meaning of section 285 No. 33 of the German Commercial Code (HGB). The adaptation of the combined management report gave rise to these consolidated financial statements.

Group Structure

(5) Acquisitions and divestments

ACCOUNTING AND MEASUREMENT POLICIES – BUSINESS COMBINATIONS

The balance sheet items intangible assets and deferred taxes are significantly influenced by purchase price allocations within the scope of business combinations. Because prices observable on the market are mostly not available for the acquired intangible assets, a valuation using inputs observable in the market is usually performed. For all material company acquisitions, Merck relies on the expertise of external professionals. The following overview shows the methods routinely used to measure intangible assets within the scope of purchase price allocations:

	Measurement method for determining fair value
Customer relationships	Multi period excess earnings method
Technology	Relief from royalty method
Trademark	Relief from royalty method

Results from foreign currency hedging of expected business combinations, if they meet the requirements for hedge accounting, are offset against the carrying value of the net assets acquired.

SIGNIFICANT DISCRETIONARY DECISIONS AND SOURCES OF ESTIMATION UNCERTAINTY – BUSINESS COMBINATIONS

The recognition and measurement of assets, liabilities, and contingent liabilities at fair value within the context of purchase price allocations are associated with significant estimation uncertainty.

In particular, estimation uncertainty and discretionary decisions exist regarding:

- the customer churn rate, which indicates how existing customer relationships will change in the future,
- the license rate for technologies, which estimates royalty savings on the basis of comparable transactions of similar technologies,
- the discount factor, which is applied for maturity- and risk-based discounting of expected cash inflows,
- the useful life and the degree of technical obsolescence which depend, among other things, on assumptions about technological trends.

The most important acquisition in fiscal 2019 was Versum Materials, Inc., United States, (Versum). Customer relationships represent the largest intangible asset in terms of value. For their measurement, assumptions, particularly concerning the customer attrition rate and thus their useful life, had to be made. If the customer retention period were one year longer, the fair value of customer relationships recognized as part of intangible assets would be € 44 million higher on the date of their acquisition. A shortening of the retention period by one year would reduce the fair value of customer relationships by € 46 million.

Acquisitions in 2019

Acquisition of Versum Materials, Inc., United States

On April 12, 2019, Merck announced the conclusion of a final agreement to acquire all issued and outstanding shares of Versum for US$53 per share in cash. The transaction closed on October 7, 2019. Its completion followed previous approvals issued by the relevant authorities, the approval of the shareholders of Versum and the fulfillment of other customary closing conditions.

Versum's business activities

Versum is one of the world's leading providers of process chemicals, gases, and equipment for semiconductor manufacturing. In fiscal 2018, the company generated annual sales of around € 1.2 billion in accordance with U.S. GAAP. Versum has around 2,300 employees and operates 14 production sites and seven research and development facilities in Asia and North America. The former Versum business will be integrated into the Semiconductor Solutions business unit, which is part of the Performance Materials business sector. The objective of the transaction is to create a leading player in the field of electronic materials specializing in the semiconductor and display industries.

Purchase price allocation

As control over Versum was obtained on October 7, 2019, and essential information for determining the purchase price allocation could only be obtained after that date for legal reasons, the purchase price allocation was only completed for some assets and liabilities such as cash and cash equivalents, trade payables, and financial debt as of December 31, 2019.

The purchase price for the acquisition of Versum was fully paid in cash. The payments were as follows:

	€ million
Purchase price for 100% of the shares at the closing rate on October 7, 2019	5,279
Reclassification of income from hedging transactions from other comprehensive income to assets	-81
Purchase price in accordance with IFRS 3	**5,198**
Cash and cash equivalents acquired	270
Payments for 100% of shares less acquired cash and cash equivalents	**4,928**

As part of the acquisition the parties did not agree on any contingent consideration to be provided by Merck in the future. The majority of the currency risk arising from payment of the purchase price for Versum in U.S. dollars was hedged as part of a hedging strategy using derivative financial instruments (forward exchange contracts and currency options) in accordance with the regulations for cash flow hedge accounting. The resulting income of € 81 million was taken into consideration in determining the purchase price in accordance with IFRS 3.

The preliminary fair values at the acquisition date are presented in the "Overview of preliminary fair values of acquisitions in 2019" section.
Material contingent liabilities were not identified as part of the preliminary purchase price allocation. The following overview shows the intangible assets identified within the scope of the preliminary purchase price allocation and recognized at the acquisition date:

€ million / years(preliminary)	**Fair value at the acquisition date**	**Useful life**
Customer relationships	2,326	7-19
Technology (patented and unpatented)	476	5-15
Trademark	45	12
Total	**2,848**	
Goodwill	3,144	indefinite
Total	**5,992**	

The preliminary positive difference of € 3,144 million was recognized as goodwill. It includes expected synergies resulting from the integration of Versum into the Merck Group, expected revenues from technical innovations and developments that go beyond the current product, development, and customer portfolios, and unrecognized intangible assets such as the expertise of the workforce. The goodwill was allocated in full to the Performance Materials business sector. The goodwill is expected to be non-tax deductible. The change in goodwill valued in foreign currency between initial recognition and December 31, 2019 is broken down as follows:

€ million	**Change in goodwill**
Goodwill on October 7, 2019	3,144
Exchange rate effects	-64
Goodwill on December 31, 2019	**3,080**

Financing the acquisition

To finance the purchase price, Merck issued a hybrid bond in two tranches on June 18, 2019, with a volume of € 1.5 billion and on July 1, 2019, bonds with a volume of € 2 billion. The hybrid bond comprises two tranches with maturities of 60 years each. Each tranche includes a redemption option for Merck after 5.5 and ten years.

Sales and earnings contribution from Versum

For the 86 calendar days to the end of the year 2019, the former Versum business contributed € 247 million to Group net sales and € –49 million to net income after taxes. This result reflects the higher cost of sales resulting from adjusting acquired inventories to their preliminary fair values and amortization of revalued assets.

Assuming that Versum had already been initially consolidated as of January 1, 2019, the Merck Group would have generated € 17,040 million in net sales (compared to reported net sales of € 16,152 million) and net income after taxes of € 1,365 million (compared to reported net earnings of € 1,324 million) for the period of January 1 to December 31, 2019. When calculating these figures it was assumed that the adjustments to carrying amounts resulting from the purchase price allocation had been identical and would have been taken into account in accordance with their useful life in terms of their effects on the consolidated income statement. Furthermore, it was assumed that the financing of the acquisition had already taken place as of January 1, 2019. There were only immaterial business relationships between Merck and Versum in 2019 up to the acquisition date (sales volume of less than € 10 million). Costs of € 44 million associated with the company's acquisition were recognized in other operating expenses.

Acquisition of Intermolecular, Inc., United States

Merck completed the acquisition of Intermolecular, Inc., United States, on September 20, 2019, for US$ 1.20 per share in cash (the equivalent of € 56 million for 100% of shares). The transaction followed the approval of the authorities and fulfillment of other customary closing conditions.

Intermolecular possesses application-specific materials expertise and platforms for accelerated learning and experimentation with a powerful analysis infrastructure that complements Merck's business and technology portfolio in the semiconductor business, part of the Performance Materials business sector.

In fiscal 2018, Intermolecular generated sales of US$ 34 million and had around 90 employees.

To a predominant extent, the intangible assets identified within the scope of the purchase price allocation and recognized as of the initial consolidation date were attributable to intangible assets related to technology. The preliminary assets and liabilities recognized as of the acquisition date are presented in the section "Overview of preliminary fair values of acquisitions in 2019". The purchase price allocation for Intermolecular was still incomplete as of December 31, 2019, in respect to the intangible assets and deferred taxes.

Since the company was included in September, the former Intermolecular business contributed € 3 million to Group net sales and € 4 million to net income after tax. The impact of a notional consolidation of Intermolecular as of January 1, 2019, on the Group's net assets, financial position, and results of operations is immaterial. Costs of € 2 million associated with the company's acquisition were recognized in other operating expenses.

Additional acquisitions in 2019

On June 17, 2019, Merck acquired the laboratory informatics provider BSSN Software GmbH, Darmstadt, (BSSN). BSSN develops and markets software for managing and integrating data, which unifies data from laboratory instruments and data systems and makes them available for analyzing, processing, and sharing. The business was integrated into the Life Science business sector. The purchase price amounted to € 16 million including milestone payments amounting to € 6 million for reaching technological development targets. As of December 31, 2019, the purchase price allocation had not yet been completed.

The closing of the acquisition of FloDesign Sonics, Inc., United States, (FloDesign) was announced on October 10, 2019. The company developed a platform for industrial manufacturing of cell and gene therapies that allows cells to be manipulated using ultrasonic waves. It forms part of the Life Science business sector.

The purchase price included fixed compensation of € 32 million. Future milestone payments of up to € 30 million for the achievement of technological development targets and a further, sales-independent milestone payment were agreed as further elements of the purchase price. Valuation of the contingent purchase price payments resulted in a purchase price of € 46 million in accordance with IFRS 3. The intangible assets identified within the scope of the preliminary purchase price allocation and recognized as of the initial consolidation date were attributable to technology-related intangible assets.

Costs of € 1 million associated with the acquisitions of BSSN and FloDesign were recognized in other operating expenses.

Overview of Preliminary Fair Values of Acquisitions in 2019

	Fair value at the acquisition date (preliminary)			
€ million	Versum	Intermolecular	Other acquisitions	**Total**
Non-current assets				
Intangible assets (excluding goodwill)	2,848	20	26	2,895
Property, plant, and equipment	534	19	–	553
Other non-current assets	62	4	2	68
	3,444	**43**	**28**	**3,515**
Current assets				
Inventories	224	1	1	226
Trade receivables and other current receivables	155	2	–	157
Cash and cash equivalents	270	7	–	277
Other current assets	87	8	–	95
	737	**18**	**1**	**755**
Total assets	**4,180**	**61**	**29**	**4,270**
Non-current liabilities				
Non-current financial debt	938	11	–	949
Other non-current provisions and liabilities	81	–	–	81
Deferred tax liabilities	763	5	6	774
	1,782	**16**	**6**	**1,805**
Current liabilities				
Trade payables and other liabilities	61	1	1	63
Income tax liabilities	122	–	–	122
Other current liabilities and provisions	161	4	–	166
	345	**5**	**1**	**351**
Total liabilities	**2,127**	**22**	**7**	**2,156**
Net assets acquired	**2,054**	**39**	**22**	**2,115**
Purchase price for acquiring the shares	**5,198**	**56**	**62**	**5,316**
Positive difference (goodwill)	**3,144**	**17**	**40**	**3,201**

Divestitures in 2018

SIGNIFICANT DISCRETIONARY DECISIONS AND SOURCES OF ESTIMATION

The assessment as to when a non-current asset, disposal group, or discontinued operation meets the prerequisites of IFRS 5 for classification as "held for sale" is subject to discretionary judgment. Even in the case of an existing management decision to review a disposal, an uncertain assessment has to be made as to the probability of whether a corresponding disposal will occur during the year.

Divestment of the Consumer Health business

On April 19, 2018, Merck signed an agreement on the divestment of its global Consumer Health business to The Procter & Gamble Company, United States. The transaction was completed on December 1, 2018. The selling price was € 3.4 billion in cash and included purchase price adjustments for transferred operating assets, cash on hand, and borrowed capital, among other things. Final determination of these purchase price adjustments was made in the first half of 2019. In the process, Merck was able to collect an additional € 52 million. The income and costs connected with the sale came to € 28 million and were reported under profit after tax from discontinued operation. The payments from discontinued operations of € 129 million shown in the consolidated cash flow statement in net cash flows from investing activities were mainly attributable to tax payments related to the divestment of the Consumer Health business, and to the cash inflows for the purchase price adjustment.

In accordance with IFRS 5, the financial figures disclosed in these consolidated financial statements relate exclusively to continuing operations unless expressly stated otherwise. Earnings contributions from supplies and services provided by Merck after the conclusion of the sale transaction according to contractual agreements were presented in the profit from continuing operations both for 2018 and for 2019.

Divestment of the flow cytometry business

On October 18, 2018, Merck signed an agreement with Luminex Corporation, United States, concerning the divestment of the flow cytometry business. These business activities comprised the flow cytometry platforms Amnis® and Guava® as well as the associated reagents under these brands. The disposal proceeds amounted to € 66 million, of which € 61 million were paid in fiscal 2018. The remaining € 5 million were paid in fiscal 2019. The transaction was completed on December 31, 2018. This divestment generated a disposal gain of € 9 million which was recognized in other operating income in fiscal 2018. Adjustments to the disposal gain of € -8 million were recognized in 2019.

(6 Collaboration agreements

Accounting and measurement policies

Collaboration agreements in the Healthcare business sector

In addition to traditional agreements for buying or selling intellectual property, Merck enters into collaboration agreements in which the Group works with partners to develop pharmaceutical drug candidates and, if regulatory approval is granted, to commercialize them. Because the partner companies do not have customer characteristics, these collaboration agreements do not fall directly within the scope of IFRS 15 and the associated income from upfront payments, milestone payments, and royalties is shown under other operating income. Reimbursements of research and development costs made between the collaboration partners are recognized on a net basis in research and development costs. The two most significant collaborations are the agreements with Pfizer Inc., United States, (Pfizer) and with GlaxoSmithKline plc, United Kingdom, (GSK) in the field of immuno-oncology.

Merck recognizes the consideration received in the course of collaboration agreements for bundled obligations arising from granting rights to intellectual property as well as other goods and services promised as income over a period of time, in line with industry practice. Income is caught up cumulatively upon receipt of uncertain future milestone payments attributable to contractual obligations which have already been fulfilled. This refers especially to milestone payments subsequent to regulatory approval.

Furthermore, collaboration agreements in the Healthcare business sector typically allocate the sales generated in specific markets, or with specific products, to the respective collaboration partners in the event of a successful approval; in turn, specific income and expense items are carried by the collaboration partners according to predefined allocation ratios. Under these circumstances, Merck recognizes the sales from the commercialization of products to third-party customers, if Merck takes on the role of a principal within the meaning of IFRS 15. Expenses resulting from payments made to collaboration partners in connection with profit share agreements are recognized in other operating expenses.

Joint arrangements in the Performance Materials business sector

Merck is a contract partner in two joint arrangements in the Performance Materials business sector. In both cases, Merck has joint control with the respective partner. Although they are legally separate from the partners, these joint operations are classified as joint activities in line with IFRS 11.B31. Merck and the contract partner ensure their contractually agreed access to the production outputs by preventing third party access. Assets, liabilities, income, and expenses from these joint arrangements allocated to Merck are accounted for in accordance with the IFRSs applicable to the respective assets, liabilities, income and expenses.

SIGNIFICANT DISCRETIONARY DECISIONS AND SOURCES OF ESTIMATION UNCERTAINTY

As part of the accounting treatment of collaboration agreements, significant discretionary decisions have to be made in the following areas:

- Identification of an appropriate type of income recognition,
- Determination of the appropriate timing of income recognition and
- Classification of joint arrangements as joint operations or joint ventures.

Estimates are to be made especially when it comes to determining the transaction price and progress on the performance obligation.

If the consideration received and deferred as a liability in the case of the collaboration agreement with Pfizer had been recognized in the income statement over a period extended by six months, in fiscal 2019 this would have reduced other operating income, and therefore also profit before income tax, by € 64 million (2018: € 38 million). If the percentage of completion of the collaboration agreement with GSK in 2019 had been 10% higher, this would have increased other operating income and profit before tax by € 30 million (reduction by € 30 million at 10% lower percentage of completion).

Agreement with GlaxoSmithKline plc, United Kingdom, to co-develop and co-commercialize active ingredients in immuno-oncology

On February 5, 2019, Merck entered into an agreement in the field of immuno-oncology with a subsidiary of GSK to co-develop and co-commercialize the drug candidate Bintrafusp alfa (formerly known as M7824). The bifunctional fusion protein, Bintrafusp alfa, is currently an investigational candidate for several types of cancer. The overriding objective of the strategic alliance is to share the risks of development and commercialization. The execution of the collaboration agreement is not structured through a separate vehicle.

After fulfilling the agreed conditions, Merck received an upfront payment of € 300 million, which was recognized as deferred income on the balance sheet and presented under other liabilities. Merck has a claim to further development milestone payments of up to € 500 million depending on clinical data. In addition, Merck can receive future payments of up to € 2.9 billion for achieving certain milestones related to approval and commercialization. Merck recognizes the upfront payment as income, as well as any developmental milestone payments potentially to be received in the future in accordance with the fulfillment of performance obligations existing on the basis of contractual agreements. A cost-based method is used to recognize these payments. Income can be caught up cumulatively when milestones are achieved.

Merck and GSK are jointly responsible for the development and potential commercialization further down the line. According to the collaboration agreement, during the development period each company bears one half of the development expenses. While Merck will realize the net sales in the United States and GSK in all other countries in the event of regulatory approval, the collaboration agreement provides for the partners to evenly split the net results of net sales less defined expense components. In fiscal 2019, Merck recognized € 92 million of the upfront payment collected within other operating income. Merck furthermore recognized research and development costs amounting to a double-digit million-euro figure.

Strategic alliance with Pfizer Inc., United States, to jointly co-develop and co-commercialize active ingredients in immuno-oncology

On November 17, 2014, Merck formed a global strategic alliance with Pfizer to co-develop and co-commerzialize the anti-PD-L1 antibody avelumab. Avelumab received its first regulatory approvals in 2017 under the trade name Bavencio®. This antibody is also being studied in multiple broad-based clinical trials as a potential treatment for further tumor types as a single agent as well as in combination with a wide array of approved or still investigational active ingredients. The overriding objective of the strategic alliance is to share the development risks and to expand the two companies' presence in immuno-oncology.

According to the collaboration agreement, during the development period each company bears one half of the development expenses. In the commercialization phase, Merck realizes the majority of sales from the commercialization of Bavencio® while Merck and Pfizer evenly split the net amount of sales less defined expense components. The execution of the collaboration agreement is not being structured through a separate vehicle.

Upon entry into the agreement in 2014, Pfizer made an upfront cash payment of US$ 850 million (€ 678 million) to Merck. Pfizer also committed to making further payments of up to US$ 2 billion to Merck subject to the achievement of defined development and commercial milestones. Based on the collaboration agreement, Merck was also granted the right to co-promote Xalkori® (crizotinib) with Pfizer for multiple years. This is a kinase inhibitor indicated for the treatment of patients with metastatic non-small cell lung cancer (NSCLC) whose tumors are anaplastic lymphoma kinase (ALK)-positive or whose tumors are metastatic ROS1-positive. During the co-promotion of Xalkori®, Merck receives a profit share from Pfizer, which is reported in net sales. In 2019, this profit share income amounted to € 56 million (2018: € 58 million). The residual carrying amount of the co-promotion right recognized as an intangible asset amounted to € 45 million as of December 31, 2019 (December 31, 2018: € 68 million).

Both the upfront payment as well as the value of the right to co-promote Xalkori® were recognized as income on a pro rata basis over the period during which the major part of the initially decided clinical development programs was conducted. Moreover, in 2019, Merck recognized income from reaching three approval milestones and, in 2018, income amounting to a mid double-digit million-euro figure in return for waiving rights to Pfizer's anti-PD-1 antibody. This had previously been included in the collaboration agreement. For further information, please refer to Note (15) "Other operating income". As in 2018, Merck recognized research and development costs in a low three-digit million euro amount in 2019.

Restructuring the agreement with Intrexon Corporation, United States, to co-develop and co-commercialize of CAR-T cancer therapies in 2018

In March 2015, Merck and Intrexon Corporation, United States, (Intrexon) entered into a strategic collaboration and license agreement to develop and commercialize chimeric antigen receptor T-cell (CAR-T) cancer therapies. The agreement provided Merck with exclusive access to Intrexon's proprietary and complementary suite of technologies to engineer T-cells with optimized and inducible gene expression.

Effective December 28, 2018, Merck transferred the above-mentioned exclusive rights back to Intrexon on the basis of a contractual agreement. At the time the contract was signed, Merck was entitled to receive Intrexon common stock worth US$ 150 million in return for the assignment of rights. Furthermore, the agreement contained another investment by Merck, amounting to US$ 25 million, in Intrexon's subsidiary Precigen, Inc., United States, (Precigen) which is involved in the development of T-cell cancer therapies. In return, Merck received a convertible note in the amount of US$ 25 million, with the option, under certain conditions, to acquire shares in either Intrexon or Precigen. The transaction led to the disposal of the intangible asset in the amount of € 104 million in 2018 and to the recognition of a disposal gain, which was reported under other operating income. As of December 31, 2019, the carrying amount of the equity interest amounted to € 101 million (December 31, 2018: € 118 million).

Agreement with Avillion LLP, United Kingdom, to develop Merck's anti-IL-17-A/F Nanobody®

On March 30, 2017, Merck announced an agreement with a subsidiary of Avillion LLP, United Kingdom, (Avillion) to develop the anti-IL-17-A/F Nanobody® M1095. As part of this collaboration, Avillion will be responsible for developing the anti-IL-17-A/F Nanobody® in plaque psoriasis. Avillion will also finance the clinical program. During the development phase, Merck recognizes a financial liability for potential repayment obligations to Avillion and records the corresponding expense as research and development costs and as finance costs. Research and development costs in the double-digit million euro range were recorded in fiscal 2019 (2018: low single-digit million-euro range).

Restructuring of the collaboration with F-star Delta Ltd., United Kingdom, in the field of immuno-oncology

In June of 2017, Merck announced a strategic collaboration with F-star Delta Ltd, United Kingdom, (F-star) for the development and commercialization of bispecific immuno-oncology antibodies. In 2019, the existing licensing and collaboration agreement with F-star was realigned due to the reprioritization of resources and programs. Based on this, all rights to FS118 reverted to F-star. The option to acquire F-star Delta Ltd. was terminated. In the course of the realignment, Merck in-licensed an innovative bispecific antibody and, in addition, holds an option to in-license a further bispecific antibody from F-star's antibody platform. Both bispecific antibodies were handled under the previous collaboration.
As a result of the abovementioned changes, impairment losses totaling € 72 million were recognized in fiscal 2019 for an intangible asset and the reverted option, which were shown in other operating expenses and finance costs.

Arrangements in the Performance Materials business sector

Upon acquiring Versum Materials, Inc., United States, (Versum), Merck became an equal 50% partner in Hydrochlor, LLC, United States, (Hydrochlor) under a joint arrangement with Linde plc. Hydrochlor was founded with the aim of supplying hydrogen chloride exclusively to the two partner companies. Also upon acquiring Versum, Merck became a partner under an agreement with Showa Denko K.K., Japan. The aim of the agreement is to manufacture a supplier product to supply to the two partner companies exclusively.

Even though both agreements are legally separate from the respective partner companies, each agreement was classified as a joint operation since each contract partner is legally obligated to purchase the entire production result and each agreement is the sole source of funding for settling liabilities.

Performance Indicators

(7) Segment reporting

Accounting and measurement policies

The internal organizational and reporting structure of the Merck Group forms the basis of the segmentation of its business operations. It is founded on the business models of the business sectors, which led to homogeneous risk structures within the segments. Resource allocation and the assessment of the segments' business development are performed by the Executive Board of Merck KGaA as the chief operating decision-maker.

Corporate and Other includes income and expenses, assets and liabilities, as well as cash flows that cannot be allocated to the reportable segments presented. They originate mainly from the central Group functions. Moreover, the column serves the reconciliation to the Group numbers. As these are managed at Group level, the expenses and income as well as cash flows attributable to the financial result and income taxes are also disclosed under Corporate and Other.

Apart from sales, the success of a segment is mainly determined by EBITDA pre (segment result) and business free cash flow. EBITDA pre and business free cash flow are performance indicators not defined by International Financial Reporting Standards (IFRSs). However, they represent important variables used to steer the Merck Group. To permit a better understanding of operational performance, calculation of EBITDA pre excludes depreciation and amortization, impairment losses and reversals of impairment losses, as well as the adjustments presented in the following.

INFORMATION BY BUSINESS SECTOR – 2019

€ million	Healthcare	Life Science	Performance Materials	Corporate and Other	Group
Net sales[1]	**6,714**	**6,864**	**2,574**	**–**	**16,152**
Intersegment sales	–	21	–	-21	–
Operating result (EBIT)[2]	**1,149**	**1,280**	**307**	**-617**	**2,120**
Depreciation	713	784	328	80	1,905
Impairment losses	34	6	2	–	42
Reversals of impairment losses	–	–	–	–	–
EBITDA[2]	**1,896**	**2,070**	**637**	**-537**	**4,066**
Adjustments[2]	25	59	166	68	318
EBITDA pre (segment result)[2]	**1,922**	**2,129**	**803**	**-469**	**4,385**
EBITDA pre margin (in % of net sales)[2]	28.6%	31.0%	31.2%	–	27.1%
Assets by business sector	7,560	21,600	10,784	3,867	43,811
Liabilities by business sector	-3,055	-1,519	-716	-20,608	-25,897
Investments in property, plant and equipment[3]	343	296	125	49	813
Investments in intangible assets[3]	91	86	12	19	208
Net cash flows from operating activities	1,830	1,867	768	-1,609	2,856
Business free cash flow[2]	1,252	1,375	641	-536	2,732

[1] Excluding intersegment sales.
[2] Not defined by International Financial Reporting Standards (IFRSs).
[3] According to the consolidated cash flow statement.

INFORMATION BY BUSINESS SECTOR – 2018

€ million	Healthcare	Life Science	Performance Materials	Corporate and Other	Group
Net sales[1]	**6,246**	**6,185**	**2,406**	**–**	**14,836**
Intersegment sales	–	20	–	-20	–
Operating result (EBIT)[2]	**731**	**1,036**	**508**	**-548**	**1,727**
Depreciation	747	696	240	60	1,743
Impairment losses	13	23	21	–	58
Reversals of impairment losses	–	–	–	–	–
EBITDA[2]	**1,492**	**1,755**	**769**	**-488**	**3,528**
Adjustments[2]	63	85	17	107	272
EBITDA pre (segment result)[2]	**1,556**	**1,840**	**786**	**-381**	**3,800**
EBITDA pre margin (in % of net sales)[2]	24.9%	29.8%	32.7%	–	25.6%
Assets by business sector	7,568	20,860	4,046	4,414	36,888
Liabilities by business sector	-2,893	-1,333	-489	-14,940	-19,655
Investments in property, plant and equipment[3]	379	313	119	100	910
Investments in intangible assets[3]	59	19	13	15	106
Net cash flows from operating activities	1,159	1,621	742	-1,303	2,219
Business free cash flow[2]	1,025	1,393	588	-497	2,508

[1] Excluding intersegment sales.
[2] Not defined by International Financial Reporting Standards (IFRSs).
[3] According to the consolidated cash flow statement.

INFORMATION BY COUNTRY AND REGION – 2019

€ million	**Europe**	thereof: Germany	thereof: Switzerland	**North America**	thereof: United States	**Asia-Pacific**	thereof: China	**Latin America**	**Middle East and Africa**	**Group**
Net sales by customer location[1]	4,735	1,010	212	4,214	4,011	5,599	2,275	1,012	591	16,152
Net sales by company location[1]	5,233	1,475	389	4,283	4,101	5,298	2,048	965	373	16,152
Goodwill and other intangible assets	5,112	1,643	1,682	20,708	20,697	494	32	2	–	26,316
Property, plant and equipment	3,386	1,590	746	1,638	1,630	973	352	159	57	6,213
Research and development costs[2]	-1,997	-923	-945	-164	-160	-79	-34	-18	-11	-2,268
Number of employees	26,714	13,806	2,337	12,829	12,648	12,728	4,110	3,430	1,335	57,036

[1] Excluding intersegment sales.
[2] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes".

INFORMATION BY COUNTRY AND REGION – 2018

€ million	**Europe**	thereof: Germany	thereof: Switzerland	**North America**	thereof: United States	**Asia-Pacific**	thereof: China	**Latin America**	**Middle East and Africa**	**Group**
Net sales by customer location[1]	4,559	1,002	211	3,818	3,627	4,965	1,869	950	544	14,836
Net sales by company location[1]	5,012	1,407	390	3,871	3,704	4,718	1,659	879	357	14,836
Goodwill and other intangible assets	5,562	575	2,124	14,868	14,857	570	32	2	–	21,001
Property, plant and equipment	3,031	1,503	647	1,024	1,020	585	266	127	43	4,811
Research and development costs[2]	-1,938	-921	-902	-186	-185	-69	-30	-17	-14	-2,227
Number of employees	25,791	13,513	2,234	10,978	10,800	10,486	3,550	3,337	1,121	51,713

[1] Excluding intersegment sales.

[2] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes".

The Merck Group is divided into three business sectors: The Healthcare business sector includes the businesses with prescription pharmaceuticals, biopharmaceuticals, allergy products, and medical devices. The customers mainly comprise wholesalers, hospitals, and pharmacies. The Life Science business sector comprises products for scientific institutions and research and analytical laboratories in the pharmaceutical/biotechnology industry and applications for customers manufacturing chemical and biological pharmaceuticals. In accordance with the product portfolio, the customers of this business sector primarily include companies of the pharmaceuticals and biotech sector as well as retailers and universities. The Performance Materials business sector consists of the entire specialty chemicals business and primarily services industrial companies. The fields of activity of the individual segments are described in detail in the sections on the business sectors in the combined management report.

No single customer accounted for more than 10% of Group sales in fiscal 2019 or 2018. Transfer prices for intragroup net sales were determined on an arm's-length basis. The intersegment sales reported in the above table are valued at group production cost.

The following table presents the reconciliation of Segment results of all operating businesses to the profit before income tax of the Merck Group:

€ million	**2019**	2018
EBITDA pre of the operating businesses[1]	**4,854**	**4,181**
Corporate and Other	-469	-381
EBITDA pre of the Merck Group[1]	**4,385**	**3,800**
Depreciation/amortization/impairment losses/reversals of impairment losses	-1,946	-1,801
Adjustments[1]	-318	-272
Operating result (EBIT)[1]	**2,120**	**1,727**
Financial result	-385	-266
Profit before income tax	**1,735**	**1,461**

[1] Not defined by International Financial Reporting Standards (IFRSs).

The adjustments comprised the following:

€ million	**2019**	2018
Restructuring expenses	-120	-46
Integration expenses/IT expenses	-95	-142
Gains (+)/losses (–) on the divestment of businesses	-6	-25
Acquisition-related adjustments	-84	-2
Other adjustments	-13	-58
Adjustments before impairment losses/reversals of impairment losses[1]	**-318**	**-272**
Impairment losses	-9	-55
Reversals of impairment losses	–	–
Adjustments in the operating result (total)[1]	**-328**	**-327**

[1] Not defined by International Financial Reporting Standards (IFRSs).

Restructuring expenses in the amount of € 120 million (2018: € 46 million) resulted mainly from the Bright Future transformation program of the Performance Materials business sector (2019: € 50 million/2018: € 0 million) and the relocation of various tasks to the shared service organization (2019: € 26 million/2018: € 25 million), which were reported under Corporate and Other.

Integration and IT expenses in the amount of € 95 million (2018: € 142 million) resulted substantially from the introduction of new ERP systems (2019: € 54 million/2018: € 50 million) and the integration of Versum Materials, Inc., United States (2019: € 12 million/2018: € 0 million). The acquisition-related adjustments resulting from the takeover of Versum Materials, Inc., United States, amounted to € 80 million (2018: € 0 million).

These adjustments were disclosed in the consolidated income statement as part of the respective functional costs and allocated to them as follows:

2019

€ million	thereof: cost of sales	thereof: marketing and selling expenses	thereof: administration expenses	thereof: research and develop-ment costs	thereof: other operating income and expenses	**Total**
Restructuring expenses	-20	-10	-40	-29	-22	-120
Integration expenses/IT expenses	–	–	-70	–	-25	-95
Gains (+)/losses (–) on the divestment of businesses	–	–	1	–	-6	-6
Acquisition-related adjustments	-35	–	–	–	-49	-84
Other adjustments	–	–	–	–	-13	-13
Adjustments before impairment losses/reversals of impairment losses[1]	**-56**	**-10**	**-109**	**-29**	**-114**	**-318**
Impairment losses	–	–	–	–	-9	-9
Reversals of impairment losses	–	–	–	–	–	–
Adjustments in the operating result (total)[1]	**-56**	**-10**	**-109**	**-29**	**-123**	**-328**

[1] Not defined by International Financial Reporting Standards (IFRSs).

2018

€ million	thereof: cost of sales[1]	thereof: marketing and selling expenses[1]	thereof: administration expenses[1]	thereof: research and development costs[1]	thereof: other operating income and expenses[1]	**Total[1]**
Restructuring expenses	-1	-6	-39	–	–	-46
Integration expenses/IT expenses	-39	-3	-99	-1	–	-142
Gains (+)/losses (–) on the divestment of businesses	–	–	–	–	-25	-25
Acquisition-related adjustments	–	–	-2	–	–	-2
Other adjustments	-6	-3	-50	-1	2	-58
Adjustments before impairment losses/reversals of impairment losses[2]	**-45**	**-13**	**-190**	**-2**	**-23**	**-272**
Impairment losses	-18	-14	-19	–	-3	-55
Reversals of impairment losses	–	–	–	–	–	–
Adjustments in the operating result (total)[2]	**-63**	**-27**	**-209**	**-2**	**-26**	**-327**

[1] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes."
[2] Not defined by International Financial Reporting Standards (IFRSs).

Business free cash flow was determined as follows:

€ million	**2019**	2018
EBITDA pre[1]	**4,385**	**3,800**
Investments in property, plant, and equipment as well as software and advance payments for intangible assets	-1,026	-932
Changes in inventories	-577	-214
Changes in trade accounts receivable as well as receivables from royalties and licenses	-259	-145
Lease payments[2]	-136	
Elimination of first-time consolidations	346	–
Business free cash flow[1]	**2,732**	**2,508**

[1] Not defined by International Financial Reporting Standards (IFRSs).
[2] Excluding payments for low-value leases and for interest components included in lease payments.

(8) Earnings per share

Accounting and measurement policies

Basic earnings per share is calculated by dividing the profit after taxes attributable to the shareholders of Merck KGaA (net income) by the weighted average number of theoretical shares outstanding. The calculation of the theoretical number of shares is based on the fact that the general partner's equity is not represented by shares. Corresponding to the division of the subscribed capital of € 168 million into 129,242,252 shares (see Note (34) "Equity"), the general partner's equity of € 397 million equates to 305,535,626 theoretical shares. Overall, equity capital thus amounted to € 565 million or 434,777,878 theoretical shares outstanding.

There were no changes to equity capital in 2019, as in 2018. The weighted average (basic) number of shares was 434,777,878 and thus corresponded to the number of theoretical shares outstanding. In fiscal 2019, there were no shares with a potential diluting effect; as a result, the diluted earnings per share were equivalent to basic earnings per share. The earnings per share attributable to discontinued operation resulted from the divestment of the Consumer Health business as of December 1, 2018.

(9) Net cash flows from operating activities

Accounting and measurement policies

The calculation and presentation of cash flows from operating activities are based on the following principles:

- The presentation of cash flows from operating activities is determined using the indirect method based on the profit after taxes.
- The option to recognize interest received and interest payments made is exercised to the extent that such transactions are recognized in cash flow from operating activities.

Tax payments are generally presented in the cash flow from operating activities. Only significant transactions where the associated tax payments can be practically calculated are recognized in the relevant item of the cash flow statement.

In 2019, tax payments totaled € 1,018 million (2018: € 900 million). Of this amount, € 130 million (2018: € 125 million) were attributed to cash flows from investing activities in connection to the divestment of the Consumer Health business.

Tax refunds amounted to € 160 million (2018: € 65 million). Interest paid totaled € 316 million (2018: € 286 million). Interest received amounted to € 60 million (2018: € 34 million).

The change of other assets and liabilities includes an advance payment of € 300 million received from GlaxoSmithKline plc, United Kingdom, within the scope of an agreement for joint development and marketing in the field of immuno-oncology (see Note (6) "Collaboration Agreements").

In 2019 as well as in 2018, the neutralization of the profits/losses from the disposal of assets and other disposals mainly comprised the effects of the divestment of the Consumer Health business.

(10) Net cash flows from investing activities

Net cash outflows from investments in financial assets amounting to € 196 million (2018: € 75 million) mainly resulted from the purchase of short-term investments in securities not classified as cash and cash equivalents. Net cash outflows from acquisitions less cash and cash equivalents acquired is broken down as shown in the table below. Most of these outflows are attributable to payments made for the acquisition of Versum Materials, Inc., United States (see Note (5) "Acquisitions and divestments").
The payments made and received from the acquisition and the disposal of other non-financial assets resulted from the short-term application of available funds.

The payments made and received from the sale of assets held for sale were primarily related to payments made in connection with the Consumer Health business divested in 2018 (see Note (5) "Acquisitions and divestments").

€ million	Versum	Other acquisitions	**Total**
Purchase price payment	-5,279	-99	-5,378
Cash income from hedging transactions	81	–	81
Purchase price in accordance with IFRS 3	**-5,198**	**-99**	**-5,297**
Cash and cash equivalents acquired	270	8	277
Payments for acquisitions less acquired cash and cash equivalents (net) in accordance with the consolidated cash flow statement in 2019	**-4,928**	**-91**	**-5,020**

Operating Activities

(11) Net sales

Accounting and measurement policies

Nature and timing of revenue recognition

Net sales are recognized when (or as) the customer obtains control of the asset. For sales of goods, the customer usually obtains control as soon as delivery is made, given that the customer is generally not able to obtain any benefits from the asset before that point in time. To a lesser extent, Merck generates net sales from the sale of goods based on bill-and-hold arrangements. In these cases, net sales are recognized before the goods are delivered to the customer, as soon as Merck has invoiced the products and the additional criteria laid out in IFRS 15.B81 are fulfilled. In the case of equipment sales, the criteria for revenue recognition are only met after installation has been successfully completed – to the extent that the installation requires specialized knowledge, does not represent a clear ancillary service and the relevant equipment can only be used by the customer once successfully set up.

For service contracts, and customer-specific contract manufacturing of goods and equipment, Merck recognizes revenue over time based on the progress towards complete satisfaction of the performance obligation, if there is a contractual claim for payment against the customer for the services already performed. The progress is mostly determined on the basis of the costs incurred, the time elapsed, and the milestones achieved as of the reporting date.

In the Healthcare and Life Science business sectors, a limited number of contracts provide for the out-licensing of intellectual property. In the Healthcare business sector, out-licensing agreements are usually not part of ordinary activities, meaning that the corresponding income is reported in other operating income (see Note (15) "Other operating income").

Net sales from contracts comprising several separate performance obligations are recognized when the respective performance obligation has been fulfilled. This affects, in particular, the sale of goods in combination with services. Therefore, the transaction price is allocated beforehand to each performance obligation identified in the contract on a relative standalone selling price basis. To a limited extent, there are multiple-element contracts in the Life Science business sector.

Determining the transaction price

Merck grants its customers various kinds of rebates and discounts. These, as well as anticipated customer refund claims, state compulsory charges, and rebates from health plans and programs are deducted from sales. The most significant portion of these deductions from sales is attributable to the Healthcare business sector.

Sales deductions provided on the invoice as price-reducing items, which will likely be applied by customers when making the respective payments, are recognized as reductions of trade accounts receivable. Expected refunds, such as bonus payments, reimbursements for rights of return, or rebates from health plans and programs, are recognized in the separate item "refund liabilities" on the consolidated balance sheet.

The measurement of sales deductions and refund liabilities resulting from expected rebates and discounts considers the following:

- past experience,
- pricing information, and
- expected product growth rates.

The measurement of sales deductions and refund liabilities resulting from rights of return considers the following:

- historical return rates for individual product groups,
- information from distributors on inventory levels, and
- publicly available information on product sales from sector-specific service providers (Healthcare business sector).

Contractual payment terms

Given that the Merck Group generates the large majority of its sales through transactions with simple structures, the company usually has an enforceable right to payment after the performance obligation has been fulfilled. The payment targets contractually agreed between Merck Group and its customers usually range between 30 and 60 days. For some service contracts, the company receives the contractually agreed consideration before the service is delivered; in such cases, the consideration received is presented as a contract liability on the consolidated balance sheet until the revenue has been recognized.

Practical expedients

Merck uses the practical expedient of IFRS 15 in which the promised amount of consideration is not adjusted for the effects of a significant financing component if the period between the fulfillment of a performance obligation and the payment by the customer amounts up to one year.

Significant discretionary decisions and sources of estimation uncertainty

Sales deductions

The measurement of sales deductions and the corresponding refund liabilities requires extensive estimates. Uncertainties exist concerning the extent to which past experience serves as reliable basis for estimating expected refunds in particular, such as bonus payments, reimbursements for rights of return, or rebates from health plans. External information from distributors and industry services outside of Merck’s control, which are also subject to uncertainty, are used to determine sales deductions.

Due to a lack of past experience, the estimate uncertainty referenced above is particularly relevant for product launches in the Healthcare business sector. Any changes in estimates of the parameters listed above have a cumulative impact on the net sales recognized in the respective adjustment period.

The following tables present a more detailed breakdown of net sales by business sector from contracts with customers.

€ million/%	2019							
Net sales by product type	**Healthcare**		**Life Science**		**Performance Materials**		**Group**	
Goods	6,531	97%	5,972	87%	2,497	97%	15,000	93%
Equipment	7	–	397	6%	50	2%	454	3%
Services	100	2%	486	7%	25	1%	611	4%
License income	–	–	8	–	–	–	8	–
Commission income	18	–	2	–	1	–	21	–
Income from co-commercialization agreements	58	1%	–	–	–	–	58	–
Total	**6,714**	**100%**	**6,864**	**100%**	**2,574**	**100%**	**16,152**	**100%**
Net sales by region (customer location)								
Europe	2,241	33%	2,277	33%	217	9%	4,735	29%
North America	1,474	22%	2,474	36%	267	10%	4,214	26%
Asia-Pacific	1,816	27%	1,743	26%	2,041	79%	5,599	35%
Latin America	702	11%	278	4%	32	1%	1,012	6%
Middle East and Africa	482	7%	92	1%	17	1%	591	4%
Total	**6,714**	**100%**	**6,864**	**100%**	**2,574**	**100%**	**16,152**	**100%**

€ million/%	2018							
Net sales by product type	Healthcare		Life Science		Performance Materials		Group	
Goods	6,085	98%	5,413	87%	2,404	100%	13,902	94%
Equipment	4	–	343	6%	–	–	347	2%
Services	84	1%	424	7%	2	–	510	4%
License income	–	–	4	–	–	–	4	–
Commission income	14	–	1	–	–	–	15	–
Income from co-commercialization agreements	58	1%	–	–	–	–	58	–
Total	**6,246**	**100%**	**6,185**	**100%**	**2,406**	**100%**	**14,836**	**100%**
Net sales by region (customer location)								
Europe	2,203	35%	2,136	35%	220	9%	4,559	31%
North America	1,432	23%	2,173	35%	214	9%	3,818	26%
Asia-Pacific	1,501	24%	1,532	25%	1,932	80%	4,965	33%
Latin America	661	11%	256	4%	32	2%	950	6%
Middle East and Africa	448	7%	88	1%	8	–	544	4%
Total	**6,246**	**100%**	**6,185**	**100%**	**2,406**	**100%**	**14,836**	**100%**

The following tables present a breakdown of net sales by key product lines/products:

HEALTHCARE

€ million/%	2019		2018	
Oncology	**1,030**	**15%**	**944**	**15%**
thereof: Erbitux®	871	13%	816	13%
thereof: Bavencio®	103	2%	69	1%
Neurology & Immunology	**1,594**	**24%**	**1,529**	**24%**
thereof: Rebif®	1,273	19%	1,438	23%
thereof: Mavenclad®	321	5%	90	1%
Fertility	**1,247**	**19%**	**1,162**	**19%**
thereof: Gonal-f®	743	11%	708	11%
General Medicine & Endocrinology	**2,557**	**38%**	**2,341**	**38%**
thereof: Glucophage®	877	13%	733	12%
thereof: Concor®	530	8%	475	8%
thereof: Euthyrox®	402	6%	363	6%
thereof: Saizen®	238	4%	234	4%
Other	**287**	**4%**	**270**	**4%**
Total	**6,714**	**100%**	**6,246**	**100%**

LIFE SCIENCE

€ million/%	2019		2018[1]	
Process Solutions	3,003	44%	2,543	41%
Research Solutions	2,176	32%	2,046	33%
Applied Solutions	1,685	24%	1,596	26%
Total	**6,864**	**100%**	**6,185**	**100%**

[1] Previous year's figures have been adjusted due to an internal realignment.

PERFORMANCE MATERIALS

€ million/%	2019		2018	
Display Solutions	1,256	49%	1,332	55%
Semiconductor Solutions	848	33%	596	25%
Surface Solutions	468	18%	476	20%
Other	2	–	1	–
Total	**2,574**	**100%**	**2,406**	**100%**

Group net sales stood at € 16,152 million in fiscal 2019 (2018: € 14,836 million), out of which € 683 million (2018: € 557 million) was recognized over time. This related mainly to net sales from services and from customer-specific equipment in the Life Science business sector.

The table below shows future net sales from concluded contracts:

	Year of expected revenue recognition		
€ million	2020	2021 or later fiscal years	**Total**
As of Dec. 31, 2019	2,018	145	2,163

	Year of expected revenue recognition		
€ million	2019	2020 or later fiscal years	**Total**
As of Dec. 31, 2018	1,605	174	1,779

The increase in comparison with 2018 resulted, in particular, from additions due to the first-time consolidation of Versum Materials, Inc., United States, and from the positive business performance in the Life Science business sector.

The following table shows the change in refund liabilities:

2019

	Rebates/bonus payments		Rights of return		
€ million	Total	thereof: United States	Total	thereof: United States	**Total**
Jan. 1, 2019	**423**	**274**	**49**	**31**	**472**
Additions	1,488	1,145	36	23	**1,524**
Utilizations	-1,344	-1,067	-41	-25	**-1,385**
Cumulative increase (-)/decrease (+) in net sales	-44	-43	-2	–	**-46**
thereof: attributable to performance obligations satisfied in prior periods	-43	-43	-2	–	**-45**
Currency translation difference	8	6	1	1	**9**
Reclassification to assets held for sale	–	–	–	–	**–**
Changes in scope of consolidation/other	-9	–	–	–	**-9**
Dec. 31, 2019	**522**	**315**	**43**	**29**	**565**

2018

	Rebates/bonus payments		Rights of return		
€ million	Total	thereof: United States	Total	thereof: United States	**Total**
Jan. 1, 2018	**379**	**244**	**52**	**32**	**431**
Additions	1,273	951	44	23	**1,317**
Utilizations	-1,193	-902	-43	-22	**-1,235**
Cumulative increase (-)/decrease (+) in net sales	-31	-30	-3	-3	**-34**
thereof: attributable to performance obligations satisfied in prior periods	-25	-24	-3	-3	**-28**
Currency translation difference	12	12	1	1	**13**
Reclassification to assets held for sale	-16	–	-3	–	**-19**
Changes in scope of consolidation/other	-1	–	–	–	**-1**
Dec. 31, 2018	**423**	**274**	**49**	**31**	**472**

The development of contract assets and contract liabilities is shown in Note (25) “Contract assets” and in Note (28) “Other non-financial liabilities”.

(12) Cost of sales

Accounting and measurement policies

Cost of sales primarily includes the cost of manufactured products sold as well as the merchandise sold.

Cost comprises the following items: directly attributable costs, such as cost of materials, personnel, and energy costs, depreciation and amortization, overheads attributable to the production process, inventory impairment losses and their reversals.

Cost of sales included amortization of intangible assets (excluding amortization of internally generated or separately acquired software) in the amount of € 188 million (2018: € 175 million). Material costs in 2019 amounted to € 2,743 million (2018: € 2,598 million) and were largely reported under cost of sales.

(13) Marketing and selling expenses

Accounting and measurement policies

Marketing and selling expenses within logistics costs also include expenses for transportation services performed on behalf of customers. The corresponding income from these services is presented under net sales.

Amortization of the intangible assets under marketing and selling expenses is mainly attributable to customer relationships, marketing authorizations, licenses and similar rights, brands, and trademarks, which can be functionally allocated to Marketing and Selling.

Marketing and selling expenses comprised the following items:

€ million	**2019**	2018[1]
Sales force	-954	-913
Internal sales services	-845	-808
Sales promotion	-521	-509
Logistics	-794	-702
Amortization of intangible assets[2]	-923	-975
Royalty and license expenses	-200	-213
Other marketing and selling expenses	-339	-276
Marketing and selling expenses	**-4,576**	**-4,396**

[1] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes".
[2] Excluding amortization of internally generated or separately acquired software.

Of royalty and license expenses, € 41 million (2018: € 84 million) related to the commercialization of Erbitux® in Japan, and € 68 million (2018: € 53 million) to the license expenses for Glucophage® in China with the distribution partner Bristol-Myers Squibb, Company, United States.

(14) Research and development costs

Accounting and measurement policies

The item comprises the costs of the Group's own research and development departments, the expenses incurred as a result of research and development collaborations as well as the costs of clinical trials in the Healthcare business sector (both before and after approval is granted).

Development costs are capitalized as soon as the relevant criteria in accordance with IAS 38 have been fulfilled (see Note (19) "Other intangible assets").

Cost reimbursements for research and development are offset against research and development costs.

The net income from repayments of subsidies received and reimbursements recognized within research and development costs came to € 99 million in 2019 (2018: net expenses of € 1 million). This income comprised reimbursements from governmental institutions as well as repayments of previously recognized governmental subsidies. In total, this resulted in net income amounting to € 5 million (2018: net expenses of € 4 million). The increase in reimbursements recognized was mainly due to the strategic alliance with GlaxoSmithKline plc, United Kingdom, in the field of immuno-oncology (see Note (6) "Collaboration agreements").

(15) Other operating income

Accounting and measurement policies

Other operating income comprises all income that cannot be allocated to net sales or finance income on account of its character.

Income from up-front payments, milestone payments, and royalties

Revenue from upfront and milestone payments, royalties, and license payments comprises considerations Merck receives from companies that do not represent customers. This relates, in particular, to collaboration and out-licensing agreements in the Healthcare business sector (see Note (6) "Collaboration agreements").

Considerations received within the scope of collaboration agreements are usually recognized over time in other operating income.

The granting of a license in most out-licensing agreements in the Healthcare business sector constitutes a distinct performance obligation that must usually be recognized at a point in time. Due to the uncertainty of development results and regulatory events, the recognition of contingent consideration usually does not take place until the result in question has materialized. In principle, sales-based and usage-based royalties are recognized only after the contract partner makes the corresponding sales or uses the intellectual property.

Income from the revaluation of contingent considerations

The accounting treatment of contingent consideration agreed at the sale of a business as defined in IFRS 3 is shown in Note (36) "Other financial assets".

Other operating income was broken down as follows:

€ million	**2019**	2018
Up-front payments, milestone payments, and royalties	557	368
Income from the disposal of businesses and non-current assets	44	83
Reversal of provisions for litigation	18	21
Income from the revaluation of contingent considerations	8	1
Income from miscellaneous services	3	15
Reversals of impairment losses on non-financial assets	–	–
Remaining other operating income	84	138
Other operating income	**715**	**627**

Revenue from upfront and milestone payments, royalties, and license payments amounting to € 557 million (2018: € 368 million) resulted, in particular, from the collaboration agreements with Pfizer Inc., United States, (2019: € 281 million / 2018: € 191 million) and GlaxoSmithKline plc, United Kingdom (2019: € 92 million / 2018: € 0 million). For further explanations see Note (6) "Collaboration agreements". Furthermore, milestone payments of € 75 million were received for the regulatory approval of the drug candidate Palynziq™, which was sold to BioMarin Pharmaceutical Inc., United States, in 2016. License income was mainly due to a license granted for interferon beta products (Biogen Inc., United States), which amounted to € 89 million (2018: € 79 million).

The income from the disposal of businesses and non-current assets was largely attributable to the sale of an office building in Latin America and the sale of a drug candidate in the oncology business. The income in 2018 was related to the out-licensing of two DNA-dependent protein kinase (DNA-PK) inhibitors and another preclinical compound used in gene editing for six defined genetic diseases to Vertex Pharmaceuticals Incorporated, United States. Furthermore, in 2018 Merck recognized gains from the transfer of exclusive rights regarding the development of T cell-based therapies using chimeric antigen receptors (CAR-T) to the Intrexon Corporation, United States, and from the termination of a license agreement in China.

Other operating income resulted, among other things, from service contracts in connection to the divestment of the Consumer Health business in 2018. Income in the previous year included a mid double-digit million euro amount in return for waiving rights to an anti-PD-1 antibody, which had previously been included in the strategic alliance with Pfizer Inc., United States.

(16) Other operating expenses

Accounting and measurement policies

Other operating expenses comprise all expenses that cannot be reasonably allocated to a functional cost type or finance costs.

The breakdown of other operating expenses was as follows:

€ million	**2019**	2018[1]
Project expenses (including integration and IT projects)	-112	-25
Currency differences from operating activities	-98	-62
Profit share agreements	-60	-46
Litigation	-60	-74
Non-income related taxes	-55	-53
Impairment losses on non-financial assets	-42	-58
Premiums, fees, and contributions	-33	-35
Restructuring expenses	-24	–
Expenses for miscellaneous services	-16	-23
Expenses for disposal of businesses and non-current assets	-14	-6
Expenses for the revaluation of contingent considerations	-8	-39
Remaining other operating expenses	-212	-153
Other operating expenses	**-735**	**-575**

[1] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes".

Project expenses of € 112 million (2018: € 25 million) were primarily incurred on advisory services in the context of the acquisition of Versum Materials, Inc. and on the global harmonization of the IT landscape.

Profit share expenses amounting to € 60 million (2018: € 46 million) were essentially incurred in connection with collaboration agreements in the field of immuno-oncology (see Note (6) "Collaboration agreements").

Information on litigation expenses is included in Note (26) "Other provisions".

Impairments of non-financial assets in the amount of € 33 million (2018: € 40 million) were attributable to intangible assets (see Note (19) "Other intangible assets") and in the amount of € 8 million (2018: € 18 million) to property, plant and equipment (see Note (20) "Property plant and equipment").

Restructuring expenses amounting to € 24 million (2018: € 0 million) included functionally unallocatable expenses in connection with reorganizational measures in all three business sectors.

The expenses for disposal of businesses amounting to € 14 million (2018: € 6 million) resulted primarily from the adjustment of the result on disposal of the flow cytometry business sold in 2018 (see Note (5) "Acquisitions and divestments").

Remaining other operating expenses included, among others, special environmental protection costs as well as personnel expenses not allocated to the functional areas. This item also included the expense for donations of Cesol® 600 tablets containing the active ingredient praziquantel to the World Health Organization (WHO) and expenses for insurance services.

(17) Income tax

Accounting and measurement policies

Current income taxes

Current income taxes for the reporting period and for prior periods are calculated in the amounts that the tax authorities are expected to demand or reimburse. The calculation is based on the entity-specific tax rate applicable in the relevant tax year.

Uncertain income tax claims and liabilities

Assessments relating to specific matters are made to calculate uncertain income tax claims and liabilities. If it is considered likely that an uncertain income-tax treatment will be accepted by the tax authority, the matter will be taken into account on the basis of the applied or planned income-tax treatment. If it is considered unlikely that the tax authority will accept a past or planned income-tax treatment, the uncertain tax assets or uncertain tax liabilities in question are valued at the most likely amount. Uncertain income tax liabilities are disclosed within income tax liabilities. Expected income-tax-related penalties and interest that do not fall within the scope of IAS 12 are treated as provisions.

Deferred taxes

Deferred tax assets resulting from deductible temporary differences, tax credits, and tax loss (and interest) carryforwards are recognized if it is considered likely that taxable profit will be available in the future to apply such tax assets.

Recognition of deferred tax assets requires an estimate of the probability of future use. The influencing factors considered as part of this assessment include the following:

- temporary differences subject to taxation in the future,
- results history,
- results planning, and
- existing tax planning of the respective Group company.

Deferred tax liabilities are recognized for projected dividend payments of subsidiaries. If no dividend payments are projected in the foreseeable future, no deferred tax liability is recognized for the difference between proportional equity and the investment value determined for tax purposes.

Significant discretionary decisions and sources of estimation uncertainty

The calculation of the reported assets and liabilities from current and deferred income taxes requires extensive discretionary judgments, assumptions, and estimates.

When assessing income tax claims and liabilities, the interpretation of tax provisions may be subject to particular uncertainty. The possibility that the relevant tax authorities will take a different view concerning the correct application and interpretation of tax standards cannot be ruled out. Changes to the assumptions underlying the correct interpretation of tax standards, for example as a result of changes in legislation, affect the accounting treatment of uncertain income tax assets and liabilities in fiscal 2019.

Regarding deferred tax items, there were degrees of uncertainty concerning the date on which an asset is realized or a liability settled and concerning the tax rate applicable on this date. This applies in particular to deferred taxes recognized in the course of acquisitions.

Assessing the recoverability, particularly of tax credits and tax loss and interest carryforwards, requires assumptions and estimates concerning the future taxable income of the respective Group company.

Assessing the extent to which a subsidiary’s planned dividend distribution is probable in the foreseeable future is discretionary.

Income taxes in the consolidated income statement were as follows:

€ million	**2019**	2018
Current income taxes in the period	-834	-579
Income tax for previous periods	-59	-79
Deferred taxes in the period	453	290
Income tax	**-440**	**-368**

Tax reconciliation

The following table presents the reconciliation from the theoretical income tax expense to the income tax expense according to the consolidated income statement. The theoretical income tax expense is determined by applying the statutory tax rate of a corporation headquartered in Darmstadt of 31.7% (2018: 31.7%).

€ million	**2019**	2018
Profit before income tax	1,735	1,461
Corporate tax rate	31.7%	31.7%
Theoretical income tax expense	-550	-463
Tax rate differences	192	150
Tax effect of companies with a negative contribution to consolidated profit	-26	-37
Income tax relating to other periods	-59	-79
Tax credits	-17	52
Tax effect on tax loss carryforwards	16	34
Tax effect of non-deductible expenses/ tax-free income/other tax effects	4	-25
Income tax expense according to consolidated income statement	**-440**	**-368**
Tax ratio according to consolidated income statement	25.4%	25.2%

Income taxes consisted of corporation and trade taxes for the companies domiciled in Germany as well as comparable income taxes for foreign companies. Income taxes relating to other periods recognized in fiscal 2019 resulted mainly from completed tax audits and mutual agreement procedures as well as from additions to liabilities for risks from tax audits.

Deferred taxes according to consolidated income statement

The reconciliation between deferred taxes on the consolidated balance sheet and deferred taxes on the consolidated income statement is presented in the following table:

€ million	**2019**	2018
Change in deferred tax assets (consolidated balance sheet)	330	-15
Change in deferred tax liabilities (consolidated balance sheet)	-540	201
Change from reclassification of the discontinued Consumer Health operation	–	-30
Deferred taxes credited/debited to equity	-67	-2
Changes in scope of consolidation/currency translation/other	730	135
Deferred taxes according to consolidated income statement	**453**	**290**

The item "changes in scope of consolidation/currency translation/other" mainly includes deferred tax effects resulting from the acquisition of Versum Materials, Inc., United States (see Note (5) "Acquisitions and divestments"). In the prior year, this item essentially comprised exchange rate effects between the euro and the U.S. dollar.

Changes in tax loss carryforwards

Tax loss carryforwards were structured as follows:

	Dec. 31, 2019			**Dec. 31, 2018**		
€ million	**Germany**	**Outside Germany**	**Total**	Germany	Outside Germany	Total
Tax loss carryforwards	**57**	**1,168**	**1,225**	**118**	**1,069**	**1,187**
Tax loss carryforwards for which a deferred tax asset is recognized	–	198	198	59	152	211
Tax loss carryforwards for which no deferred tax asset is recognized	57	970	1,027	59	917	976
Potential deferred tax assets for tax loss carryforwards	**17**	**270**	**287**	**27**	**254**	**281**
Recognized deferred tax assets on tax loss carryforwards	–	27	27	9	24	33
Not recognized deferred tax assets on tax loss carryforwards	17	243	260	18	230	248

The majority of the tax loss carryforwards either has no expiry date or can be utilized for up to 20 years. In 2019, the income tax expense was reduced by € 16 million (2018: € 34 million) due to the utilization of tax loss carryforwards from prior years for which no deferred tax asset had been recognized in previous periods.

Deferred taxes according to consolidated balance sheet

Deferred tax assets and liabilities corresponded to the following balance sheet items:

	Dec. 31, 2019		Dec. 31, 2018	
€ million	**Assets**	**Liabilities**	Assets	Liabilities
Intangible assets	141	1,968	119	1,479
Property, plant and equipment	25	119	34	84
Financial assets	6	1	12	3
Inventories	657	17	564	18
Receivables/other assets	29	6	25	5
Provisions for pensions and other post-employment benefits	546	6	454	37
Other provisions	212	24	236	66
Liabilities	93	6	67	12
Tax loss carryforwards	27	–	33	–
Tax credits/other	73	71	60	98
Deferred taxes (before offsetting)	**1,811**	**2,217**	**1,606**	**1,803**
Offset deferred tax assets and liabilities	-390	-390	-515	-515
Deferred taxes according to consolidated balance sheet	**1,421**	**1,828**	**1,091**	**1,288**

The rise in deferred tax liabilities is essentially attributable to the recognition of intangible assets originating from the purchase price allocation in connection with the acquisition of Versum Materials, Inc., United States (see Note (5) "Acquisitions and divestments"). Deferred tax assets in 2019 rose mainly as a result of the change in interim profits on inventories from Group-internal transactions and higher temporary measurement differences for pension obligations.

Deferred tax liabilities from outside basis differences for planned dividend payouts were recorded in the amount of € 9 million (December 31, 2018: € 30 million). Temporary differences relating to the retained earnings of subsidiaries, for which no deferred taxes are recognized, amounted to € 10,238 million as of December 31, 2019 (December 31, 2018: € 9,934 million).

Income tax receivables and income tax liabilities

Income tax receivables amounted to € 600 million (December 31, 2018: € 460 million). Of this figure, € 11 million (December 31, 2018: € 0 million) are disclosed in other non-current non-financial assets. Income tax receivables resulted primarily from tax prepayments that exceeded the actual amount of tax payable for 2019 and prior fiscal years as well as from refund claims for prior years. As of December 31, 2019, income tax liabilities, including liabilities for uncertain tax obligations, amounted to € 1,402 million (December 31, 2018: € 1,187 million). The figure consists of current and non-current income tax liabilities. As of December 31, 2019, there were no non-current income tax liabilities (December 31, 2018: € 11 million).

Operating Assets, Liabilities, and Contingent Liabilities

(18) Goodwill

Accounting and measurement policies

In the course of business combinations, goodwill is recognized on the acquisition date. The option to measure non-controlling interests at fair value on the date of their acquisition (full goodwill method) is not utilized.

Method for impairment test

Goodwill impairment tests take place at the level of the business sectors because it is the lowest level at which goodwill at Merck is monitored for internal management purposes. In 2019, the recoverable amount for the cash-generating units Healthcare and Life Science was determined on the basis of the value in use (2018: value in use). The impairment test of the cash-generating unit Performance Materials took place in 2019 on the basis of the fair value less costs of disposal (2018: value in use). It was performed both including and excluding the acquired business of Versum Materials, Inc., United States, (Versum). The information below refers to the impairment test where the acquired Versum Materials business was included on the basis of the preliminary purchase price allocation.

The methodology used in Performance Materials to calculate the fair value less costs of disposal took into account the perspective of an independent market participant. The measurement took into consideration non-observable input factors in the market pursuant to Level 3 in the fair value hierarchy of IFRS 13.

Moreover, the methodology used in the implementation of the impairment tests and the main assumptions for determining value are shown below:

Measurement basis	**Value in use**	**Fair value less costs of disposal**
Measurement method	Discounted cash flow method	
Planning basis	Last medium-term plan approved by the Executive Board	
Detailed planning period	4 years	
Determining the value of the key assumptions		
Net cash flows:		
• Sales growth in the detailed planning period	Based on plan approved by the Executive Board, taking into consideration internal past experience and external market data and market estimations, for example regarding market shares, and excluding new products from the development pipeline and other expansion investments	Based on past experiences and management estimates, taking into consideration largely non-observable input factors in the market, for example regarding future market shares, selling prices and volumes
• Profit margins in the detailed planning period	Based on past experiences, adjusted for expected cost developments	
Long-term growth rate after the detailed planning period	Taking into consideration expected long-term growth and long-term inflation expectations	
Discount factor after tax (weighted average cost of capital – WACC)		
• Risk-free interest rate:	Derived from the returns of long-term government bonds	
• Beta factor:	Derived from the respective peer group	
• Market risk premium:	Based on a combination of different estimating methods; e.g. historical and implied stock yields	
• Cost of debt and capital structure:	Derived from the market data of the respective peer group companies	

Significant measurement assumptions

Expected average sales growth in the detailed planning period for Healthcare in 2019 was a low single-digit percentage rate, as in the previous year. In line with the value-in-use concept, this did not include net sales from the launch of new products. Expected average sales growth in the cash-generating unit Life Science in the detailed planning period totaled a mid single-digit percentage rate, as in the previous year. The calculation of the fair value less costs of disposal of the cash-generating unit Performance Materials included expected average sales growth in the detailed planning period amounting to a mid single-digit percentage rate (2018: low single-digit percentage rate). The EBITDA pre margins used to calculate the recoverable amounts of the cash-generating units Performance Materials and Life Science in the detailed planning period, taking into account Group costs allocated on a pro rata basis, were around 30% each in 2019 as well as in 2018.

The additional significant assumptions for determining value underlying the goodwill impairment tests are quantified below:

	Long-term growth rate		Discount factor			
			Weighted cost of capital after tax		Weighted cost of capital before tax	
%	**2019**	2018	**2019**	2018	**2019**	2018
Healthcare	0.00%	0.00%	5.8%	6.4%	7.8%	8.5%
Life Science	1.75%	1.75%	7.1%	7.2%	8.9%	8.8%
Performance Materials[1]	1.00%	0.50%	6.3%	5.8%	8.0%	7.4%

[1] In 2019 considering Versum Materials Inc., United States, on the basis of the preliminary purchase price allocation.

Net cash flows were discounted using cost of capital after tax. The aforementioned cost of capital before tax was subsequently derived iteratively. The first-time application of IFRS 16 had no material effect on the goodwill impairment test.

Significant discretionary decisions and sources of estimation uncertainty

The determination of the recoverable amount is subject to discretion and significant estimation uncertainty. Assumptions regarding the amount of net cash flows, long-term growth rates, and discount factors are considered a material source of estimation uncertainty due to their inherent uncertainty.

In all the impairment tests performed, the recoverable amount in 2019 and in 2018 was more than 15% higher than the carrying amount of the respective cash-generating unit or group of cash-generating units. Regardless of this, the planning data used was checked for plausibility against external analyst forecasts and the recoverable amounts determined were validated using validation multiples based on peer group information.

In addition, sensitivity analyses of the key assumptions were performed as part of the impairment tests. As a result, no change of a significant assumption deemed possible by management would have resulted in an impairment. The following table presents the amount by which key assumptions would have to change before the impairment test would trigger the recognition of an impairment loss:

	Reduction in net cash flows		Decrease in long-termgrowth rate		Increase in cost of capital after tax	
	%		percentage points		percentage points	
	2019	2018	**2019**	2018	**2019**	2018
Healthcare	> 10%	> 10%	> 2	> 2	> 2	> 2
Life Science	> 10%	> 10%	> 1	> 1	> 1	0.9
Performance Materials[1]	> 10%	> 10%	> 2	> 2	> 1.5	> 2

[1] In 2019 considering Versum Materials Inc., United States, on the basis of the preliminary purchase price allocation.

Goodwill shown below was incurred mainly in the course of the acquisitions of the Versum Materials Inc., United States, the Sigma-Aldrich Corporation, United States, the AZ Electronic Materials S.A., Luxembourg, the Millipore Corporation, United States, and the Serono SA, Switzerland.

	Goodwill			
€ million	Healthcare	Life Science	Performance Materials	**Total**
Cost as of Jan. 1, 2018	**1,785**	**10,519**	**1,278**	**13,582**
Changes in scope of consolidation	–	–	–	–
Additions	–	–	–	–
Disposals	–	–	–	–
Transfers	–	–	–	–
Reclassification to assets held for sale	-251	-31	–	-282
Currency translation difference	-1	408	57	464
Dec. 31, 2018	**1,534**	**10,896**	**1,334**	**13,764**
Accumulated amortization and impairment losses as of Jan. 1, 2018	**–**	**–**	**–**	**–**
Changes in scope of consolidation	–	–	–	–
Impairment losses	–	–	–	–
Disposals	–	–	–	–
Transfers	–	–	–	–
Reversals of impairment losses	–	–	–	–
Reclassification to assets held for sale	–	–	–	–
Currency translation difference	–	–	–	–
Dec. 31, 2018	**–**	**–**	**–**	**–**
Net carrying amounts as of Dec. 31, 2018	**1,534**	**10,896**	**1,334**	**13,764**
Cost as of Jan. 1, 2019	**1,534**	**10,896**	**1,334**	**13,764**
Changes in scope of consolidation	–	40	3,161	3,201
Additions	–	–	–	–
Disposals	–	–	–	–
Transfers	–	–	–	–
Reclassification to assets held for sale	–	–	–	–
Currency translation difference	–	199	-23	175
Dec. 31, 2019	**1,534**	**11,135**	**4,472**	**17,141**
Accumulated depreciation and impairment losses as of Jan. 1, 2019	**–**	**–**	**–**	**–**
Changes in scope of consolidation	–	–	–	–
Impairment losses	–	–	–	–
Disposals	–	–	–	–
Transfers	–	–	–	–
Reversals of impairment losses	–	–	–	–
Reclassification to assets held for sale	–	–	–	–
Currency translation difference	–	–	–	–
Dec. 31, 2019	**–**	**–**	**–**	**–**
Net carrying amounts as of Dec. 31, 2019	**1,534**	**11,135**	**4,472**	**17,141**

The changes in goodwill caused by foreign exchange rates resulted almost exclusively from translating the goodwill from the acquisitions of the Sigma-Aldrich Corporation, the Versum Materials, Inc., the AZ Electronic Materials S.A., and the Millipore Corporation, which were partially denominated in U.S. dollars, into the reporting currency.

Changes in the scope of consolidation in fiscal 2019 mainly resulted from the acquisition of Versum Materials, Inc., United States. See Note (5) "Acquisitions and divestments" for additional information on the acquisitions.

In the Healthcare business sector, the reclassification as assets held for sale in 2018 related to the sale of the Consumer Health business to The Procter & Gamble Company, United States, while in the Life Science business sector it related to the sale of the flow cytometry business to the Luminex Corporation, United States.

As in 2018, there was impairment loss recognized on goodwill in fiscal 2019.

(19) Other intangible assets

Accounting and measurement policies

Recognition and initial measurement of purchased intangible assets

For intangible assets acquired in the course of in-licensing, the portion of the consideration paid by Merck to acquire intellectual property is recognized as an intangible asset. If development services are also acquired from the selling contract party, an appropriate portion of the consideration is allocated to research and development costs in line with the service performance.

Contingent consideration in the form of milestone payments in connection with the purchase of intangible assets outside of a business combination is capitalized as an intangible asset and recognized as a financial liability once the milestone is reached, since the consideration is contingent upon future events that are beyond Merck's control.

Intangible assets acquired in the course of business combinations are recognized at fair value on the acquisition date. This also includes contingent considerations.

Capitalization of internally generated intangible assets

Owing to the high risks until pharmaceutical products are approved, the criteria for the capitalization of development costs in accordance with IAS 38 are not met in the Healthcare business sector for the development of drug candidates. Costs incurred after regulatory approval are insignificant and are therefore not recognized as intangible assets. In the Life Science and Performance Materials business sectors, development expenses are capitalized as soon as the criteria have been met. This includes expenses that arose as part of registration for REACH. Furthermore, development expenses for internally developed software are capitalized provided that the relevant criteria have been fulfilled.

Subsequent measurement

In the course of subsequent measurement, the option to remeasure intangible assets at fair value is not exercised.

Intangible assets with a finite useful life are amortized using the straight-line method. The useful lives of customer relationships, brand names, and trademarks as well as marketing authorizations, acquired patents, licenses and similar rights, and software are between three and 24 years. In determining these useful lives, Merck considers factors including the typical product life cycles for each asset and publicly available information about the estimated useful lives of similar assets.

An impairment test is performed if there are indications of impairment. Such indications of impairment and the need to reverse an impairment is determined during an annual process involving the responsible departments and considering external and internal information. Impairment losses are reversed if the original reasons for impairment no longer apply.

Intangible assets with indefinite useful lives and intangible assets not yet available for use are tested for impairment when a triggering event arises or at least once a year. Amortization does not begin until the product is ready for commercial use and is charged on a straight-line basis over the shorter of the patent or contract term and the estimated useful life.

Significant discretionary decisions and sources of estimation uncertainty

Purchased intangible assets

Identification and measurement of intangible assets acquired in the course of business combinations are subject to significant discretion and estimation uncertainty (for further details on measurement methods and on sensitivity analyses regarding the acquisition of Versum Materials, Inc., United States, see Note (5) "Acquisitions and divestments").

In connection with in-licensing agreements in the Healthcare business sector, Merck moreover has to make a discretionary estimate of the extent to which up-front payments and milestone payments represent remuneration for services received or whether such payments result in an in-licensing of an intangible asset that has to be capitalized.

Determination of the amortization amount

Substantial assumptions and estimates are required to determine the appropriate level of amortization of other intangible assets. This is especially relevant for to the determination of the underlying remaining useful life.

If the amortization of intangible assets from customer relationships, brands, trademarks, marketing authorizations, patents, licenses and similar rights and other had been 10% higher, for example due to shortened remaining useful lives, profit before income tax would have been € 112 million lower in fiscal 2019 (2018: € 117 million).

In fiscal 2019, an extension of the useful life of the intangible asset reported in connection with the drug Rebif® by one year would have raised profit before income tax by € 185 million (2018: € 123 million).

Identification of impairment loss and reversal of impairment losses

Discretionary decisions are required in the identification of objective evidence of impairment as well as in identifying the need to reverse the impairment of other intangible assets.

€ million	Customer relationships, brands, and trademarks	Marketing authorizations, patents, licenses, similar rights, and other items		Software and software in development	Advance payments	**Total**
		Finite useful life	Not yet available for use			
Cost as of Jan. 1, 2018	**7,171**	**10,685**	**1,017**	**705**	**–**	**19,577**
Changes in scope of consolidation	–	–	–	–	–	–
Additions	1	14	35	55	1	106
Disposals	-6	-37	-111	-8	–	-162
Transfers	–	57	-56	4	-1	4
Reclassification to assets held for sale	-29	-51	–	-7	–	-87
Currency translation difference	265	71	–	6	–	342
Dec. 31, 2018	**7,402**	**10,739**	**885**	**755**	**–**	**19,780**
Accumulated amortization and impairment losses as of Jan. 1, 2018	**-1,868**	**-8,438**	**-596**	**-357**	**–**	**-11,260**
Changes in scope of consolidation	–	–	–	–	–	–
Depreciation, amortization, and write-downs	-427	-747	–	-57	–	-1,231
Impairment losses	–	-21	–	-19	–	-40
Disposals	5	14	–	7	–	26
Transfers	–	-1	–	–	–	–
Reversals of impairment losses	–	–	–	–	–	–
Reclassification to assets held for sale	24	38	–	2	–	65
Currency translation difference	-61	-40	–	-3	–	-104
Dec. 31, 2018	**-2,326**	**-9,195**	**-596**	**-426**	**–**	**-12,544**
Net carrying amounts as of Dec. 31, 2018	**5,076**	**1,543**	**289**	**329**	**–**	**7,237**
Cost as of Jan. 1, 2019	**7,402**	**10,739**	**885**	**755**	**–**	**19,780**
Changes in scope of consolidation	2,372	342	181	–	–	2,895
Additions	–	46	40	122	–	208
Disposals	-2	-19	–	-4	–	-26
Transfers	-1	1	-1	5	-1	5
Reclassification to assets held for sale	–	–	–	–	–	–
Currency translation difference	94	34	-4	5	–	129
Dec. 31, 2019	**9,865**	**11,143**	**1,101**	**883**	**–**	**22,992**
Accumulated depreciation and impairment losses as of Jan. 1, 2019	**-2,326**	**-9,195**	**-596**	**-426**	**–**	**-12,544**
Changes in scope of consolidation	–	–	–	–	–	–
Depreciation	-466	-654	–	-75	–	-1,195
Impairment losses	–	–	-33	-1	–	-33
Disposals	2	17	–	4	–	23
Transfers	–	6	-5	–	–	–
Reversals of impairment losses	–	–	–	–	–	–
Reclassification to assets held for sale	–	–	–	–	–	–
Currency translation difference	-39	-26	–	-4	–	-68
Dec. 31, 2019	**-2,829**	**-9,853**	**-634**	**-501**	**–**	**-13,817**
Net carrying amounts as of Dec. 31, 2019	**7,036**	**1,290**	**467**	**382**	**–**	**9,175**

Changes in the scope of consolidation in fiscal 2019 mainly included additions to intangible assets from the acquisition of Versum Materials, Inc., United States. This acquisition and the accompanying effects are described in detail in Note (5) "Acquisitions and divestments."

The additions to market authorizations, patents, licenses, similar rights, and other items with finite useful lives in the amount of € 46 million (2018: € 14 million) were mainly attributable to the Life Science and Healthcare business sectors.

The additions to marketing authorizations, patents, licenses, similar rights, and other items not yet available for use amounted to € 40 million in fiscal 2019 (2018: € 35 million) and were mostly attributable to the Healthcare business sector.

Impairment losses on market authorizations, patents, licenses, similar rights, and other items not yet available for use amounted to € 33 million (2018: € 0 million) and were accounted for by the Healthcare business sector. They were mostly attributable to the restructuring of the collaboration with F-star Delta Ltd., United Kingdom (see Note (6) "Collaboration agreements"). These impairment losses were recognized as impairment losses on non-financial assets under other operating expenses on the consolidated income statement.

The additions to software and software in development in the amount of € 122 million (2018: € 55 million) resulted mainly from development costs in connection with new ERP programs.

The reclassifications in 2018 to assets held for sale were made in connection with the divestment of the Consumer Health business and of the flow cytometry business (see Note (5) "Acquisitions and divestments").

The carrying amounts of customer relationships, brands, and trademarks as well as marketing authorizations, patents, licenses, similar rights, and other items were attributable to the business sectors as follows:

€ million	Remaining useful life in years	Healthcare	Life Science	Performance Materials	**Total Dec. 31, 2019**	Total Dec. 31, 2018
Customer relationships, brands, and trademarks		**–**	**4,598**	**2,438**	**7,036**	**5,076**
Customer relationships	1.5-17.9	–	3,873	2,389	6,262	4,263
thereof: from the acquisition of the Sigma-Aldrich Corporation	16.9-17.9	–	3,231	–	3,231	3,496
thereof: from the acquisition of Versum Materials, Inc.	6.8-18.8	–	–	2,238	2,238	–
thereof: from the acquisition of Millipore Corporation	1.5-7.5	–	470	–	470	569
Brands and trademarks	3.5-7.9	–	725	49	774	813
thereof: from the acquisition of the Sigma-Aldrich Corporation	7.9	–	563	–	563	655
Marketing authorizations, patents, licenses, similar rights, and other items						
Finite useful life		**120**	**314**	**856**	**1,290**	**1,543**
Marketing authorizations	–	58	–	–	58	500
Xalkori®	2.0	45	–	–	45	68
Rebif®	–	–	–	–	–	369
Saizen®	–	–	–	–	–	31
Other marketing authorizations		13	–	–	13	32
Patents, licenses, and similar rights	0.5-13.3	–	309	845	1,154	966
thereof: from the acquisition of AZ Electronic Materials S.A.	1.3-13.3	–	–	516	516	616
thereof: from the acquisition of Versum Materials, Inc.	4.8-6.8	–	–	277	277	–
Other		62	5	11	78	77
Not yet available for use		**269**	**14**	**184**	**467**	**289**
thereof: from the acquisition of Versum Materials, Inc.	–	–	–	177	177	–

(20) Property, plant and equipment

Accounting and measurement policies

Recognition and initial measurement

In the course of determining cost, government grants received are deducted from the asset's carrying amount within the scope of IAS 20. Grants receivable for financial support that are not longer linked to future costs are recognized in profit or loss.

Subsequent measurement

Subsequent measurement is based on amortized cost. Property, plant and equipment is depreciated using the straight-line method over the useful life of the asset concerned and depreciation expenses are allocated to the respective functional costs. Depreciation of property, plant and equipment is based on the following useful lives:

	Useful life
Production buildings	No more than 33 years
Administration buildings	No more than 40 years
Plant and machinery	6 to 25 years
Operating and office equipment, other facilities	3 to 10 years

The useful lives of the assets are reviewed regularly and adjusted if necessary.

An impairment test is performed if there are indications of impairment. External and internal information is used in this context. In the event of impairment, an impairment loss is recorded under other operating expenses. Impairment losses are reversed to the amortized cost and presented in other operating income if the original reasons for impairment no longer apply.

SIGNIFICANT DISCRETIONARY DECISIONS AND SOURCES OF ESTIMATION UNCERTAINTY

Determination of the amotization amount

Assumptions and estimates are required to determine the appropriate level of amortization of property, plant and equipment. This is related in particular to the determination of the underlying remaining useful life. In making these estimates, Merck considers the useful lives of the property, plant and equipment derived from past experience.

Identification of a need to recognize impairment loss and reverse impairment loss

Discretionary decisions are required in the identification of objective evidence of impairment as well as in identifying the need to reverse impairment of property, plant and equipment.

€ million	Land, land rights, and buildings	Plant and machinery	Other facilities, operating and office equipment	Construction in progress and advance payments to vendors and contractors	**Total**
Cost as of Jan. 1, 2018	**3,517**	**4,136**	**1,178**	**1,026**	**9,857**
Changes in scope of consolidation	–	–	–	–	–
Additions	16	41	47	786	890
Disposals	-14	-64	-46	-28	-152
Transfers	319	237	140	-696	–
Reclassification to assets held for sale	-43	-69	-20	-2	-134
Currency translation difference	43	31	6	10	90
Dec. 31, 2018	**3,837**	**4,313**	**1,305**	**1,096**	**10,551**
Accumulated depreciation and impairment losses as of Jan. 1, 2018	**-1,474**	**-2,978**	**-887**	**-4**	**-5,343**
Changes in scope of consolidation	–	–	–	–	–
Depreciation, amortization, and write-downs	-156	-246	-115	–	-517
Impairment losses	-12	-3	-1	-2	-18
Disposals	11	59	42	2	116
Transfers	24	–	-24	–	–
Reversals of impairment losses	–	–	–	–	–
Reclassification to assets held for sale	13	40	13	–	66
Currency translation difference	-16	-23	-5	–	-44
Dec. 31, 2018	**-1,609**	**-3,150**	**-977**	**-4**	**-5,740**
Net carrying amounts as of Dec. 31, 2018	**2,228**	**1,163**	**328**	**1,092**	**4,811**
Cost as of Dec. 31, 2018	**3,837**	**4,313**	**1,305**	**1,096**	**10,551**
Adjustment on initial application of IFRS 16	384	17	67	–	467
Cost as of Jan. 1, 2019[1]	**4,222**	**4,330**	**1,372**	**1,096**	**11,019**
Changes in scope of consolidation	139	271	58	84	553
Additions	190	45	57	812	1,104
Disposals	-81	-88	-46	-8	-223
Transfers	299	327	100	-713	14
Reclassification to assets held for sale	–	–	–	–	–
Currency translation difference	47	26	13	8	95
Dec. 31, 2019	**4,816**	**4,911**	**1,555**	**1,278**	**12,561**
Accumulated depreciation and impairment losses as of Jan. 1, 2019[1]	**-1,609**	**-3,150**	**-977**	**-4**	**-5,740**
Changes in scope of consolidation	–	–	–	–	–
Depreciation	-273	-284	-153	–	-710
Impairment losses	-6	–	–	-1	-8
Disposals	48	85	41	1	176
Transfers	1	-21	–	–	-20
Reversals of impairment losses	–	–	–	–	–
Reclassification to assets held for sale	–	–	–	–	–
Currency translation difference	-14	-19	-10	–	-44
Dec. 31, 2019	**-1,854**	**-3,390**	**-1,100**	**-4**	**-6,348**
Net carrying amounts as of Dec. 31, 2019	**2,962**	**1,521**	**456**	**1,274**	**6,213**

[1] Values effective January 1, 2019, have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes".

Changes in the scope of consolidation in fiscal 2019 mainly included additions to property, plant and equipment from the acquisition of Versum Materials, Inc., United States. A detailed account of the acquisition is included in Note (5) "Acquisitions and divestments".

The largest individual additions to property, plant and equipment in fiscal 2019 were related to the investment projects shown below:

Business sector	**Investment project**	**Country**
Healthcare	Biotech development system	Switzerland
Healthcare	Filling and packaging center	Switzerland
Healthcare	Extention of research center	United States
Healthcare	Logistics center	China
Healthcare	Filling plant	Switzerland
Life Science	Production plant	China
Life Science	Production plant	Ireland
Life Science	Warehouse	Korea
Life Science	Laboratory	China
Life Science	Production plant	Germany
Performance Materials	Research center	Germany
Performance Materials	Production plant	Germany

Impairment losses of € 8 million (2018: € 18 million) were recognized in fiscal 2019. They mainly referred to assets allocated to the Performance Materials business sector and related essentially to a research center in the United Kingdom. Reclassifications to assets held for sale in fiscal 2018 were mainly in connection with the divestment of the Consumer Health business.

The carrying amounts of the right-of-use assets arising from leases for fiscal 2019 are shown separately in Note (21) "Leasing" based on the requirements of IFRS 16 "Leases." The following table shows the carrying amounts of the assets classified as finance leases in 2018 in accordance with the requirements of IAS 17 "Leases".

€ million	Dec. 31, 2018
Land and buildings	8
Other property, plant, and equipment	1
Net carrying amount of assets classified as finance lease	**9**

(21) Leasing

Accounting and measurement policies

Merck has applied the requirements of IFRS 16 "Leases" since January 1, 2019. The effects of the first-time application of IFRS 16 are set out in Note (45) "Effects from new accounting standards and other presentation changes".

For further information on the accounting and measurement policies applied in 2018 for existing leases (IAS 17), please refer to the 2018 Annual Report.

IFRS 16 scope

Merck exercises the option of not recognizing leases of intangible and low-value underlying assets in the context of IFRS 16. If the provision of company cars to employees qualifies as an employee benefit within the meaning of IAS 19, IFRS 16 is not applied. In this case, its balance-sheet treatment is governed solely by IAS 19.

Separation of lease and non-lease components

For leases, Merck generally elects to exercise the option not to separate non-lease components from lease components. Only leases for land, land rights, and buildings are separated into lease and non-lease components.

Depreciation of the right-of-use assets arising from leases

Basically, right-of-use assets are depreciated over the lease term. If it should be considered reasonably certain that an existing purchase option will be exercised or ownership will be automatically transferred at the end of the lease term, depreciation is applicable over the same period to corresponding assets under property, plant and equipment (see Note (20) "Property, plant and equipment").

Determining the incremental borrowing rate

If the interest rate for the lease can not be determined, the incremental borrowing rate is applicable for measuring the lease. At Merck, the incremental borrowing rate is determined on the basis of the risk-free interest rate of the currency of the respective Group company over a similar term. This interest rate is adjusted using a risk surcharge specific to Merck. Merck applies the repayment model to determine the current portion of the lease. The current portion of the lease corresponds to the repayment share of the next 12 months.

Determining the lease term

Where renewal or termination options are available, their exercise is assessed on a case-by-case basis, considering factors such as location strategies, leasehold improvements, and the degree of specificity.

SIGNIFICANT DISCRETIONARY DECISIONS AND SOURCES OF ESTIMATION UNCERTAINTY

Identification of a lease

Discretionary decisions can arise during the identification of leases in answering the question of whether a lessor's right of substitution is substantive. In cases of doubt, Merck classifies rights of substitution as not substantive if the facts and circumstances of the case do not support a different assessment.

Measurement of lease and non-lease components

In the case of leases for land, land rights, and buildings, discretion and estimation uncertainty may occur in the course of separating the lease into lease and non-lease components if observable prices are not available from the contract partner or other potential lessors.

Determining the lease term

When determining the lease term, existing renewal and termination options must be evaluated to determine the probability that such options will be exercised.

These assessments may be discretionary even though they rely on existing and material information on the general economic context, such as location strategies, leasehold improvements, or the degree of specificity. If the available information does not allow a reliable assessment, Merck uses historical experience for comparable situations.

The 20 largest leases accounted for around 50% of total lease liabilities. The subject matter of the leases essentially comprised right-of-use assets for office, warehouse, and laboratory buildings. If options to renew these leases were exercised in future, which is not yet considered likely, this would result in additional potential cash outflows of up to € 279 million.

Where individual contracts included termination options, it was considered unlikely that these would be exercised so that additional lease payments were already considered in the corresponding lease liability.

Determining the incremental borrowing rate

Determining the risk-free interest rate and determining the risk surcharge are both discretionary.

Initial measurement of the lease liability and the right-of-use asset

In measuring the lease liability Merck is subject to discretion and significant estimation uncertainty regarding:

- measuring any payments in the course of promised residual value guarantees, and
- assessing the probability that existing exercise options will be exercised.

In measuring right-of-use assets under leases, Merck is subject to estimation uncertainty regarding any demolition obligations and their resulting payments.

Right-of-use assets under leases are reported in the balance sheet item "Property, plant and equipment" (see Note (20) "Property, plant and equipment").

The reconciliation of net carrying amounts of right-of-use assets from leases was as follows:

	Right-of-use assets			
€ million	Land, land rights and buildings	Plant and machinery	Other facilities, operating and office equipment	**Total**
Net carrying amounts as of Jan. 1, 2019	**391**	**17**	**67**	**476**
Changes in scope of consolidation	36	1	5	42
Additions	175	2	24	200
Disposals	-22	–	-2	-24
Depreciation	-100	-6	-39	-144
Impairment losses	-1	–	–	-1
Reversals of impairment losses	–	–	–	–
Other	9	-1	2	10
Net carrying amounts as of Dec. 31, 2019	**487**	**13**	**58**	**557**

The net carrying amounts of other facilities, operating and office equipment mainly include the right-of-use assets for vehicles.

The leases existing under IFRS 16 affected the consolidated income statement as follows:

€ million	**2019**
Right-of-use assets	
Depreciation	-144
Impairment losses	-1
Reversals of impairment losses	–
Expenses for leasing low-value assets	-22
Expenses for leases with variable lease payments	–
Income from subleasing right-of-use assets	1
Income from sale-and-lease-back transactions	21
Interest expenses for lease liabilities	-14
Total	**-160**

Payments from leases are shown in the consolidated cash flow statement as follows:

€ million	**2019**
Net cash flows from operating activities	-33
Net cash flows from financing activities	-136
Total	**-169**

The expected maturities of the lease liabilities were as follows:

€ million Dec. 31, 2019	Within 1 year	1-5 years	After more than 5 years	**Total**
Future lease payments	119	319	189	627
Interest portion of future payments	-12	-30	-20	-61
Present value of future lease payments	**107**	**289**	**169**	**565**

(22) Other non-financial assets

Accounting and measurement policies

Other non-financial assets are carried at amortized cost. Impairments are recognized for any credit risks.

Other non-financial assets are broken down as follows:

	Dec. 31, 2019			Dec. 31, 2018		
€ million	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Receivables from non-income related taxes	340	4	344	318	8	326
Prepaid expenses	153	14	167	117	5	121
Assets from defined benefit plans	4	–	4	7	–	7
Other assets	94	79	172	94	62	157
Other non-financial assets	**591**	**97**	**688**	**536**	**76**	**611**

(23) Inventories

Accounting and measurement policies

In addition to directly attributable unit costs, manufacturing costs also include overheads attributable to the production process, which are determined on the basis of normal capacity utilization of the production facilities. Goods for resale are recognized at cost. When determining amortized cost or manufacturing costs, the "first-in, first-out" (FIFO) and weighted average cost formulas are used.

Inventories are tested for impairment using a business sector-specific method. Under this method, cost is compared to the net realizable values. The net realizable value corresponds to the expected sale proceeds less any costs for completing and distributing the product. If the net realizable value is lower than the amortized cost, the asset is written down by a corresponding amount which is recognized as an expense in the cost of sales for that period.

In addition to the impairment derived from the procurement and/or sales market, impairment losses may also be necessary for quality reasons or due to a lack of usability of the items, or their shelf life. If the reason for impairment no longer applies, the carrying amount is adjusted to the lower of cost and new net realizable value.

Since inventories are for the most part not manufactured within the scope of long-term production processes, the manufacturing costs exclude borrowing costs.

Inventory prepayments are recognized under other non-financial assets.

Significant discretionary decisions and sources of estimation uncertainty

Identification of impairment losses or reversal of impairment losses

Discretionary decisions are required in the identification of impairment as well as in identifying the need to reverse impairment of inventories. There are estimation uncertainties with respect to the calculation of the net realizable value. In particular, changes in selling prices and expected costs of completion are considered in calculating this value.

Inventories consisted of the following:

€ million	**Dec. 31, 2019**	Dec. 31, 2018
Raw materials and supplies	622	510
Work in progress	943	834
Finished goods/merchandise sold	1,776	1,420
Inventories	**3,342**	**2,764**

The increase in inventories in 2019 was due to accelerating business volumes in all three business sectors. In the Healthcare business sector the build-up occurred mainly due to the positive market development in China due to Erbitux® stocks and products to treat infertility and diabetes.

In the Life Science business sector, the increase in inventories resulted in particular from the Process Solutions and Research Solutions business units due to the good order situation. The increase in inventories in the Performance Materials business sector resulted mainly from the first-time consolidation of Versum Materials, Inc., United States. Impairment losses on inventories in 2019 amounted to € 275 million (2018: € 183 million); reversals of impairment losses came to € 74 million (2018: € 77 million).

The rise in impairments compared to 2018 was predominantly attributable to the Healthcare and Life Science business sectors.

As of the balance sheet date, no inventories were pledged as security for liabilities.

(24) Trade and other receivables

Accounting and measurement policies

Trade accounts receivable without significant financing components that are not the subject of a factoring agreement are measured at the amount of the unconditional claim for consideration on initial recognition. For additions to trade accounts receivable, loss allowances are recognized based on individual transactions to allow for expected credit losses.
At initial recognition, other receivables are measured at fair value plus the direct transaction costs incurred upon acquisition of the asset.

Trade accounts receivable that are potentially designated to be sold on account of a factoring agreement are measured at fair value through other comprehensive income.

The accounting and measurement policies applied in determining loss allowances for trade and other receivables are shown in Note (42) “Management of financial risks” in the “Credit risks” section.

Loss allowances and reversals of loss allowances are presented under the item “Impairment losses and reversals of impairment losses on financial assets (net)” in the consolidated income statement if the asset can be characterized as operational. If the asset can be characterized as financial, it is recognized in financial income or financial expenses.

Further information on the accounting and measurement policies governing financial assets can be found in Note (36) “Other financial assets”.

Trade and other receivables are measured as follows:

	Dec. 31, 2019			Dec. 31, 2018		
€ million	Subsequently measured at amortized cost	Subsequently measured at fair value through other comprehensive income	**Total**	Subsequently measured at amortized cost	Subsequently measured at fair value through other comprehensive income	Total
Gross trade accounts receivable	3,227	25	3,251	2,983	21	3,004
Gross other receivables	340	–	340	314	–	314
Gross trade and other receivables	**3,567**	**25**	**3,591**	**3,297**	**21**	**3,319**
Loss allowances on trade accounts receivable	-77	–	-77	-73	–	-73
Loss allowances on other receivables	-4	–	-4	-3	–	-3
Net trade and other receivables	**3,485**	**24**	**3,510**	**3,222**	**21**	**3,243**
thereof: current	3,463	24	3,488	3,205	21	3,226
thereof: non-current	22	–	22	17	–	17

In fiscal 2019, trade accounts receivable in Italy with a nominal value of € 22 million (2018: € 28 million) were sold for € 22 million (2018: € 28 million). These receivables did not involve any further rights of recovery against Merck.

The following table provides details on the development of trade accounts receivable before loss allowances:

€ million	**2019**	2018
Jan. 1	**3,004**	**3,277**
Additions	19,505	16,395
thereof: attributable to performance obligations satisfied in prior periods	1	1
Customer payments/derecognition of uncollectable receivables	-19,452	-16,590
Effects of currency translation	43	6
Reclassification to assets held for sale	–	-86
Changes in scope of consolidation/other	152	3
Dec. 31	**3,251**	**3,004**

(25) Contract assets

Accounting and measurement policies

Contract assets represent contractual claims to receive payment from customers for whom the contractual performance obligation has already been fulfilled although an unconditional claim to payment has yet to arise.

The following table shows the change in contract assets:

€ million	**2019**	2018
Jan. 1	**52**	**35**
Additions	311	205
thereof: attributable to performance obligations satisfied in prior periods	7	–
Reclassification to trade accounts receivable	-270	-188
Reclassification to assets held for sale	–	–
Effects of currency translation	10	1
Changes in scope of consolidation/other	53	–
Dec. 31	**156**	**52**

Contract assets resulted in particular from rendering services and manufacturing of customer-specific equipment in the Life Science and Performance Materials business sectors. In the reporting period, the changes in the scope of consolidation/other were mainly attributable to the acquisition of Versum Materials, Inc., United States (see Note (5) "Acquisitions and divestments").

(26) Other provisions

Other provisions developed as follows:

€ million	Litigation	Restructuring	Employee benefits	Environmental protection	Acceptance and follow-on obligations	Interest and penalties related to income taxes	Other	**Total**
Jan. 1, 2019	**551**	**90**	**316**	**137**	**30**	**46**	**211**	**1,381**
Additions	61	113	194	6	11	25	76	485
Utilizations	-24	-25	-101	-8	-6	-9	-48	-222
Release	-55	-51	-68	-3	-14	-20	-63	-274
Interest effect	14	–	1	11	–	–	–	26
Currency translation difference	–	–	3	–	–	–	2	6
Changes in scope of consolidation/other	1	8	3	–	–	9	1	23
Reclassification to assets held for sale	–	–	–	–	–	–	–	–
Dec. 31, 2019	**548**	**135**	**347**	**143**	**21**	**51**	**179**	**1,424**
thereof: current	531	62	110	25	10	51	144	933
thereof: non-current	17	73	237	117	11	–	35	490

Litigation

Accounting and measurement policies – other provisions for litigation

To assess a recognition obligation in relation to provisions for litigation and to quantify future outflows of resources, Merck draws on the knowledge of the legal department as well as outside counsel.

Assessing the need for recognizing provisions for litigation is based on the likelihood of possible outcomes for proceedings. In particular, the factors influencing this likelihood are:

- the validity of the arguments brought forward by the opposing party and
- the legal situation and current court rulings in comparable proceedings in the jurisdiction in question.

In addition, the following factors are also relevant in measuring other provisions for litigation:

- the duration of proceedings in pending legal disputes,
- the applicable license rate plus an expected infringement surcharge,
- the usual damages and fines for other legal disputes, and
- the discount factor to be used.

Significant discretionary decisions and sources of estimation uncertainty – other provisions for litigation

Like the measurement of provisions, the assessment of a recognition obligation for provisions for litigation is to a particular extent subject to a degree of estimation uncertainty. The uncertainties relate, in particular, to the assessment of the likelihood and the amount of an outflow of resources to cover probable obligations.

The legal matters described below represented the most significant legal risks.

Product-related and patent disputes

Rebif®: Merck is involved in a patent dispute with Biogen Inc., United States, (Biogen) in the United States. Biogen claims that the sale of Rebif® in the United States infringes on a Biogen patent. The disputed patent was granted to Biogen in the United States in 2009. Subsequently, Biogen sued Merck and other pharmaceutical companies for infringement of this patent. Merck defended itself against all allegations and brought a countersuit against Biogen claiming that the patent was invalid and not infringed by Merck's actions. In the first instance, a jury recognized the invalidity of the patent. This jury verdict was overturned by the judge in the same instance in September 2018. For the time being, the patent is thus deemed to be legally valid and to have been infringed. Merck filed a complaint with the United States Court of Appeals for the Federal Circuit (second instance) against the first-instance ruling in October 2018. A decision is expected in the first half of 2020. Merck recognized provisions in a three-digit million euro amount for these proceedings. Cash outflow within the next 12 months is considered possible at present.

PS-VA liquid crystals mixtures: In the Performance Materials business sector, Merck is involved in a legal dispute with JNC Corporation, Japan, (JNC). JNC claims that by manufacturing and marketing certain liquid crystals mixtures, Merck has infringed JNC patents. JNC asserts its claims in court in two jurisdictions. Merck maintains that JNC's patent infringement assertion is invalid in three jurisdictions owing to relevant prior art and has filed the relevant nullity actions. Two jurisdictions have yet to reach their final decisions. In 2019, the nullity action was concluded in one jurisdiction with legally binding effect in favor of Merck in 2019. In

this jurisdiction, JNC refrained from filing a patent infringement claim. In view of this development, the provision was reduced in 2019. After the adjustment, the remaining provision for this matter amounts to a double-digit million euro sum. Cash outflow within the next 12 months is considered possible at present.

Antitrust and other proceedings

Antitrust review proceedings for the acquisition of Sigma-Aldrich Corporation, United States, (Sigma-Aldrich): On July 6, 2017, Merck received notice from the European Commission (EU Commission) in connection with the antitrust review proceedings for the acquisition of Sigma-Aldrich, in which the EU Commission informed Merck of its preliminary conclusion that Merck and Sigma-Aldrich allegedly transmitted incorrect and/or misleading information within the scope of the acquisition of Sigma-Aldrich. The EU Commission received registration of the merger on April 21, 2015, and granted clearance on June 15, 2015, subject to the condition that Merck and Sigma-Aldrich divest parts of the European solvents and inorganic chemicals businesses of Sigma-Aldrich in order to resolve antitrust concerns. According to the preliminary viewpoint of the EU Commission communicated in a letter dated July 6, 2017, Merck and Sigma-Aldrich withheld related important information about an innovation project. According to the EU Commission, the innovation project should have been included in the remedies package. At present, an administrative procedure is carried out at the EU Commission which might result in the issuance of a fine. Merck is entitled to legal recourse should a fine be imposed. The ongoing investigations are limited to the examination of violations of EU merger control procedures and do not affect the validity of the EU Commission’s decision to approve the merger. A provision in a fixed double-digit million-euro amount was still in place for this issue. A potential outflow of resources is considered possible for 2020.

Paroxetine: In connection with the divested generics business, Merck is subject to antitrust investigations by the British Competition and Market Authority (CMA) in the United Kingdom. In March 2013, the authorities informed Merck of the assumption that a settlement agreement entered into in 2002 between Generics (UK) Ltd. and several subsidiaries of GlaxoSmithKline plc, United Kingdom, in connection with the antidepressant drug paroxetine violates British and European competition law. Merck, the then owner of Generics (UK) Ltd., was allegedly involved in the negotiations for the settlement agreement and is therefore liable. The investigations into Generics (UK) Ltd. started in 2011, without this being known to Merck. On February 11, 2016, the CMA imposed a fine in this matter. Merck has taken legal action against this fine. The Appeals Tribunal has since submitted the relevant legal questions to the European Court of Justice (CJEU) for a preliminary ruling. The CJEU confirmed in January 2020 that such settlement agreements may breach European competition law. Appropriate accounting measures have been taken. A decision and an outflow of resources within the next 12 months are considered possible. Merck recognized provisions in a low double-digit million-euro amount for these proceedings.

In addition to provisions for the above-mentioned legal disputes, provisions existed as of the balance sheet date for various other pending legal disputes.

Restructuring

Accounting and measurement policies – other provisions for restructuring projects

Merck uses a formal restructuring plans to assess recognition obligation for provisions for restructuring projects and the amount of the expected outflow of resources.

The main parameters in determining the amount of the provisions are

- the size of the affected business units,
- the planned implementation date of the restructuring plan, and
- the anticipated expenses arising from the change in or termination of the working relationships of the affected employees.

Significant discretionary decisions and sources of estimation uncertainty – other provisions for restructuring projects

Estimation uncertainty about the provisions for restructuring primarily relate to determining the amount of the expected outflow of resources.

The uncertainty factors arise in particular from the change in or termination of the working relationships of the affected employees.

Restructuring provisions mainly included commitments to employees in connection with communicated restructuring projects and provisions for related onerous contracts.
The additions to restructuring provisions in the amount of € 113 million were mainly attributable to reorganizational measures in the Performance Materials business sector, as well as to the ongoing expansion of shared services activities and the related relocation of activities. Outflows of resources are expected within the next five years.
In addition to the aforementioned programs, restructuring provisions also included obligations from the Life Science business sector, which, will carry out relocations that have already been decided and communicated as well as the gradual closure of operations at various German sites by 2022.

Employee benefits

Provisions for employee benefits include obligations from long-term variable compensation programs. More information on these compensation programs can be found in Note (33) “Share-based compensation”.

Obligations for partial retirement programs and other severance payments that were not set up in connection with restructuring programs as well as obligations in connection with long-term working hour accounts and anniversary bonuses are also included under provisions for employee benefits.

With respect to provisions for pensions and other post-employment benefits, see Note (32) “Provisions for pensions and other post-employment benefits”.

Environmental protection

ACCOUNTING AND MEASUREMENT POLICIES – OTHER PROVISIONS FOR ENVIRONMENTAL PROTECTION

To assess a recognition obligation in relation to provisions for environmental protection and to quantify future outflows of resources, Merck draws on external appraisals and the knowledge of in-house and outside specialists.

The following are key parameters in calculating the present value of the future settlement amount of provisions for environmental protection:

- the future settlement date,
- the actual extent of environmental damages,
- the applicable remediation methods,
- the associated future costs, and
- the discount factor.

Measurement is carried out regularly in consultation with independent experts.

Significant discretionary decisions and sources of estimation uncertainty – other provisions for environmental protection

The assessment of a recognition obligation as well as the measurement of the provisions for environmental protection are subject to a degree of estimation uncertainty.

The uncertainty relates, in particular, to the assessment of the timing and likelihood of a future outflow of resources and assessment of the extent of necessary remediation measures and the related calculation of the amount of present and potential liabilities.

Provisions for environmental protection resulted in particular from obligations for soil remediation and groundwater protection in connection with the crop protection business in Germany and Latin America that was discontinued in 1987.

Acceptance and follow-on obligations

Accounting and measurement policies – other provisions for acceptance and follow-on obligations

The assessment of the recognition obligation for provisions for acceptance and follow-on obligations and the quantification of future outflows of resources is based on internal project plans as well as on the assessment of the respective matters by in-house and external specialists.

The main parameters in determining the amount of the provision are

- the ability to use or potential for modification of secured manufacturing capacities at third-party providers, particularly for pharmaceutical compounds,
- the number and duration of continued treatments of affected patients in clinical development programs,
- the expected date or period of the outflow of resources, and
- the expectations concerning future events influencing the obligations.

Significant discretionary decisions and sources of estimation uncertainty – other provisions for acceptance and follow-on obligations

Estimation uncertainty regarding the provisions for acceptance and follow-on obligations primarily relates to determining the amount of the expected outflow of resources.

The uncertainties primarily involve assessing future events that will influence the obligation.

Provisions for acceptance and follow-on obligations primarily considered costs stemming from discontinued development projects as well as obligation surpluses from onerous contracts. Utilizations and releases were mainly attributable to development projects discontinued in previous years.

Interest and penalties related to income taxes

Provisions for interest and penalties related to income taxes mainly comprised interest payables associated with or resulting from tax payables.

Miscellaneous other provisions

Miscellaneous other provisions mainly comprised provisions related to remaining risks from the divestment of the Consumer Health business, for warranty obligations, and for uncertain commitments from contributions, fees, and other duties.

(27) Contingent liabilities

Accounting and measurement policies

To identify contingent liabilities from litigation and tax matters, Merck draws on the knowledge of the legal department and the tax department as well as the opinions of external consultants and attorneys.

The key factors in the assessment to identify contingent liabilities are:

- the validity of the arguments brought forward by the opposing party or the tax authority and
- the legal situation and current court rulings in comparable proceedings in the jurisdiction in question.

The amount of the contingent liability is based on the best possible estimate which in turn is based on likelihood of possible outcomes of proceedings and on the applicable license rate in patent disputes.

Significant discretionary decisions and sources of estimation uncertainty

The identification and the measurement of contingent liabilities are both strongly associated with discretionary decisions and estimation uncertainties.
This applies for assessing the likelihood of an outflow of resources and determining its amount for future and potential obligations.

€ million	**Dec. 31, 2019**	Dec. 31, 2018
Contingent liabilities from litigation and tax matters	128	47
Other contingent liabilities	1	1

Contingent liabilities from litigation mainly related to obligations under civil law, labor law, and antitrust law. The potential civil law obligations primarily related to potential liabilities to pay damages due to a legal dispute under antitrust law. It is possible that Merck would be subject to claims for compensation for damages asserted by health insurance companies due to excessively high drug prices in case of a valid judgment under antitrust law.

In addition, there are contingent liabilities from various legal disputes with Merck & Co., Inc., United States, of the United States (outside the United States and Canada: MSD), among other things due to breach of the co-existence agreement entered into between the two companies and/or trademark/name right infringement regarding the use of the designation "Merck". In this context, Merck has sued MSD in various countries and has been sued by MSD in the United States. An outflow of resources – except costs for legal defense – was not deemed sufficiently probable as of the balance sheet date to justify the recognition of a provision. Since the contingent liability from these legal disputes could not be reliably quantified as of the balance sheet date, this matter was not considered in the table presented above.

Contingent liabilities from tax matters included various non-German income and non-income tax matters that were mainly attributable to the determination of earnings under tax law, customs regulations, and excise tax matters.

(28) Other non-financial liabilities

Accounting and measurement policies

Accruals for personnel expenses included in other non-financial liabilities comprise, in particular, liabilities resulting from vacation entitlements, bonuses, and social security contributions.

Contract liabilities include payments received by Merck prior to completion of contractual performance. In addition to consideration received within the scope of collaboration agreements, this applies particularly to service agreements.

Other non-financial liabilities comprise the following:

	Dec. 31, 2019			Dec. 31, 2018		
€ million	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Accruals for personnel expenses	681	–	681	687	–	687
Contract liabilities	291	87	379	332	4	336
Liabilities from non-income related taxes	207	5	212	171	15	186
Other accruals	32	1	33	21	–	22
Other non-financial liabilities	**1,211**	**93**	**1,304**	**1,211**	**19**	**1,230**

The following table shows the development of contract liabilities in the period under review:

	2019			2018		
€ million	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Jan. 1	**332**	**4**	**336**	**311**	**194**	**506**
Additions	693	209	902	391	2	393
Recognition of income/reversal	-861	-3	-864	-563	-2	-564
Cumulative catch-up adjustments to revenue	–	–	–	–	–	–
Reclassification from non-current to current	122	-122	–	193	-193	–
Reclassification to assets held for sale	–	–	–	–	–	–
Currency translation difference	2	–	2	2	–	2
Changes in scope of consolidation/other	3	–	3	-2	2	–
Dec. 31	**291**	**87**	**379**	**332**	**4**	**336**

The increase in contract liabilities compared to the 2018 balance sheet date was mainly attributable to an accrued upfront payment from the collaboration agreement with GlaxoSmithKline plc, United Kingdom (see Note (6) "Collaboration agreements").

As of January 1, 2019, contract liabilities amounted to € 336 million (January 1, 2018: € 506 million), of which € 328 million (2018: € 299 million) was recognized through profit or loss in fiscal 2019.

(29) Trade and other payables

Accounting and measurement policies

Trade and other payables are subsequently measured at amortized cost.

Trade and other payables amounted to € 2,054 million (December 31, 2018: € 1,766 million). This item included accrued amounts of € 673 million (December 31, 2018: € 622 million) from outstanding invoices.

Employees

(30) Number of employees

As of December 31, 2019, the number of employees at Merck Group stood at 57,036 (December 31, 2018: 51,713 employees).

The following table provides the annual average number of employees by function. The 2018 figure also included the share of employees at the Consumer Health business which was divested as of December 1, 2018.

	2019	2018
Production	16,455	16,239
Administration	10,338	9,856
Research and development	7,559	7,243
Supply chain	4,109	4,012
Marketing and sales	13,939	15,445
Other	1,207	965
Average number of employees	**53,607**	**53,760**

(31) Personnel expenses

Personnel expenses comprised the following:

€ million	**2019**	2018
Wages and salaries	4,293	4,111
Compulsory social security contributions and other costs	631	594
Pension expenses	357	319
Personnel expenses	**5,281**	**5,024**

Personnel expenses comprised expenses of € 152 million (2018: € 130 million) for defined contribution plans which are funded exclusively using external funds and therefore do not represent any obligation for Merck other than making contribution payments. In addition, employer contributions amounting to € 86 million (2018: € 81 million) were transferred to the German statutory pension insurance system and € 68 million (2018: € 65 million) to statutory pension insurance systems abroad.

(32) Provisions for pensions and other post-employment benefits

Accounting and measurement policies

The present value of the defined benefit obligation is determined by expert third parties who prepare actuarial appraisals for this purpose.

The actuarial assumptions which are used as the basis for the calculation of the defined benefit obligation, e.g. discount rates, rates of salary increases, and pension trends, were determined on a country-by-country basis in line with the economic conditions prevailing in each country. Furthermore, the latest country-specific mortality tables are used. The respective discount rates are generally determined on the basis of the returns on high-quality corporate bonds issued with adequate maturities and currencies. For euro-denominated obligations, bonds with ratings of at least "AA" or comparable from one of the leading rating agencies as of the reporting date, and a euro swap rate of adequate duration serve as the basis for the data.

Apart from the net balance of interest expense on the defined benefit obligations and interest income from the plan assets, which is recorded under the financial result, the expenses for defined benefit pension systems are allocated to the individual functional areas in the consolidated income statement.

The calculation of the defined benefit obligations was based on the following actuarial parameters:

	Germany		Switzerland		United Kingdom		Other countries	
	2019	2018	**2019**	2018	**2019**	2018	**2019**	2018
Discount rate	1.30%	1.97%	0.17%	1.00%	2.06%	2.95%	2.36%	3.16%
Future salary increases	2.50%	2.51%	1.74%	1.74%	–	2.00%	3.22%	3.21%
Future pension increases	1.74%	1.75%	–	–	2.65%	2.94%	1.56%	1.77%

These were average values weighted by the present value of the respective defined benefit obligation.

Significant discretionary decisions and sources of estimation uncertainty

Determining the present value of the obligation

The determination of the present value of the obligation from defined benefit pension plans primarily requires discretionary judgment as regards the selection of methods to determine the discount rate and to select suitable mortality tables, as well as estimates of future salary and pension increases.

The following overview shows how the present value of all defined benefit obligations would have been impacted by changes to relevant actuarial assumptions.

€ million	**Dec. 31, 2019**	Dec. 31, 2018
Increase (+)/decrease (–) in present value of all defined benefit obligations if		
the discount rate were 50 basis points higher	-550	-435
the discount rate were 50 basis points lower	626	503
the expected rate of future salary increase were 50 basis points higher	175	151
the expected rate of future salary increase were 50 basis points lower	-160	-130
the expected rate of future pension increase were 50 basis points higher	291	251
the expected rate of future pension increase were 50 basis points lower	-234	-196

Sensitivities are determined on the basis of the respective parameters in question, with all other measurement assumptions remaining unchanged.

Depending on the legal, economic, and fiscal circumstances prevailing in each country, different retirement benefit systems are provided for the employees. Generally, these systems are based on the years of service and salaries of the employees. Pension obligations comprise both obligations from current pensions and accrued benefits for pensions payable in the future.

In order to limit the risks of changing capital market conditions and other developments, for the past number of years newly hired employees have been offered plans that are not based on final salary.

The value recognized in the consolidated balance sheet for pensions and other post-employment benefits was derived as follows:

€ million	**Dec. 31, 2019**	Dec. 31, 2018
Present value of all defined benefit obligations	**5,644**	**4,719**
Fair value of the plan assets	-2,692	-2,391
Funded status	**2,952**	**2,328**
Effects of the asset ceilings	1	1
Net defined benefit liability	**2,953**	**2,329**
Assets from defined benefit plans	4	7
Provisions for pensions and other post-employment benefits	**2,957**	**2,336**

The defined benefit obligations were based on the following types of benefits provided by the respective plan:

	Dec. 31, 2019				
€ million	Germany	Switzerland	United Kingdom	Other countries	**Total**
Benefit based on final salary					
Annuity	3,081	1	530	99	3,711
Lump sum	–	–	–	139	139
Installments	1	–	–	–	1
Benefit not based on final salary					
Annuity	677	942	–	85	1,704
Lump sum	–	–	6	38	44
Installments	6	–	–	–	6
Other	–	–	–	10	10
Medical plan	–	–	–	29	29
Present value of defined benefit obligations	**3,765**	**943**	**536**	**400**	**5,644**
Fair value of the plan assets	**1,222**	**778**	**518**	**174**	**2,692**

The vast majority of defined benefit obligations of German entities were attributable to plans that encompass old-age, disability, and surviving dependent pensions. On the one hand, these obligations were based on benefit rules comprising benefit commitments dependent upon years of service and final salary from which newly hired employees have been excluded. On the other hand, the benefit rules applicable to employees newly hired since January 1, 2005, comprise a direct commitment that is not based on the final salary. The benefit entitlement resulted from the cumulative total of annually determined pension components that were calculated based on a defined benefit expense and an age-dependent annuity table. Statutory minimum funding obligations did not exist.

Pension obligations in Switzerland mainly comprised old-age, disability, and surviving dependent benefits regulated by law. The employer and the employees made contributions to the plans. Merck had to observe the existing statutory minimum funding obligations.

Pension obligations in the United Kingdom resulted primarily from benefit plans which are based on years of service and final salary and were closed to newly hired employees in 2006. The agreed benefits comprised old-age, disability, and surviving dependent benefits. The employer and the employees made contributions to the plans. Merck had to observe the existing statutory minimum funding obligations.

The following table shows the development of the net defined benefit liability:

€ million	Present value of all defined benefit obligations	Fair value of the plan assets	Effects of the asset ceilings	**Net defined benefit liability**
Jan. 1, 2019	**-4,719**	**2,391**	**-1**	**-2,329**
Current service cost	-162	–	–	-162
Interest expense	-93	–	–	-93
Interest income	–	46	–	46
Plan administration costs recognized in income	–	-2	–	-2
Past service cost	-3	–	–	-3
Gains (+) or losses (–) on settlement	–	–	–	–
Currency effects recognized through profit or loss	-21	17	–	-4
Other effects recognized through profit or loss	-2	–	–	-2
Items recognized through profit or loss	**-281**	**61**	**–**	**-220**
Remeasurements of defined benefit obligations				
Actuarial gains (+)/losses (–) arising from changes in demographic assumptions	5	–	–	5
Actuarial gains (+)/losses (–) arising from changes in financial assumptions	-727	–	–	-727
Actuarial gains (+)/losses (–) arising from experience adjustments	35	–	–	35
Remeasurement of plan assets				
Actuarial gains (+)/losses (–) arising from experience adjustments	–	199	–	199
Change in effects of the asset ceilings				
Actuarial gains (+)/losses (–)	–	–	–	–
Actuarial gains (+)/losses (–)	**-687**	**199**	**–**	**-488**
Payments made	125	-49	–	76
Employer contributions	–	37	–	37
Employee contributions	-15	15	–	–
Payment transactions	**110**	**3**	**–**	**113**
Changes in scope of consolidation	-30	6	–	-24
Reclassification to liabilities directly related to assets held for sale	–	–	–	–
Currency translation differences recognized in equity	-42	37	–	-5
Other changes	5	-5	–	–
Other	**-67**	**38**	**–**	**-29**
Dec. 31, 2019	**-5,644**	**2,692**	**-1**	**-2,953**

€ million	Present value of all defined benefit obligations	Fair value of the plan assets	Effects of the asset ceilings	**Net defined benefit liability**
Jan. 1, 2018	**-4,707**	**2,452**	**-1**	**-2,256**
Current service cost	-161	–	–	-161
Interest expense	-85	–	–	-85
Interest income	–	42	–	42
Plan administration costs recognized in income	–	-2	–	-2
Past service cost	4	–	–	4
Gains (+) or losses (–) on settlement	–	–	–	–
Currency effects recognized through profit or loss	-17	14	–	-3
Other effects recognized through profit or loss	3	–	–	3
Items recognized through profit or loss	**-256**	**54**	**–**	**-202**
thereof: attributable to the divested Consumer Health business	-7	2	–	-5
Remeasurements of defined benefit obligations				
Actuarial gains (+)/losses (–) arising from changes in demographic assumptions	-40	–	–	-40
Actuarial gains (+)/losses (–) arising from changes in financial assumptions	139	–	–	139
Actuarial gains (+)/losses (–) arising from experience adjustments	-18	–	–	-18
Remeasurement of plan assets				
Actuarial gains (+)/losses (–) arising from experience adjustments	–	-115	–	-115
Change in effects of the asset ceilings				
Actuarial gains (+)/losses (–)	–	–	–	–
Actuarial gains (+)/losses (–)	**81**	**-115**	**–**	**-34**
Payments made	124	-49	–	75
Employer contributions	–	48	–	48
Employee contributions	-14	14	–	–
Payment transactions	**110**	**13**	**–**	**123**
Changes in scope of consolidation	–	–	–	–
Reclassification to liabilities directly related to assets held for sale	48	-5	–	43
Currency translation differences recognized in equity	-10	5	–	-5
Other changes	15	-13	–	2
Other	**53**	**-13**	**–**	**40**
Dec. 31, 2018	**-4,719**	**2,391**	**-1**	**-2,329**

The actual income from plan assets amounted to € 245 million (2018: loss of € 73 million).

Covering the benefit obligations with financial assets represents a means of providing for future cash outflows, which are required in some countries (for example Switzerland and the United Kingdom) on the basis of legal requirements and in other countries (for example Germany) on a voluntary basis.

Both the benefit obligations as well as the plan assets are subject to fluctuations over time. The reasons for such fluctuations could include changes in market interest rates and thus the discount rate, as well as adjustments to other actuarial assumptions (such as life expectancy or expected future increases in pension). This could lead to – or cause an increase in – underfunding. Depending on statutory regulations, it could become necessary in some countries to reduce underfunding through additions of liquid assets.

In order to minimize fluctuations of the net defined benefit liability, in managing its plan assets, Merck also pays attention to potential fluctuations in liabilities. The portfolio is structured in such a way that, in the ideal scenario, plan assets and defined benefit obligations develop in opposing directions when exposed to exogenous factors. This applies in particular to interest rate fluctuations – thus creating a natural defense against these factors.

The fair value of the plan assets can be allocated to the following categories:

	Dec. 31, 2019			Dec. 31, 2018		
€ million	**Quoted market price in an active market**	**No quoted market price in an active market**	**Total**	Quoted market price in an active market	No quoted market price in an active market	Total
Cash and cash equivalents	191	–	191	147	–	147
Equity instruments	609	–	609	592	–	592
Debt instruments	1,273	–	1,273	993	–	993
Direct investments in real estate	–	121	121	–	105	105
Investment funds	395	1	396	458	–	458
Insurance contracts	–	77	77	–	77	77
Other	19	6	25	19	–	19
Fair value of the plan assets	**2,487**	**205**	**2,692**	**2,209**	**182**	**2,391**

Plan assets did not directly include financial instruments issued by Group companies or real estate used by Group companies.

Employer contributions to plan assets and direct payments to plan beneficiaries are expected to amount to € 37 million and € 79 million, respectively, next year.

The weighted duration of defined benefit obligations amounted to 22 years.

(33) Share-based payments

Accounting and measurement policies

Corresponding provisions are recognized for the current share-based compensation program with cash settlement at Merck (the Merck Long-Term Incentive Plan) and reported under employee benefits (see Note (26) "Other provisions").

The fair value of the obligations is recalculated by an external expert using a Monte Carlo simulation on each balance sheet date. The main parameters in the measurement of the share-based compensation programs with cash-settlement are long-term indicators of company performance and the price movement of Merck shares in relation to the DAX®.

The expected volatilities are based on the implicit volatility of Merck shares and the DAX® in accordance with the remaining term of the respective tranche. The dividend payments incorporated into the valuation model are based on medium-term dividend expectations.

Changes to the intrinsic value of share-based compensation programs are allocated to the respective functional costs according to the causation principle. Fair value changes are recognized in financial income or finance costs.

Significant discretionary decisions and sources of estimation uncertainty

The measurement of long-term share-based compensation programs implies extensive estimation uncertainty. The following overview shows the amounts by which the non-current provisions (carrying amount as of December 31, 2019: € 63 million / carrying amount as of December 31, 2018: € 54 million) would have been impacted by changes in the DAX® or the closing price of the Merck share on the balance sheet date. The amounts stated would have led to a corresponding reduction or increase in profit before income tax.

		Increase (+)/decrease (–) of the provision	
€ million		**Dec. 31, 2019**	Dec. 31, 2018
Variation of Merck share price	10%	16	14
	-10%	-16	-15
Change in the DAX®	10%	-9	-10
	-10%	9	8

Sensitivities were determined on the basis of the respective parameters in question, with all other measurement assumptions remaining unchanged. The 2017 tranche reported under current provisions will not be subject to any value fluctuations between December 31, 2019, and the payout date and was therefore excluded from the sensitivity analysis (December 31, 2018: exclusion of 2016 tranche).

These share-based compensation programs with cash settlement in place at Merck are aligned not only with target achievement based on key performance indicators, but above all with the long-term performance of Merck shares. Certain executives and employees could be eligible to receive a certain number of virtual shares – Merck Share Units (MSUs) – at the end of a three-year performance cycle. The number of MSUs that could be received depends on the individual grant defined for the respective person and the average closing price of Merck shares in Xetra® trading during the last 60 trading days prior to January 1 of the respective performance cycle (reference price). An obligatory personal investment is not a precondition to receive payments apart from Executive Board members. When the three-year performance cycle ends, the number of MSUs to then be granted is determined based on the development of defined key performance indicators (KPIs).

These KPIs are the performance of the Merck share price compared to the performance of the DAX® with a weighting of 50%, the development of the EBITDA pre margin during the performance cycle as a proportion of a defined target value with a weighting of 25%, and the development of organic sales growth as a proportion of a defined target value, also with a weighting of 25%.

Depending on the development of the KPIs, at the end of the respective performance cycle the eligible participants are granted between 0% and 150% of the MSUs they could be eligible to receive. Based on the MSUs granted, the eligible participants receive a cash payment at a specified point in time in the year after the three-year performance cycle has ended. The value of a granted MSU, which is relevant for payment, corresponds to the average closing price of Merck shares in Xetra® trading during the last 60 trading days prior to the end of the performance cycle. The payout amounts of the respective tranches are limited to two and a half times the individual grant.

The Executive Board members have their own Long-Term Incentive Plan, the conditions of which largely correspond to the Long-Term Incentive Plan described here. A description of the plan for the Executive Board can be found in the compensation report, which is part of the Statement on Corporate Governance.

The following table presents the key parameters as well as the development of the potential number of Merck Share Units (MSUs) for the individual tranches.

	2017 tranche	2018 tranche	2019 tranche
Performance cycle	Jan. 1, 2017 – Dec. 31, 2019	Jan. 1, 2018 – Dec. 31, 2020	Jan. 1, 2019 – Dec. 31, 2021
Term	3 years	3 years	3 years
Reference price of Merck shares in € (60-day average Merck share price prior to the start of the performance cycle)	95.63	91.73	93.75
DAX® value (60-day average of the DAX® prior to the start of the performance cycle)	10,822.06	13,089.39	11,304.33
Potential number of MSUs			
Potential number offered for the first time in 2017	853,624	–	–
Forfeited	24,897	–	–
Dec. 31, 2017	828,727	–	–
Potential number offered for the first time in 2018	–	891,345	–
Forfeited	13,988	37,953	–
Transferred as part of the divestment of the Consumer Health business	39,889	23,760	–
Dec. 31, 2018	774,850	829,632	–
Potential number offered for the first time in 2019	–	–	876,061
Forfeited	54,512	52,957	37,122
Dec. 31, 2019	**720,338**	**776,675**	**838,939**

The value of the provisions as of December 31, 2019, was € 113 million (December 31, 2018: € 114 million). Net expenses of € 60 million were incurred in fiscal 2019 (2018: net expenses of € 92 million). The three-year tranche issued in 2016 ended at the end of 2018; an amount of € 60 million was paid out in 2019. The three-year tranche issued in fiscal 2017 ended at the end of 2019; a payout of € 50 million is expected for 2020.

Capital Structure, Investments, and Financing Activities

(34) Equity

Accounting and measurement policies

Accounting treatment of the general partner's equity

As a partnership limited by shares, Merck KGaA has two different shareholder groups who have contributed to the company: The general partner E. Merck KG as the personally liable partner and the shareholders.

From an accounting perspective, the contributions both shareholder groups are treated as equity, regardless of the general partner's option to terminate its capital share. For this to happen, the limited liability shareholders must be able to decide, on the basis of the Articles of Association of Merck KGaA, on the conversion of the company into a stock corporation and thus limit the general partner's settlement claim to fulfillment in equity instruments.

Measurement of non-controlling interests within the scope of a company acquisition

In cases where a company was not acquired in full, non-controlling interests are measured using the fair value of the proportionate share of net assets.

Equity capital/capital reserves

The equity capital of the company consists of the subscribed capital composed of shares and the equity interest held by the general partner E. Merck KG (general partner's equity). As of the balance sheet date, the company's subscribed capital amounting to € 168 million was divided into 129,242,251 no-par value bearer shares plus one registered share. Each share therefore corresponds to € 1.30 of the subscribed capital. The amount resulting from the issue of shares by Merck KGaA exceeding the nominal amount was recognized in the capital reserves. The equity interest held by the general partner amounted to € 397 million. As in 2018, the subscribed capital did not change in fiscal 2019.

E. Merck KG's share of net profit

E. Merck KG and Merck KGaA engage in reciprocal net profit transfers. This makes it possible for E. Merck KG, the general partner of Merck KGaA, and the shareholders to participate in the net profit/loss of Merck KGaA in accordance with the ratio of the general partner's equity interest and the subscribed capital (70.274% or 29.726% of the equity capital).

The allocation of net profit/loss is based on the net income of both E. Merck KG and Merck KGaA determined in accordance with the provisions of the German Commercial Code. These results are adjusted for trade tax and/or corporation tax and create the basis for the allocation of net profit/loss. The adjustment for corporation tax is made to compensate for the difference in the tax treatment between the general partner and the limited liability shareholders. Corporation tax is only calculated on the income received by the limited liability shareholders. Its equivalent is the income tax applicable to the partners of E. Merck KG which must be paid by them directly. The adjustment thus ensures that the share in net profit corresponds to the respective interests held by the two shareholder groups.

Appropriation of profits

The profit distribution to be resolved upon by shareholders also defines the amount of that portion of net profit/loss freely available to E. Merck KG. If the shareholders resolve to carry forward or to allocate to retained earnings a portion of Merck KGaA's net retained profit to which they are entitled, E. Merck KG shall be obliged to allocate to the profit brought forward/retained earnings of Merck KGaA a comparable sum determined according to the ratio of subscribed capital to general partner's equity. This ensures that the retained earnings and the profit carried forward of Merck KGaA correspond to the ownership ratios of the shareholders on the one hand, and E. Merck KG on the other hand. Consequently, for distributions to E. Merck KG, only the amount is available that results after netting the profit transfer of Merck KGaA with the amount either allocated or withdrawn by E. Merck KG from retained earnings/profit carried forward. This amount corresponds to the sum paid as a dividend to the shareholders and reflects their pro rata shareholding in the company.

The reciprocal net profit/loss transfer between E. Merck KG and Merck KGaA as stipulated by the Articles of Association was as follows:

		2019		2018	
€ million		**E. Merck KG**	**Merck KGaA**	E. Merck KG	Merck KGaA
Result of E. Merck KG before reciprocal profit transfer, adjusted for trade tax		-25	–	-24	–
Net income of Merck KGaA before reciprocal profit transfer		–	625	–	616
Corporation tax		–	14	–	20
Basis for appropriation of profits	**(100%)**	**-25**	**639**	**-24**	**637**
Profit transfer to E. Merck KG (ratio of general partner's equity to equity capital)	(70.274%)	449	-449	447	-447
Profit/loss transfer to Merck KGaA (ratio of subscribed capital to equity capital)	(29.726%)	7	-7	7	-7
Corporation tax		–	-14	–	-20
Net income		**431**	**169**	**430**	**162**

The result of E. Merck KG on which the appropriation of profits adjusted for trade tax is based amounted to € –25 million (2018: € –24 million). This resulted in a profit/loss transfer to Merck KGaA of € –7 million (2018: € –7 million). Merck KGaA's net income adjusted for corporation tax, on which the appropriation of its profit is based, amounted to € 639 million (2018: € 637 million). Merck KGaA transferred a profit/loss in the amount of € 449 million of its profit to E. Merck KG (2018: € 447 million). In addition, an expense from corporation tax charges amounting to € 14 million resulted (2018: expense of € 20 million).

	2019		2018	
€ million	**E. Merck KG**	**Merck KGaA**	E. Merck KG	Merck KGaA
Net income	431	169	430	162
Profit carried forward from previous year	61	26	60	25
Withdrawal from revenue reserves	–	–	–	–
Transfer to revenue reserves	–	–	–	–
Retained earnings Merck KGaA		**194**		**187**
Withdrawal by E. Merck KG	-430		-430	
Dividend proposal		-168		-162
Profit carried forward	63	26	61	26

A dividend of € 1.25 per share was distributed for fiscal 2018. The dividend proposal for fiscal 2019 will be € 1.30 per share. The proposed dividend payment to shareholders amounts to € 168 million (2018: € 162 million). The amount withdrawn by E. Merck KG would amount to € 430 million (2018: € 430 million).

Appropriation of profits and changes in reserves

€ million	2019			2018		
	Merck & Cie	**Merck KGaA**	**Total**	Merck & Cie	Merck KGaA	Total
Profit transfer to E. Merck KG	-56	-449	-505	-62	-447	-509
Profit/loss transfer from E. Merck KG	–	-7	-7	–	-7	-7
Transfer to revenue reserves	–	2	2	–	1	1
Profit transfer to E. Merck KG including changes in reserves	-56	-455	-510	**-62**	**-454**	**-515**
Result of E. Merck KG before reciprocal profit transfer, adjusted for trade tax		-25			-24	
Profit transfer to E. Merck KG/withdrawal by E. Merck KG	-56	-430		**-62**	**-430**	

Based on the assumed appropriation of profits, the profit/loss transfer to E. Merck KG for 2019, including changes in reserves, amounted to € -510 million. This consisted of the profit transfer to E. Merck KG (€ -449 million), the profit/loss transfer to Merck KGaA (€ -7 million), the change in profit carried forward of E. Merck KG (€ 2 million), as well as the profit transfer from Merck & Cie to E. Merck KG (€ -56 million). For 2018, the profit/loss transfer to E. Merck KG including changes in reserves amounted to € -515 million. This consisted of the profit transfer to E. Merck KG (€ -447 million), the profit/loss transfer from E. Merck KG to Merck KGaA (€ -7 million), the change in profit carried forward of E. Merck KG (€ 1 million) as well as the profit transfer from Merck & Cie to E. Merck KG (€ -62 million).

Merck & Cie is a partnership under Swiss law that is controlled by Merck KGaA but distributes its operating result directly to E. Merck KG. This distribution is a payment to shareholders and is therefore also presented under changes in equity.

The proposed withdrawal of E. Merck KG in the amount of € 430 million (2018: € 430 million) results from the total amount of the profit/loss transfer to E. Merck KG, including changes in reserves, and the profit/loss of E. Merck KG before reciprocal profit transfer.

Non-controlling interests

The calculation of non-controlling interests was based on the stated equity of the subsidiaries concerned after any adjustment required to ensure compliance with the accounting policies of the Merck Group as well as pro rata consolidation entries.

The equity and the profit attributable to non-controlling interests mainly related to the minority interests in the publicly traded company P.T. Merck Tbk., Indonesia, in Versum Materials Taiwan Co., Ltd., Taiwan, and in Merck Ltd., Thailand.

(35) Cash and cash equivalents

Accounting and measurement policies

Cash and cash equivalents include short term investments with a maximum remaining term of up to three months which can be readily converted to a determined amount of cash.

Cash and cash equivalents comprised the following items:

€ million	**Dec. 31, 2019**	Dec. 31, 2018
Cash, bank balances, and checks	618	780
Short-term cash investments (up to 3 months)	162	1,391
Cash and cash equivalents	**781**	**2,170**

Changes in cash and cash equivalents as defined by IAS 7 are presented in the consolidated cash flow statement.

Cash and cash equivalents included restricted cash amounting to € 240 million (December 31, 2018: € 295 million). This related mainly to cash and cash equivalents at subsidiaries to which the Group only had restricted access owing to foreign exchange controls.

The maximum default risk was equivalent to the carrying amount of cash and cash equivalents.

(36) Other financial assets

Accounting and measurement policies

This section does not cover the accounting and measurement policies for derivative financial instruments. They are presented in Note (39) "Derivative financial instruments".

Recognition and initial measurement

Financial assets are initially measured at fair value and recognized as of the settlement date. For financial assets not subsequently measured at fair value through profit or loss in subsequent periods, initial measurement also includes directly attributable transaction costs.

Detailed information on the measurement methods for financial assets measured at fair value are presented in Note (43) "Information on fair value measurement".

Classification and subsequent measurement

At initial recognition, financial assets are assigned to one of the following measurement categories which at Merck also correspond to the financial instrument classes as defined in IFRS 9:

- Subsequent measurement at amortized cost
- Subsequent measurement at fair value through other comprehensive income
- Subsequent measurement at fair value through profit or loss

This classification is based on the business model and the structure of contractual payment flows. Financial assets subsequently measured at amortized cost are accounted for using the effective interest method and considering any impairment losses. The calculation of impairment losses is described in Note (42) "Management of financial risks". These financial assets are intended to collect contractual cash flows from the assets held which are exclusively principal repayments and interest payments on the outstanding capital amount.

Except for derivative financial instruments with positive market value, Merck only applies subsequent measurement at fair value through profit or loss for debt instruments with contractual properties resulting in cash flows that do not exclusively represent principal repayments and interest payments on the outstanding capital amount. In particular, this includes contingent consideration that was contractually agreed with the acquirer within the context of the disposal of businesses within the meaning of IFRS 3 (see Note (43) "Information on fair value measurement"). Merck does not utilize the existing option of the subsequent measurement of debt instruments at fair value through profit or loss.

Equity instruments not subject to mandatory subsequent measurement at fair value through profit or loss are consistently measured at fair value through other comprehensive income in subsequent periods because they are intended to be held for the longer term. Further details on the measurement of financial assets at fair value are presented in Note (43) "Information on fair value measurement".

Financial assets are only reclassified in rare cases in which Merck changes its business model in managing financial assets.

Derecognition

Merck derecognizes financial assets if there is no reasonable expectation that the contract party will fulfill its contractual obligations or if Merck transfers the contractual rights including all material risks and rewards of the financial asset to a contract partner.

Recognition

The following table provides details on the measurement effects of debt instruments on the consolidated balance sheet and the consolidated income statement:

Category	Asset type	Impairment losses/reversals of impairment losses	Net gain (or loss) on disposal/value adjustments	Foreign currency gains or losses	Interest income or expenses
Subsequent measurement atamortized cost	Operational	Impairment losses and reversals of impairment losseson financial assets (net)	Other operating income or other operating expenses	Other operating income or other operating expenses	Financial result (using the effective interest method)
	Financial	Financial result	Financial result	Financial result	
Subsequent measurementat fair value through other comprehensive income	Operational	Impairment losses and reversals of impairment losseson financial assets (net)	Group equity (upon derecognition: reclassification to other operating income or other operating expenses)	Other operating income or other operating expenses	Financial result
	Financial	Financial result	Group equity (upon derecognition: reclassification to financial result)	Financial result	
Subsequent measurement at fair value through profit or loss	Operational		Other operating income or other operating expenses	Other operating income or other operating expenses	Financial result
	Financial		Financial result	Financial result	

The following table provides details on the measurement effects of equity instruments on the consolidated balance sheet and the consolidated income statement:

Category	Asset type	Impairment losses/reversals of impairment losses	Value adjustments	Foreign currency gains or losses	Dividend income
Subsequent measurement at fair value through other comprehensive income	Operational		Results recognized directly in equity (value adjustments)	Foreign currency gains and losses recognized directly in equity	Other operating income
			Recycling of the cumulative results previously recognized directly in equity through retained earnings when asset is disposed		
	Financial		Results recognized directly in equity (value adjustments)	Foreign currency gains and losses recognized directly in equity	Financial result
			Recycling of the cumulative results previously recognized directly in equity through retained earnings when asset is disposed		
Subsequent measurement at fair value through profit or loss	Operational		Other operating income or other operating expenses	Other operating income or other operating expenses	Other operating income
	Financial		Financial result	Financial result	Financial result

€ million	Dec. 31, 2019 Current	Dec. 31, 2019 Non-current	Dec. 31, 2019 Total	Dec. 31, 2018[1] Current	Dec. 31, 2018[1] Non-current	Dec. 31, 2018[1] Total
Subsequent measurement at amortized cost	**1**	**8**	**9**	**1**	**9**	**10**
Loans against third parties	1	8	9	1	9	9
Other	–	–	–	–	–	–
Subsequent measurement at fair value through other comprehensive income	**29**	**408**	**438**	**8**	**278**	**285**
Equity instruments	–	399	399	–	274	274
Debt instruments	29	9	39	8	4	12
Subsequent measurement at fair value through profit or loss	**20**	**322**	**342**	**16**	**369**	**385**
Equity instruments	–	–	–	–	–	–
Contingent considerations	–	258	258	–	259	259
Other debt instruments	–	50	50	–	50	50
Derivatives without a hedging relationship (financial transactions)	20	14	33	16	14	30
Derivatives without a hedging relationship (operational)	–	–	–	–	45	45
Derivatives with a hedging relationship (operational)	**7**	**–**	**7**	**4**	**1**	**4**
Financial assets	**57**	**738**	**795**	**29**	**656**	**685**

[1] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes".

As in 2018, contingent considerations included claims from the divestments of the Biosimilars and Kuvan® businesses.

The shares held in Progyny, Inc., United States, and in the Intrexon Corporation, United States, in particular, were disclosed in equity instruments with subsequent measurement at fair value through other comprehensive income. Please refer to Note (52) "List of shareholdings" for a detailed list of all investments made in equity instruments with subsequent measurement at fair value through other comprehensive income.

(37) Financial debt/Capital management

Accounting and measurement policies

Except for lease liabilities and derivatives with negative market values, all financial debt is subsequently measured at amortized cost using the effective rate method.

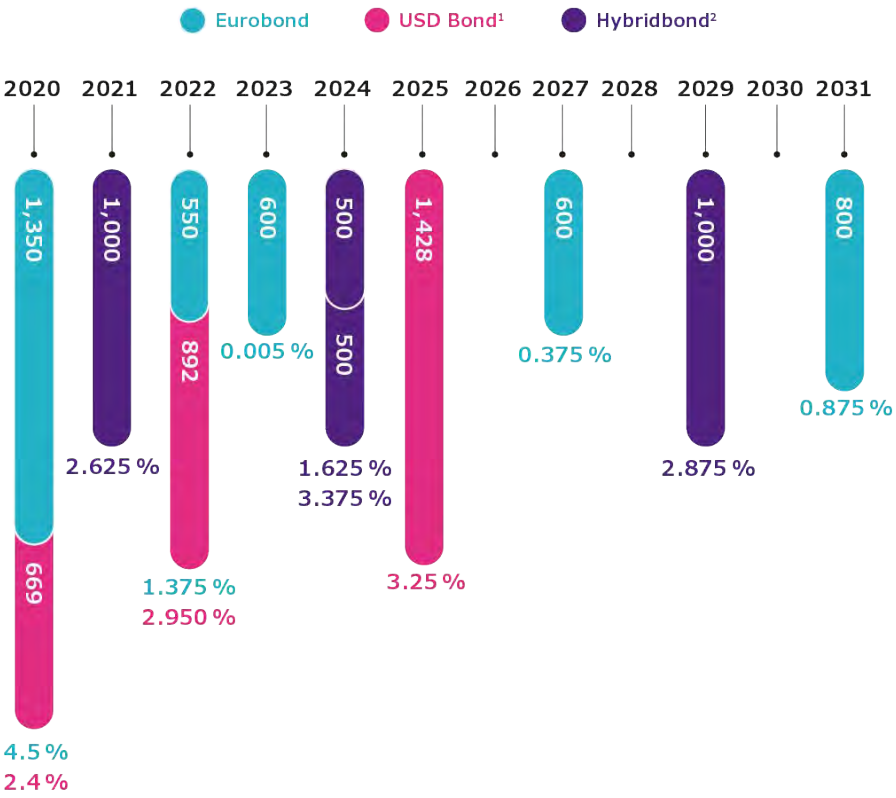
The accounting and measurement policies of lease liabilities and derivatives are presented in Notes (21) "Leasing" and (39) "Derivative financial instruments".

The composition of financial debt as well as a reconciliation to net financial debt are presented in the following table:

	Dec. 31, 2019 € million	Dec. 31, 2018 € million	Maturity	Interest rate %	**Nominal value** € million	Currency
Eurobond 2015/2019	–	799	Sept. 2019	0.750%	800	€
Eurobond 2009/2019	–	70	Dec. 2019	4.250%	70	€
USD bond 2015/2020	669	–	March 2020	2.400%	750	USD
Eurobond 2010/2020	1,350	–	March 2020	4.500%	1,350	€
Bonds (current)	**2,019**	**869**				
Commercial paper	205	113				
Bank loans	1,337	370				
Liabilities to related parties	809	824				
Loans from third parties and other financial debt	53	20				
Liabilities from derivatives (financial transactions)	19	16				
Liabilities from finance leases (IAS 17)		2				
Lease liabilities (IFRS 16)	109					
Current financial debt	**4,550**	**2,215**				
USD bond 2015/2020	–	655	March 2020	2.400%	750	USD
Eurobond 2010/2020	–	1,348	March 2020	4.500%	1,350	€
USD bond 2015/2022	891	872	March 2022	2.950%	1,000	USD
Eurobond 2015/2022	549	548	Sept. 2022	1.375%	550	€
Eurobond 2019/2023	600	–	Dec. 2023	0.005%	600	€
USD bond 2015/2025	1,419	1,389	March 2025	3.250%	1,600	USD
Eurobond 2019/2027	596	–	July 2027	0.375%	600	€
Eurobond 2019/2031	796	–	July 2031	0.875%	800	€
Hybrid bond 2014/2074	997	994	Dec. 2074[1]	2.625%	1,000	€
Hybrid bond 2014/2074	498	498	Dec. 2074[2]	3.375%	500	€
Hybrid bond 2019/2079	495	–	June 2079[3]	1.625%	500	€
Hybrid bond 2019/2079	995	–	June 2079[4]	2.875%	1,000	€
Bonds (non-current)	**7,835**	**6,304**				
Bank loans	250	250				
Liabilities to related parties	–	–				
Loans from third parties and other financial debt	44	51				
Liabilities from derivatives (financial transactions)	56	73				
Liabilities from finance leases (IAS 17)		2				
Lease liabilities (IFRS 16)	458					
Non-current financial debt	**8,644**	**6,681**				
Financial debt	**13,194**	**8,896**				
less:						
Cash and cash equivalents	781	2,170				
Current financial assets	50	24				
Net financial debt[5]	**12,363**	**6,701**				

[1] Merck has the right to prematurely repay this tranche of the hybrid bond issued in December 2014 for the first time in June 2021.
[2] Merck has the right to prematurely repay this tranche of the hybrid bond issued in December 2014 for the first time in December 2024.
[3] Merck has the right to prematurely repay this tranche of the hybrid bond issued in June 2019 for the first time in December 2024.
[4] Merck has the right to prematurely repay this tranche of the hybrid bond issued in June 2019 for the first time in June 2029.
[5] Not defined by International Financial Reporting Standards (IFRSs).

The repayment profile of the bonds was as follows:



[1] The nominal volumes of bonds denominated in U.S. dollars were converted into euros at the closing rate on December 31, 2019.
[2] For the hybrid bonds repayment is assumed at the earliest possible date.

For the 2014/2074 hybrid bond issued in two tranches and the 2019/2079 hybrid bond also issued by Merck KGaA in two tranches, the rating agencies Standard & Poor's, Moody's, and Scope have given equity credit treatment to half of the issuances, thus making the issuances more favorable to Merck's credit rating than a traditional bond issue. The bonds are recognized in full as financial liabilities in the balance sheet.

The financial debt of the Group was not secured by liens or similar forms of collateral. The loan agreements do not contain any financial covenants. The Merck Group's average borrowing cost as of the balance sheet date was 2.5% (December 31, 2018: 2.7%).

Information on liabilities to related parties can be found in Note (46) "Related-party disclosures".

Capital management

The objective of capital management is to secure financial flexibility in order to maintain long-term business operations and to realize strategic options. Maintaining a stable investment grade rating, ensuring liquidity, limiting financial risks, as well as optimizing the cost of capital are the objectives of our financial policy and set important framework conditions for capital management. The responsible committees decide on the target capital structure of the balance sheet, the appropriation of net retained profit, and the dividend level. In this context, net financial debt is one of the leading capital management indicators.

Traditionally, the capital market represents a major source of financing for Merck, for instance via bond issues. As of December 31, 2019, there were liabilities of € 3.90 billion (December 31, 2018: € 2.77 billion) from a debt issuance program most recently renewed in 2019. In addition, Merck had access to a commercial paper program to meet short-term capital requirements with a volume of € 2 billion, of which € 205 million had been utilized as of December 31, 2019 (December 31, 2018: € 113 million).

Loan agreements represent a further source of financing for Merck. At the balance sheet date, the bank financing commitments vis-à-vis the Merck Group were as follows:

	Dec. 31, 2019		Dec. 31, 2018			
€ million	**Financing commitments from banks**	**Utilization**	Financing commitments from banks	Utilization	Interest	Maturity of financing commitments
Syndicated loan	2,000	–	2,000	–	variable	2024
Loan agreement with banking syndicate for acquisition financing	1,017	1,017	–	–	variable	2022
Bilateral credit agreement with banks	250	250	250	250	variable	2022
Various bank credit lines	552	320	549	370	variable	< 1 year
	3,820	**1,587**	**2,799**	**620**		

There are no indications that the availability of extended credit lines was restricted.

(38) Other financial liabilities

ACCOUNTING AND MEASUREMENT POLICIES

All other financial liabilities apart from liabilities from derivatives and contingent considerations, which are recognized in the context of business combinations according to IFRS 3, are initially measured at fair value and in subsequent periods at amortized cost, applying the effective interest method. The accounting and measurement policies of derivatives are presented in Note (39) "Derivative financial instruments".

Other financial liabilities comprised the following:

	Dec. 31, 2019			Dec. 31, 2018		
€ million	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Miscellaneous other financial liabilities	1,081	43	1,124	1,019	13	1,032
thereof: Liabilities to related parties	512	–	512	511	–	511
thereof: interest accruals	119	–	119	94	–	94
Liabilities from derivatives with a hedging relationship (operational)	46	–	46	58	20	78
Other financial liabilities	**1,127**	**43**	**1,170**	**1,077**	**33**	**1,110**

The liabilities to related parties primarily consist of liabilities to E. Merck KG.

(39) Derivative financial instruments

Accounting and measurement policies

The IFRS 9 provisions are applied for hedge accounting. Hedging transactions are entered into for highly probable forecast transactions in foreign currencies and for hedging fair values of assets on the balance sheet. Cash flow hedge accounting for forecasted transactions in foreign currency will lead to the hedged item being recognized at a fixed exchange rate on a net basis – instead of being recognized at the spot exchange rate at the transaction date.

As a result of hedging fair values of assets on the balance sheet, the compensating changes in value of the corresponding hedged item and hedging instrument offset each other.

Merck only uses derivatives as hedging instruments. Merck uses the dollar offset method as well as regression analyses to measure hedge effectiveness.

Hedging ineffectiveness may occur in the timing of forecasted cash flows or if hedged items are dissolved. Derivatives that do not or no longer meet the documentation or effectiveness requirements for hedge accounting, whose hedged item no longer exists, or for which hedge accounting rules are not applied are classified, depending on their balance, as "financial assets or liabilities at fair value through profit or loss".

In the case of hedging relationships where Merck uses options as hedging instruments, only the intrinsic value of options is designated as the hedging instrument. Changes in the fair value of the time value component of options that are used for hedge accounting are recognized in other comprehensive income and in the cost of cash flow hedge reserve within equity. The subsequent accounting of these amounts depends on the type of the hedged transaction.

In the case of hedging relationships where Merck uses forward contracts as hedging instruments, only the spot element is designated as the hedging instrument. Changes in the fair value of the forward element in forward contracts are initially recognized in the cost of cash flow hedge reserve within equity. The subsequent accounting of these amounts depends on the type of hedged transaction.

Reclassifications of the cash flow hedge reserve to profit or loss are recognized in the operating result, while reclassifications of the cost of cash flow hedge reserve are recognized in the financial result.

Derivative financial instruments are recognized in the consolidated balance sheet, the consolidated income statement, and the consolidated statement of comprehensive income – with the exception of the balance sheet treatment of amounts included directly from the reserve in the initial cost or in the other carrying amount of a non-financial asset or liability – as follows:

					Changes in fair value in the consolidated income statement/consolidated statement of comprehensive income	
Hedging relationship	**Type of collateral**	**Type of hedged item**	**Market value**	**Presentation on the balance sheet**	**during the term**	**at maturity**
Derivatives with a cash flow hedging relationship	Interest rate hedge	Financial transactions	Positive market values	Other financial assets	Fair value adjustments (in equity)	Financial result
			Negative market values	Financial debt	Fair value adjustments (in equity)	Financial result
	Currency hedging	Financial transactions	Positive market values	Other financial assets	Fair value adjustments (in equity)	Financial result
			Negative market values	Financial debt	Fair value adjustments (in equity)	Financial result
		Transactions in operating business	Positive market values	Other financial assets	Fair value adjustments (in equity)	Other operating income
			Negative market values	Other financial liabilities	Fair value adjustments (in equity)	Other operating expenses
Derivatives without a hedging relationship	Interest rate hedge	Financial transactions	Positive market values	Other financial assets	Financial result	Financial result
			Negative market values	Financial debt	Financial result	Financial result
	Currency hedging	Financial transactions	Positive market values	Other financial assets	Financial result	Financial result
			Negative market values	Financial debt	Financial result	Financial result
		Transactions in operating business	Positive market values	Other financial assets	Other operating income	Other operating income
			Negative market values	Other financial liabilities	Other operating expenses	Other operating expenses

The nominal amounts of Merck's derivative exposures were as follows:

	Dec. 31, 2019		Dec. 31, 2018	
€ million	**Current**	**Non-current**	Current	Non-current
Cash flow hedge	2,765	2	1,573	366
Interest rate	–	–	–	–
Currency	2,765	2	1,573	366
No hedge accounting	5,147	1,100	5,286	1,100
Interest rate	–	1,100	–	1,100
Currency	5,147	–	5,286	–
Equity	–	–	–	–
	7,912	1,102	6,859	1,466

The fair values of Merck's derivative exposures were as follows:

DECEMBER 31, 2019

	Positive market values				Negative market values			
	Financial transactions		Transactions in operating business		Financial transactions		Transactions in operating business	
€ million	Current	Non-current	Current	Non-current	Current	Non-current	Current	Non-current
Cash flow hedge	**–**	**–**	**7**	**–**	**–**	**–**	**46**	**–**
Interest rate	–	–	–	–	–	–	–	–
Currency	–	–	7	–	–	–	46	–
No hedge accounting	**20**	**14**	**–**	**–**	**19**	**56**	**–**	**–**
Interest rate	–	14	–	–	–	56	–	–
Currency	20	–	–	–	19	–	–	–
Equity	–	–	–	–	–	–	–	–
	20	**14**	**7**	**–**	**19**	**56**	**46**	**–**

DECEMBER 31, 2018

	Positive market values				Negative market values			
	Financial transactions		Transactions in operating business		Financial transactions		Transactions in operating business	
€ million	Current	Non-current	Current	Non-current	Current	Non-current	Current	Non-current
Cash flow hedge	**–**	**–**	**4**	**1**	**–**	**–**	**58**	**20**
Interest rate	–	–	–	–	–	–	–	–
Currency	–	–	4	1	–	–	58	20
No hedge accounting	**16**	**14**	**–**	**45**	**16**	**73**	**–**	**–**
Interest rate	–	14	–	–	–	73	–	–
Currency	16	–	–	–	16	–	–	–
Equity	–	–	–	45	–	–	–	–
	16	**14**	**4**	**46**	**16**	**73**	**58**	**20**

As in the previous year, all hedging relationships were transaction related. Netting of derivatives from an economic perspective was possible due to the existing framework agreements on derivatives trading that Merck had entered into with commercial banks. Actual netting only takes place in the case of insolvency of the contract partner. Balance sheet netting of derivatives did not take place, as with other financial assets and other financial liabilities.

The following table presents the potential netting volume of the reported derivative assets and liabilities:

DECEMBER 31, 2019

				Potential netting volume		
€ million	**Gross presentation**	**Netting**	**Net presentation**	**due to master netting agreements**	**due to financial collateral**	**Potential net amount**
Derivative assets	40	–	40	32	–	7
Derivative financial liabilities	-122	–	-122	-32	–	-89

DECEMBER 31, 2018

				Potential netting volume		
€ million	Gross presentation	Netting	Net presentation	due to master netting agreements	due to financial collateral	Potential net amount
Derivative assets	80	–	80	29	–	51
Derivative financial liabilities	-168	–	-168	-29	–	-139

The reserves for cash flow hedges and the cost of cash flow hedging of the Group applied to the following hedging instruments:

	Cost of hedging cash flows		**Cash flow hedge**		
€ million	Time value of options	Forward component of currency forwards	Intrinsic value of options	Spot component of currency forwards	Interest rate swaps
Jan. 1, 2018	**-1**	**–**	**3**	**-64**	**-60**
Fair value adjustment (directly recognized in equity)	1	-48	-3	-68	–
Reclassification to profit or loss	–	5	–	38	14
Reclassification to assets	–	–	–	–	–
Tax effect	–	10	–	13	-1
Dec. 31, 2018	**–**	**-33**	**1**	**-81**	**-47**
Jan. 1, 2019	**–**	**-33**	**1**	**-81**	**-47**
Fair value adjustment (directly recognized in equity)	-1	12	13	-29	–
Reclassification to profit or loss	-22	14	-52	17	14
Reclassification to assets	22	-1	35	26	–
Tax effect	-6	-18	-10	-3	-3
Dec. 31, 2019	**-8**	**-25**	**-13**	**-70**	**-36**

(40) Finance income and expenses / Net gains and losses from financial instruments

Finance income and expenses were as follows:

€ million	**2019**	2018
Interest income and similar income	66	55
Income from fair value changes from debt instruments with subsequent measurement at fair value through profit or loss	5	5
Income from the change of the fair value of share-based compensation programs	14	–
Currency differences from financing activities	12	16
Finance income	**97**	**77**
Interest expenses and similar expenses	-430	-323
Capital loss from disposal of debt instruments with subsequent measurement at amortized cost	-1	-1
Expenses from fair value changes from debt instruments with subsequent measurement at fair value through profit or loss	-5	-2
Expenses from fair value changes of share-based compensation programs	–	-15
Other interest expenses	-46	-1
Finance costs	**-481**	**-343**
Financial result	**-385**	**-266**

Interest income and expenses and similar income and expenses were as follows:

	2019		2018	
€ million	**Interest income**	**Interest expenses**	Interest income	Interest expenses
Financial instruments	27	-270	35	-259
Leases	–	-14	–	–
Pension provisions	–	-47	–	-42
Other non-current provisions	–	-26	–	-14
Other interest income/expenses and similar income and expenses	39	-86	20	-23
Capitalized borrowing costs for	–	13	–	15
Property, plant and equipment	–	11	–	7
Other intangible assets	–	2	–	8
Interest income/expenses and similar income and expenses	**66**	**-430**	**55**	**-323**

The rise in other interest expenses and similar expenses compared to 2018 resulted, in particular, from interest expenses for tax matters and from the restructuring of financial liabilities in connection with the acquisition of Versum Materials, Inc., United States.

The following table shows the development of net gains and losses, interest income and expenses, as well as dividend income from financial instruments (excluding items recognized in other comprehensive income) by measurement categroy in the period under review:

2019

			Interest result		Net gains and losses			
€ million	**Currency differences**	**Dividends**	**Interest income**	**Interest expenses**	**Impairment losses**	**Reversals of impairment losses**	**Fair value adjustments**	**Disposal gains/losses**
Financial assets								
Subsequent measurement at amortized cost	-31		7		-95	87		-1
Subsequent measurement at fair value through other comprehensive income								
Equity instruments		–						
Debt instruments	–		–		–	–		–
Subsequent measurement at fair value through profit or loss	1	–	20	–	–	–	-714	–
Financial debt								
Subsequent measurement at amortized cost	24			-270				–
Subsequent measurement at fair value through profit or loss	–		–	–			782	
Total	**-7**	**–**	**27**	**-270**	**-95**	**87**	**67**	**-1**

2018

			Interest result		Net gains and losses			
€ million	Currency differences	Dividends	Interest income	Interest	Impairment losses	Reversals of impairment losses	Fair value adjustments	Disposal gains/losses
Financial assets								
Subsequent measurement at amortized cost	-47		12		-77	105		–
Subsequent measurement at fair value through other comprehensive income								
Equity instruments		–						
Debt instruments	–		1		–	–		–
Subsequent measurement at fair value through profit or loss	–	–	22	–			-669	
Financial debt								
Subsequent measurement at amortized cost	-54			-259				–
Subsequent measurement at fair value through profit or loss	–		–	–			735	
Total	**-101**	**–**	**35**	**-259**	**-77**	**105**	**66**	**–**

In the table above, interest income or expenses related to derivatives without a hedging relationship are recognized within fair value adjustments. The currency result from equity instruments with subsequent measurement at fair value through other comprehensive income was recognized in other comprehensive income.

(41) Net cash flows from financing activities

Accounting and measurement policies

In determining the cash flows from financing activities, the option to recognize dividend payments in the cash flows from financing activities is exercised.

The change in financial debt was as follows:

2019

		Cash			Non-cash					
€ million	**Jan. 1, 2019**[1]	Cash inflows	Repayments	Other	Change in lease liabilities	Exchange rate effects	Fair value adjustment	Other	Changes in scope of consolidation	**Dec. 31, 2019**
Bonds	7,173	3,482	-1,290	–	–	59	–	9	420	9,854
Financial liabilities to E. Merck KG	821	406	-418	–	–	–	–	–	–	808
Other current and non-current financial liabilities	1,367	1,193	-1,281	-11	198	24	495	–	546	2,531
Financial debt	**9,361**	**5,080**	**-2,989**	**-11**	**198**	**84**	**495**	**9**	**966**	**13,194**
Derivative assets (current and non-current)	-30	499	–	–	–	–	-502	–	–	-33

[1] Values effective January 1, 2019, have been adjusted due to the first-time application of IFRS 16, see Note (45) "Effects from new accounting standards and other presentation and measurement changes".

2018

		Cash		Non-cash				
€ million	**Jan. 1, 2018**	Cash inflows	Repayments	Exchange rate effects	Fair value adjustment	Other	Changes in scope of consolidation	**Dec. 31, 2018**
Bonds	7,375	–	-323	121	–	–	–	7,173
Financial liabilities to E. Merck KG	765	375	-319	–	–	–	–	821
Other current and non-current financial liabilities	2,687	32	-2,316	-2	500	–	–	902
Financial debt	**10,827**	**407**	**-2,958**	**119**	**500**	**–**	**–**	**8,896**
Derivative assets (current and non-current)	-22	495	–	–	-503	–	–	-30

An inflow of € 3,482 million in the reporting period resulted from the issuance of bonds to finance the acquisition of Versum Materials, Inc., United States.

Other cash changes show interest payments for lease liabilities that are recognized in the net cash flow from operating activities. Changes in lease liabilities include additions and retirements of right-of-use from leases and the effects from unwinding of the discount on lease liabilities. Other non-cash changes resulted from the effects of the application of the effective interest method.

Fair value adjustments of other current and non-current financial liabilities are attributable to liabilities from derivatives. In the consolidated cash flow statement, cash changes of assets from derivatives were recognized together with repayments of other current and non-current financial liabilities. In the above reconciliation, changes of assets from derivatives were recognized separately because they did not form part of financial liabilities.

The amount of undrawn borrowing facilities that could be tapped for future operating activities and to meet obligations is disclosed in Note (37) "Financial liabilities/capital management".

(42) Management of financial risks

Market fluctuations with respect to foreign exchange and interest rates represent significant profit and cash flow risks for Merck. Merck aggregates these Group-wide risks and steers them centrally, partly by using derivatives. To estimate existing risks of foreign exchange and interest rate fluctuations, Merck uses scenario analyses. Merck is not subject to any material risk concentration from financial transactions.

Merck uses marketable forward exchange contracts, options, and interest swaps as hedging instruments. The strategy to hedge interest rate and foreign exchange rate fluctuations arising from forecast transactions and transactions already recognized in the balance sheet is set by a risk committee, which meets on a regular basis. The use of derivatives is regulated by extensive guidelines and subject to ongoing risk controls by Group Treasury. Speculation is prohibited. The strict separation of functions between trading, settlement, and control functions is ensured. Derivatives are only entered into with banks that have a good credit rating. Related default risks are continuously monitored.

The Report on Risks and Opportunities included in the combined management report provides further information on the management of financial risks.

Foreign exchange risks

Owing to the international nature of its business, Merck is exposed to transactional foreign exchange risks within the scope of both its business activities and financing activities. Foreign exchange risks are continuously analyzed and different hedging strategies used to limit or eliminate these risks.

A more rule-based hedging approach was gradually introduced for hedging foreign exchange risks as of the beginning of the past fiscal year. The entire foreign exchange exposure is divided into several defined risk levels and systematically hedged using suitable hedging instruments. Furthermore, the number of currencies included in hedging was once again expanded in the reporting period. Hedging is performed based on of a regularly reviewed basket of currencies. As part of the new hedging concept, the time horizon for hedging was reduced from a maximum of 36 months to 12 months. The new hedging concept aims to ensure a consistent hedging quality at lower costs.

Foreign exchange risks from the following transactions are hedged using foreign exchange contracts and currency options:

- Forecast transactions in non-functional currency, the expected probability of which is very high for the next 12 months (2018: 36 months),
- Firm purchase commitments over the next 12 months (2018: 36 months) in non-functional currency.

Foreign exchange risks from the following transactions are economically hedged through the use of foreign exchange contracts and currency options:

- Intragroup financing in non-functional currency,
- Receivables from and liabilities to third parties in non-functional currency.

The following table shows the net exposure and the effects of transactional exchange rate movements of the key currencies against the euro in relation to the net income and equity of the Group on the balance sheet date:

DECEMBER 31, 2019

€ million		USD	CHF	CNY	TWD	JPY	KRW
Net exposure		**802**	**-493**	**933**	**200**	**39**	**284**
Exchange rate -10% (appreciation vs. €)	Consolidated income statement	80	-49	93	20	4	28
	Equity (other comprehensive income)	-114	6	-18	-12	-10	-10
Exchange rate +10% (appreciation vs. €)	Consolidated income statement	-80	49	-93	-20	-4	-28
	Equity (other comprehensive income)	83	-5	14	8	7	7

DECEMBER 31, 2018

€ million		USD	CHF	CNY	TWD	JPY	KRW
Net exposure		**618**	**-274**	**741**	**153**	**132**	**163**
Exchange rate -10% (appreciation vs. €)	Consolidated income statement	62	-27	74	15	13	16
	Equity (other comprehensive income)	-135	20	-9	-19	-11	-14
Exchange rate +10% (appreciation vs. €)	Consolidated income statement	-62	27	-74	-15	-13	-16
	Equity (other comprehensive income)	110	-16	8	15	10	12

In this presentation, effects of cash flow hedges are taken into consideration in the equity of the Group. The net exposure of each of the above currencies consisted of the following components:

- Planned cash flows in the next 12 months in the respective currency less
- The nominal values of hedging instruments of these planned cash flows.

The planned cash flows in the next 12 months are usually hedged at a ratio of 25% to 90% (2018: 30% to 70%).

Balance sheet items in the above currencies were economically hedged in full in both 2019 and 2018 by derivatives if they did not correspond to the functional currency of the respective subsidiary. Accordingly, they do not affect the net exposure presented above.

The impact of cash flow hedge accounting for forecasted transactions in foreign currency on the Group's net assets and results of operations was as follows for the major currencies:

DECEMBER 31, 2019

€ million	USD	CHF	CNY	TWD	JPY	KRW
Notional amount	1,794	55	392	151	139	165
thereof: current	1,794	55	392	151	139	163
thereof: non-current	–	–	–	–	–	2
Fair value of the hedging instrument	-28	2	–	-6	-2	-4
thereof: positive market values	2	2	–	–	–	–
thereof: negative market values	-31	–	–	-6	-3	-4
Maturity profile	January 2020 – December 2020	January 2020 – December 2020	January 2020 – December 2020	January 2020 – December 2020	January 2020 – December 2020	January 2020 – January 2021
Hedge ratio[1]	1:1	1:1	1:1	1:1	1:1	1:1
Change in value of outstanding hedging instruments since Jan. 1, 2019	-11	2	–	-2	-1	–
Change in value of hedged item used to determine hedge effectiveness since January 1, 2019	11	-2	–	2	1	–
Weighted average hedging rate	1.19	1.12	8.08	36.24	127.40	1,378.90

[1] The hedging instruments and the corresponding hedged items were denominated in the same currency, therefore the hedge ratio was 1:1.

DECEMBER 31, 2018

€ million	USD	CHF	CNY	TWD	JPY	KRW
Notional amount	1,180	178	85	169	125	129
thereof: current	1,055	125	85	122	101	85
thereof: non-current	125	53	–	47	24	44
Fair value of the hedging instrument	-49	-2	-5	-8	–	-10
thereof: positive market values	–	2	–	–	3	–
thereof: negative market values	-49	-3	-5	-8	-3	-10
Maturity profile	January 2019 – December 2020	January 2019 – December 2020	January 2019 – December 2019	January 2019 – December 2020	January 2019 – December 2020	January 2019 – January 2021
Hedge ratio[1]	1:1	1:1	1:1	1:1	1:1	1:1
Change in value of outstanding hedging instruments since Jan. 1, 2018	-58	5	-3	-3	-6	-7
Change in value of hedged item used to determine hedge effectiveness since January 1, 2018	58	-5	3	3	6	7
Weighted average hedging rate	1.22	1.12	8.48	36.68	126.74	1,397.39

[1] The hedging instruments and the corresponding hedged items were denominated in the same currency, therefore the hedge ratio was 1:1.

In addition to the transactional foreign exchange risks described previously, Merck was exposed to currency translation risks since many of Merck's subsidiaries were located outside the eurozone and had functional currencies other than the reporting currency. Exchange differences resulting from translation of the assets and liabilities of these companies into euros, the reporting currency, are recognized in equity.

Interest rate risks

The Merck Group's net exposure to interest rate changes comprised the following:

€ million	**Dec. 31, 2019**	Dec. 31, 2018
Short-term or variable interest rate monetary deposits	811	2,196
Short-term or variable interest rate monetary borrowings	-4,761	-2,465
Net interest rate exposure	**-3,950**	**-269**

The effects of a parallel shift in the yield curve by +100 or -100 basis points on the consolidated income statement as well as on equity relative to all short-term or variable monetary deposits and monetary borrowings within the scope of IAS 32, except contingent considerations, are presented in the following table. In the event of a downward shift, the interest rate for instruments subject to a contractual interest rate floor of zero percent was limited accordingly.

€ million	**2019**		2018	
Change in market interest rate	**+100 basis points**	**-100 basis points**	**+100 basis points**	**-100 basis points**
Effects on consolidated income statement	-23	11	6	-9
Effects on equity (other comprehensive income)	–	–	–	–

Share price risks

The shares in publicly listed companies amounting to € 209 million (December 31, 2018: € 134 million) are generally exposed to a risk of fluctuations in fair value. A 10% change in the price of these financial instruments would impact Group equity by € 21 million (2018: € 13 million). This change in value would be recognized in Group equity.

Liquidity risks

The risk that Merck cannot meet its payment obligations resulting from financial liabilities, is limited by establishing the required financial flexibility and by Group-wide cash management. Information on issued bonds and other sources of financing can be found in Note (37) "Financial debt/Capital Management".

Liquidity risks are monitored and reported to management on a regular basis.

The following liquidity risk analysis presents the contractual cash flows such as repayments and interest on financial liabilities and derivative financial instruments with a negative fair value:

DECEMBER 31, 2019

		Cash flows < 1 year		Cash flows 1–5 years		Cash flows > 5 years	
€ million	**Carrying amount**	**Interest**	**Repayment**	**Interest**	**Repayment**	**Interest**	**Repayment**
Subsequent measurement at amortized cost							
Bonds and commercial paper	10,059	-120	-2,224	-519	-4,042	-223	-3,828
Bank loans	1,587	-25	-1,337	-1	-250	–	–
Trade accounts payables	2,054	–	-2,054	–	–	–	–
Liabilities to related parties	1,320	–	-1,320	–	–	–	–
Other financial liabilities	596	–	-569	–	-27	–	–
Loans from third parties and other financial debt	97	-1	-53	-8	-44	–	–
Subsequent measurement at fair value through profit or loss							
Contingent considerations	16	–	–	–	-16	–	–
Derivatives without a hedging relationship	76	-15	-19	-29	–	–	–
Derivatives with a hedging relationship	**46**	**–**	**-46**	**–**	**–**	**–**	**–**
Refund liabilities	**565**	**–**	**-565**	**–**	**–**	**–**	**–**
Lease liabilities	**567**	**-12**	**-119**	**-30**	**-319**	**-20**	**-189**
	16,982	**-174**	**-8,305**	**-587**	**-4,698**	**-243**	**-4,017**

DECEMBER 31, 2018

		Cash flows < 1 year		Cash flows 1–5 years		Cash flows > 5 years	
€ million	Carrying amount	Interest	Repayment	Interest	Repayment	Interest	Repayment
Subsequent measurement at amortized cost							
Bonds and commercial paper	7,286	-208	-984	-458	-4,430	-85	-1,899
Bank loans	620	-17	-369	-2	-250	–	–
Trade accounts payables	1,766	–	-1,766	–	–	–	–
Liabilities to related parties	1,335	–	-1,335	–	–	–	–
Other financial liabilities	522	–	-508	–	-13	–	–
Loans from third parties and other financial debt	67	-1	-17	-3	-50	–	–
Subsequent measurement at fair value through profit or loss						**–**	**–**
Contingent considerations	5	–	-1	–	-4	–	–
Derivatives without a hedging relationship	90	-15	-16	-45	–	–	–
Derivatives with a hedging relationship	**78**	**–**	**-58**	**–**	**-20**	**–**	**–**
Refund liabilities	**472**	**–**	**-472**	**–**	**–**	**–**	**–**
Finance lease liabilities	**4**	**–**	**-2**	**–**	**-2**	**–**	**–**
	12,244	**-241**	**-5,528**	**-508**	**-4,769**	**-85**	**-1,899**

Credit risks

Credit risk for Merck means the risk of a financial loss if a customer or other contract partner is not able to meet its contractual payment obligations. Merck is exposed to credit risks mainly due to existing trade accounts receivable, other receivables, other debt instruments, derivatives, and contract assets.
Credit risks are continuously monitored by credit management. It additionally carries out the management of risks arising from extending credit to customers, suppliers, and in the course of other business relationships.
Merck analyzes all financial assets that are more than 90 days past due and examines whether the credit risk has risen significantly and, as a result, there is objective evidence of impairment requiring the recognition of additional risk provisions.

Accounting and measurement policies – CREDIT RISKS

Impairment of trade accounts receivable and contract assets

Merck uses the simplified impairment model for trade accounts receivable subsequently measured at amortized cost and contract assets, pursuant to which any credit losses expected to occur over the entire lifetime of an asset are taken into account. In order to measure expected credit risks, the assets are grouped based of the existing credit risk structure and the respective maturity structure.

The customer groups with comparable default risks to be considered are determined according to the business sector at Merck and the place of business of the respective customers.

The expected credit loss rates used in the simplified impairment model are derived on the basis of past experience and current macroeconomic expectations. In doing so, country-specific ratings are taken into consideration since many of Merck's customers depend directly or indirectly on the economic trends in the country where their place of business is located (public and private healthcare systems, universities and research companies from within the pharmaceutical industry as well as state subsidized industries, particularly in Asia). These country ratings are aggregated into three separate rating groups. Under the impairment model, past default rates and country ratings are used as an approximation of the defaults to be expected in the future.

Accordingly, when a country's rating changes, the historical default rates of the rating group to which the respective country has been re-allocated have to be applied, rather than the historical default rates of the previous rating group.

If there is objective evidence that certain trade accounts receivable are fully or partially impaired, additional loss allowances are recognized to provide for expected credit defaults.

A default generally exists when the debtor cannot fully meet its liabilities.

A debtor's creditworthiness is assumed to be impaired if there are objective indications that the debtor is in financial difficulties, such as the disappearance of an active market for its products or impending insolvency. On initial recognition, the credit losses expected over the overall term are deducted from the carrying amount of trade accounts receivable as originally credit-impaired financial assets.

Impairment of other receivables

The individual credit rating of the contract partner is used to determine impairment of other receivables. The general three-stage impairment model and the simplified approach are used to recognize loss allowances of financial instruments included in other receivables.

Individual cases are analyzed to ascertain whether objective findings suggest that the value of other receivables is impaired. Such suggestions may include, for example, economic difficulties of the debtor, contractual breaches or the renegotiation of contractual payment obligations. If the analysis concludes that Merck is subject to a substantially increased risk of default, the credit losses expected to occur over the entire lifetime are considered.

Impairment of other financial assets

Investments in debt instruments subsequently measured either at amortized cost or at fair value through other comprehensive income were primarily considered to be investments with low risk so that the expected credit loss in the upcoming 12 months was used to determine the impairment loss.

For financial assets with only a minimal default risk, the rules concerning the mandatory establishment of a risk provision for the expected credit loss over the full term were not observed at the time of addition or during subsequent measurement. Therefore, no assessment of whether there had been a significant increase in the credit risk was carried out for such assets. Merck does not presume an increased credit risk as of the balance sheet date if the contract partner has an investment grade rating.

If there were indications that the debtor's creditworthiness had worsened but that this was not yet reflected in its existing credit rating, the credit risk assessment was adjusted and the impairment allowances recognized for expected credit losses were increased. In all other cases, there were no new risk assessments as of the balance sheet date and the risk profile initially assumed was maintained.

Wherever Merck presumes a considerable increase in the default risk, the expected credit loss over the full term of the financial asset is considered.

On the balance sheet date, the theoretical maximum default risk for all items referenced above corresponded to the net carrying amounts less any compensation from credit insurance.

Significant discretionary decisions and sources of estimation uncertainty – credit risks

Impairment of trade accounts receivable and contract assets

In terms of the impairment of trade accounts receivable and of contract assets, there is significant discretion and estimation uncertainty when it comes to

- the identification of customer groups with identical default risks,
- the identification of a substantial increase in the credit risk, and
- the calculation of the expected credit losses.

As of December 31, 2019, trade accounts receivable were impaired by 2.4% (December 31, 2018: 2.4%). If it were necessary to recognize impairment on trade accounts receivable and contract assets at 10% higher in 2018, this would have caused a € 8 million reduction in profit before tax (2018: € 8 million).

Impairment of other financial assets

Discretionary judgement is applied in determining individual impairment allowances.

The following table shows impairments for financial assets from operative transactions and contract assets as well as gains from their reversals recognized in the consolidated income statement:

€ million	**2019**	2018
Impairment losses	**-95**	**-77**
of trade accounts receivable	-89	-75
of contract assets	–	–
of other debt instruments subsequently measured at amortized cost	-5	-2
of other debt instruments subsequently measured at fair value through other comprehensive income	–	–
Reversals of impairment losses	**87**	**105**
of trade accounts receivable	85	69
of contract assets	–	–
of other debt instruments subsequently measured at amortized cost	2	35
of other debt instruments subsequently measured at fair value through other comprehensive income	–	–
Net impairment on financial assets	**-8**	**27**

The loss allowances recognized for trade accounts receivable shown above applied entirely to receivables resulting from contracts with customers. Reversals of impairment losses in 2018 mainly related to an other receivable from a final payment in connection with the generics business divested in 2007.

Credit risks from trade accounts receivable

The credit risk from trade receivables is largely impacted by the specific circumstances of individual customers. Merck also considers additional factors such as the general default risk in the respective industry and country in which the customer operates. The credit risk of customers is assessed using established credit management processes that take individual customer risks into account. This is done in particular by analyzing the aging structure of trade accounts receivable.
Merck continuously reviews and monitors open positions of all its customers in the corresponding countries and takes steps to-mitigate risks if necessary.

The table below contains an overview of the credit risk by business sector and country rating established by leading rating agencies as of December 31, 2019:

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€ million	Healthcare	Life Science	Performance Materials	**Group**
External credit rating of at least AA- or comparable	763	883	526	2,172
External credit rating of at least BBB- or comparable	278	164	20	463
External credit rating lower than BBB- or comparable	573	42	2	617
Trade accounts receivable before loss allowances	**1,614**	**1,089**	**548**	**3,251**

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€ million	Healthcare	Life Science	Performance Materials	**Group**
External credit rating of at least AA- or comparable	856	827	437	2,120
External credit rating of at least BBB- or comparable	252	146	21	420
External credit rating lower than BBB- or comparable	427	36	2	465
Trade accounts receivable before loss allowances	**1,535**	**1,010**	**460**	**3,004**

Goods were generally sold under retention of title so that a reimbursement claim exists in the event of default. Other guarantees generally were not demanded. The scope of credit-insured receivables was immaterial for Merck.

Loss allowances based on expected credit losses for trade accounts receivable as of December 31, 2019, were as follows:

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€ million	Not yet due	Up to 90 days past due	Up to 180 days past due	Up to 360 days past due	More than 360 days past due	**Total**
Expected loss rate	0.6%	1.9%	6.1%	11.1%	41.3%	
Trade accounts receivable before loss allowances	2,669	367	59	43	112	3,251
thereof: credit impaired	5	1	2	3	42	53
Loss allowances	**-16**	**-7**	**-4**	**-5**	**-46**	**-77**
thereof: credit impaired	-2	-1	-1	-2	-41	-47

The carrying amounts, already reduced by their expected lifetime credit loss, of trade accounts receivable that are classified as originated credit impaired financial assets were € 3 million (2018: € 0 million) as of December 31, 2019. They are included in the above table under credit impaired trade accounts receivable. For these receivables, expected credit losses in the amount of € 3 million (2018: € 0 million) were recognized in fiscal 2019.

Loss allowances based on expected credit losses for trade accounts receivable as of December 31, 2018, were as follows:

DECEMBER 31, 2018

€ million	Not yet due	Up to 90 days past due	Up to 180 days past due	Up to 360 days past due	More than 360 days past due	**Total**
Expected loss rate	0.5%	0.8%	3.3%	34.8%	53.1%	
Trade accounts receivable before loss allowances	2,415	399	60	66	64	3,004
thereof: credit impaired	2	1	2	16	30	51
Loss allowances	**-12**	**-3**	**-2**	**-23**	**-34**	**-73**
thereof: credit impaired	-1	–	–	-14	-29	-44

The corresponding loss allowances changed as follows:

€ million	**2019**	2018
1.1	**-73**	**-373**
Additions	-89	-75
Utilizations	7	308
Derecognition	85	69
Reclassification to assets held for sale	–	4
Effects of currency translation	-3	-7
Changes in scope of consolidation	-3	1
31.12	**-77**	**-73**

In 2018, Merck utilized a recognized impairment loss of € 299 million in connection with loss allowances established on trade accounts receivable for the Venezuelan subsidiary, as the probability of receiving payments was considered to be minimal. The Venezuelan subsidiary was deconsolidated in fiscal year 2016 due to the absence of the possibility of exercising control.

Credit risks from other receivables

As of December 31, 2019, other receivables of € 340 million were almost exclusively allocated to Level 1 of the general three-stage impairment model, as in 2018 (other receivables as of December 31, 2018: € 314 million). In these cases, the credit loss expected in the next 12 months was used to determine the amount of impairment when examining the individual credit risk of the respective contract partner. The loss allowances recognized amounted to € 4 million as of December 31, 2019 (December 31,2018: € 3 million).

Credit risks from other financial assets

Merck limits credit risks from other financial assets by concluding contracts only with contract partners whose creditworthiness is good. The credit risk from financial contracts is monitored daily on the basis of rating information as well as market information on credit default swap rates.

(43) Information on fair value measurement

Accounting and measurement policies

The measurement techniques and main input factors used to determine the fair value of financial instruments are as follows:

FAIR VALUE DETERMINED BY OFFICIAL PRICES AND QUOTED MARKET VALUES (LEVEL 1)

	Financial instruments concerned	Description of the measurement technique	Main input factors used to determine fair values
Financial assets			
Subsequent measurement at fair value through other comprehensive income			
Equity instruments	Shares	Derived from active market	Quoted prices in an active market
Other debt instruments	Bonds		
	Other short-term cash investments		
Subsequent measurement at fair value through profit or loss			
Other debt instruments	Publicly-traded funds	Derived from active market	Quoted prices in an active market
Financial debt			
Subsequent measurement at amortized cost			
Financial debt	Bonds	Derived from active market	Quoted prices in an active market

FAIR VALUE
DETERMINED USING INPUT FACTORS OBSERVABLE IN THE MARKET (LEVEL 2)

	Financial instruments concerned	Description of the measurement technique	Main input factors used to determine fair values
Financial assets			
Subsequent measurement at fair value through other comprehensive income			
Equity instruments	Shares	Derived from active market including a liquidity discount	Quoted prices in an active market and volatilities observable on the market
Subsequent measurement at fair value through profit or loss			
Other debt instruments	Convertible note/bond with embedded settlement option for equity in companies	Nominal value considering a liquidity discount	Volatilities observable on the market
Derivatives (without a hedging relationship)	Forward exchange contracts and currency options	Use of recognized actuarial methods	Spot and forward rates observable on the market as well as exchange rate volatilities
	Interest rate swaps		Interest rate curves available on the market
Derivatives (with a hedging relationship)			
	Forward exchange contracts and currency options	Use of recognized actuarial methods	Spot and forward rates observable on the market as well as exchange rate volatilities
Financial debt			
Subsequent measurement at fair value through profit or loss			
Derivatives (without a hedging relationship)	Forward exchange contracts and currency options	Use of recognized actuarial methods	Spot and forward rates observable on the market as well as exchange rate volatilities
	Interest rate swaps		Interest rate curves available on the market
Derivatives (with a hedging relationship)			
	Forward exchange contracts and currency options	Use of recognized actuarial methods	Spot and forward rates observable on the market as well as exchange rate volatilities
Subsequent measurement at amortized cost			
Financial debt	Liabilities to banks and other loan liabilities	Discounting of future cash flows	Interest rates observable on the market

FAIR VALUE DETERMINED USING INPUT FACTORS UNOBSERVABLE IN THE MARKET (LEVEL 3)

	Financial instruments concerned	Description of the measurement technique	Main input factors used to determine fair values
Financial assets			
Subsequent measurement at fair value through other comprehensive income			
Equity instruments	Equity investments in unlisted companies	Discounting of expected future cash flows	Expected cash flows from recent business planning, average cost of capital, expected long-term growth rate
		Derived from observable prices within the scope of equity refinancing sufficiently close to the balance sheet date, considered risk allowances	Observable prices derived from equity refinancing
		Cost-based determination	Acquisition cost
Trade and other receivables	Trade accounts receivable that are intended for sale due to a factoring agreement	Nominal value less factoring fees	Nominal value of potentially sold trade accounts receivable, average fees for sales of trade accounts receivable
Subsequent measurement at fair value through profit or loss			
Derivatives (without a hedging relationship)	Option on equity instruments in unlisted companies	Option pricing models	Sales planning, milestone payments, probabilities of regulatory and commercial events, discount rates
Contingent considerations	Contingent considerations from the sale of businesses or shares in corporations	Discounting of probability-weighted future milestone payments and license fees	Sales planning,milestone payments, probabilities of regulatory and commercial events, discount rates
Other debt instruments	Interests in unlisted funds	Consideration of the fair value of companies in which the funds are invested	Net asset values of the fund interests
	Bonds with embedded settlement option for equity in an unlisted company	Use of recognized actuarial methods	Interest rates observable on the market
Financial debt			
Subsequent measurement at fair value through profit or loss			
Contingent considerations	Contingent considerations from the purchase of businesses	Discounting of probability-weighted future milestone payments and license fees	Sales planning,milestone payments, probabilities of regulatory and commercial events, discount rates

Counterparty credit risk was taken into consideration for measurements of financial instruments at fair value. In the case of non-derivative financial instruments, such as other liabilities or interest-bearing securities, this was reflected using risk premiums on the discount rate, while discounts on market value (so-called credit valuation adjustments and debit valuation adjustments) were used for derivatives.

Equity investments in unlisted companies (Level 3)

The planning periods used to determine the fair value of equity investments in unlisted companies ranged from 1 to 9 years (December 31, 2018: 2 to 8 years). Cash flows for periods in excess of this are included in the terminal value calculation using long-term growth rates of between 1.0% and 2.0% (December 31, 2018: 0.5% and 2.0%). The applied average cost of capital (after tax) was 7.0% on December 31, 2019 (December 31, 2018: 7.0%).

Assets from contingent considerations (Level 3)

The fair values of assets from contingent considerations are calculated by weighting the expected future milestone payments and royalties using their probability of occurrence and discounting them. The main parameters when determining contingent considerations are

- the estimated probability of reaching the individual milestone events,
- the underlying sales planning used to derive royalties,
- and the discount factor used.

When determining the probability of occurrence of the individual milestones events in connection with the development of drug candidates, the focus is on empirically available probabilities of success of development programs in comparable phases of clinical development in the relevant therapeutic areas. To determine the sales planning, internal sales plans and sales plans of external industry services are used. The discount rate (after tax) as of December 31, 2019, of between 5.9% and 6.9% (December 31, 2018: 6.3% to 7.3%) was calculated using the weighted average cost of capital.

Significant discretionary decisions and sources of estimation uncertainty

Equity investments in unlisted companies

Determining the parameters that are to be included in discounted cash-flow-methods and deriving the fair value from observable prices within the scope of equity refinancing are both subject to discretionary decisions and estimation uncertainty.

Assets from contingent consideration

The calculation of the fair value of assets from contingent considerations is subject to significant discretionary judgment. The most significant contingent consideration was the future purchase price claim from the disposal of the Biosimilars business to Fresenius SE & Co. KGaA, Bad Homburg vor der Höhe, on August 31, 2017. It was calculated by an external valuation expert on initial recognition in 2017 and continued on this basis. As of December 31, 2019, the carrying amount was € 198 million (December 31, 2018: € 196 million).

If, in the context of determining the fair value of this contingent consideration at the date of transaction, the probability of approval as well as the discount factor of the three major development programs had been estimated to be lower or higher, this would have led to the following changes in the measurement and the corresponding effects on the profit before income tax:

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		Change in probability of regulatory approval		
€ million		-10%	unchanged	10%
	5.4%	-28	6	40
Change of discount rate	5.9% (unchanged)	-33	0	33
	6.4%	-37	-6	26

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		Change in probability of regulatory approval		
€ million		-10%	unchanged	10%
	5.8%	-34	5	45
Change of discount rate	6.3% (unchanged)	-38	0	38
	6.8%	-42	-5	32

The following table presents the carrying amounts and the fair values of the individual financial assets and liabilities as of December 31, 2019, for each financial instrument class pursuant to IFRS 9:

DECEMBER 31, 2019

		Carrying amount			Fair value[1]			
€ million	Consolidated notes	Current	Non-current	Total	Fair value determined by official prices and quoted market values (Level 1)	Fair value determined using input factors observable in the market (Level 2)	Fair value determined using input factors not observable in the market (Level 3)	Total
Financial assets								
Subsequent measurement at amortized cost								
Cash and cash equivalents	35	781	–	**781**				
Trade and other receivables (excluding leasing receivables)	24	3,458	22	**3,480**				
Other debt instruments	36	1	8	**9**				
Subsequent measurement at fair value through other comprehensive income								
Equity instruments	36	–	399	**399**	209	–	190	**399**
Trade and other receivables	24	24	–	**24**	–	–	24	**24**
Other debt instruments	36	29	9	**39**	39	–	–	**39**
Subsequent measurement at fair value through profit or loss								
Equity instruments	36	–	–	**–**	–	–	–	**–**
Contingent considerations	36	–	258	**258**	–	–	258	**258**
Other debt instruments	36	–	50	**50**	2	22	26	**50**
Derivatives without a hedging relationship	36, 39	20	14	**33**	–	33	–	**33**
Derivatives with a hedging relationship	36, 39	7	–	**7**	–	7	–	**7**
Lease receivables (measured in accordance with IFRS 16)[2]	24	5	–	**5**				
Total		**4,325**	**761**	**5,086**	**250**	**62**	**499**	**810**
Financial debt								
Subsequent measurement at amortized cost								
Trade payables and other liabilities	29	2,054	–	**2,054**				
Financial debt	37	4,422	8,129	**12,551**	10,183	2,706	–	**12,889**
Other financial liabilities	38	1,081	27	**1,108**				
Subsequent measurement at fair value through profit or loss								
Contingent considerations	38	–	16	**16**	–	–	16	**16**
Derivatives without a hedging relationship	37, 39	19	56	**76**	–	76	–	**76**
Derivatives with a hedging relationship	38, 39	46	–	**46**	–	46	–	**46**
Refund liabilities	11	565	–	**565**				
Lease liabilities (measured in accordance with IFRS 16)[2]	37	109	458	**567**				
Total		**8,295**	**8,687**	**16,982**	**10,183**	**2,828**	**16**	**13,027**

[1] The simplification option under IFRS 7.29(a) was used for disclosures of certain fair values.

[2] Measurements within the scope of IFRS 16 are exempted from the requirements of IFRS 13 (IFRS 13.6(b)).

The following table presents the carrying amounts and the fair values of the individual financial assets and liabilities as of December 31, 2018, for each individual financial instrument class pursuant to IFRS 9:

DECEMBER 31, 2018

		Carrying amount			Fair value[1]			
€ million	Consolidated notes	Current	Non-current	**Total**	Fair value determined by official prices and quoted market values (Level 1)	Fair value determined using input factors observable in the market (Level 2)	Fair value determined using input factors not observable in the market (Level 3)	**Total**
Financial assets[2]								
Subsequent measurement at amortized cost								
Cash and cash equivalents	35	2,170	–	**2,170**				
Trade and other receivables (excluding leasing receivables)	24	3,204	17	**3,221**				
Other debt instruments	36	1	9	**10**				
Subsequent measurement at fair value through other comprehensive income								
Equity instruments	36	–	274	**274**	17	118	140	**274**
Trade and other receivables	24	21	–	**21**	–	–	21	**21**
Other debt instruments	36	8	4	**12**	12	–	–	**12**
Subsequent measurement at fair value through profit or loss								
Equity instruments	36	–	–	**–**	–	–	–	**–**
Contingent considerations	36	–	259	**259**	–	–	259	**259**
Other debt instruments	36	–	50	**50**	2	22	27	**50**
Derivatives without a hedging relationship	36, 39	16	59	**76**	–	30	45	**76**
Derivatives with a hedging relationship	36, 39	4	1	**4**	–	4	–	**4**
Lease receivables (measured in accordance with IAS 17)[3]	24	1	–	**1**				
Total		**5,425**	**673**	**6,098**	**30**	**174**	**492**	**696**
Financial liabilities[2]								
Subsequent measurement at amortized cost								
Trade payables and other liabilities	29	1,766	–	**1,766**				
Financial debt	37	2,196	6,601	**8,797**	7,258	1,645	–	**8,903**
Other financial liabilities	38	1,019	13	**1,032**				
Subsequent measurement at fair value through profit or loss								
Contingent considerations	37	1	4	**5**	–	–	5	**5**
Derivatives without a hedging relationship	37, 39	16	73	**90**	–	90	–	**90**
Derivatives with a hedging relationship	38, 39	58	20	**78**	–	78	–	**78**
Refund liabilities	11	472	–	**472**				
Lease liabilities (measured in accordance with IAS 17)[3]	37	2	2	**4**				
Total		**5,530**	**6,714**	**12,244**	**7,258**	**1,813**	**5**	**9,076**

[1] The simplification option under IFRS 7.29(a) was used for disclosures of certain fair values.

[2] Previous year's figures have been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes".

[3] Measurements within the scope of IAS 17 are exempted from the requirements of IFRS 13 (IFRS 13.6(b)).

The changes in financial assets and liabilities for each of the individual classes of financial instruments allocated to Level 3 and measured at fair value were as follows:

2019

		Financial assets					Financial liabilities
		Subsequent measurement at fair value through profit or loss			Subsequent measurement at fair value through other comprehensive income		Subsequent measurement at fair value through profit or loss
€ million	**Total**	Other debt instruments	Contingent considerations	Derivatives without a hedging relationship	Equity instruments	Trade and other receivables	Contingent considerations
Net carrying amounts, Jan. 1, 2019	**487**	**27**	**259**	**45**	**140**	**21**	**-5**
Additions due to acquisitions/divestments/conclusion of factoring agreements	73	9	–	–	53	26	-13
Transfers into Level 3 from Level 1/Level 2	–	–	–	–	–	–	–
Fair value changes							
Gains (+)/losses (–) recognized in the consolidated income statement	-22	3	19	-45		–	1
thereof: other operating result	3	2	-1	–		–	2
thereof: attributable to assets/liabilities held as of the balance sheet date	-11	2	-15	–		–	2
thereof: financial result	-25	1	20	-45		–	–
thereof: attributable to assets/liabilities held as of the balance sheet date	20	1	20	–		–	–
Gains (+)/losses (–) recognized in other comprehensive income	98				98	–	
Currency translation difference	–	–	–	–	–	–	–
Disposals due to divestments/payments received/payments made	-50	-2	-20	–	-6	-22	1
Transfers out of Level 3 into Level 1/Level 2	-104	–	–	–	-104	–	–
Other	–	-10	–	–	10	–	–
Net carrying amounts as of Dec. 31, 2019	**483**	**26**	**258**	**–**	**190**	**24**	**-16**

Additions during the reporting period comprised primarily acquisitions of equity instruments, trade accounts receivable that are designated to be sold on account of a factoring agreement, as well as bonds with a conversion right for shares in unlisted companies. Disposals during the reporting period related particularly to advance payments received in connection with trade accounts receivable under factoring agreements and payments received in connection with the contingent consideration from the sale of the Biosimilars business. The transfer from Level 3 to Level 1 relates to the M Ventures portfolio company Progyny, Inc., United States which has since been listed. The gains and losses from Level 3 assets recognized in other comprehensive income were reported in the consolidated statement of comprehensive income under the item “fair value adjustments”.

2018

		Financial assets					Financial liabilities
		Subsequent measurement at fair value through profit or loss			Subsequent measurement at fair value through other comprehensive income		Subsequent measurement at fair value through profit or loss
€ million	**Total**	Other debt instruments	Contingent considerations	Derivatives without a hedging relationship	Equity instruments	Trade and other receivables	Contingent considerations
Net carrying amounts, Jan. 1, 2018	**447**	**21**	**277**	**46**	**106**	**–**	**-3**
Additions due to acquisitions/divestments/conclusion of factoring agreements	105	15	8	–	33	49	–
Transfers into Level 3 from Level 1/Level 2	–	–	–	–	–	–	–
Fair value changes							
Gains (+)/losses (–) recognized in the consolidated income statement	-7	2	-7	-1		–	-1
thereof: other operating result	-31	-1	-29	–		–	-1
thereof: attributable to assets/liabilities held as of the balance sheet date	-37	-1	-36	–		–	-1
thereof: financial result	24	3	22	-1		–	–
thereof: attributable to assets/liabilities held as of the balance sheet date	24	3	22	-1		–	–
Gains (+)/losses (–) recognized in other comprehensive income	30				30	–	
Currency translation difference	1	1	–	–	–	–	–
Disposals due to divestments/payments received/payments made	-80	-4	-20	–	-29	-28	–
Transfers out of Level 3 into Level 1/Level 2	-9	–	–	–	-9	–	–
Other	–	-8	–	–	8	–	–
Net carrying amounts as of Dec. 31, 2018	**487**	**27**	**259**	**45**	**140**	**21**	**-5**

The following equity instruments measured at fair value through other comprehensive income were disposed of in 2019 and 2018:

€ million	Reasons for the disposal	Fair value on the date of derecognition	The cumulative gain (+) or loss (–) on disposal recognized in other comprehensive income	Transfer of the cumulative gains (+) or losses (–) within group equity to retained earnings
2019[1]				
M Ventures portfolio companies	Portfolio adjustment/restructuring and full acquisition by third parties	13	5	5
2018[1]				
M Ventures portfolio companies	Portfolio adjustment/restructuring and full acquisition by third parties	40	32	32
Cascadian Therapeutics, Inc., United States	Acquired in full by Seattle Genetics, Inc., United States	–	-17	-17
Nature's Best Health Products Ltd., United Kingdom	Sale to The Procter & Gamble Company, United States	–	–	–

[1] Disposals due to liquidations are not included.

M Ventures portfolio companies mainly include minority interests in unlisted companies. The mandate of M Ventures is to invest in innovative technologies and products that are related to Merck's three business sectors. The M Ventures portfolio companies that were disposed of in fiscal 2019 were Translate Bio, Inc., United States, Canbex Therapeutics Ltd., United Kingdom, and shares in Progyny, Inc., United States (2018: Prexton Therapeutics SA, Switzerland, F-Star Gamma Limited, United Kingdom, and shares in ObsEva SA, Switzerland).

(44) Other financial obligations

Other financial obligations comprised the following:

€ million	**Dec. 31, 2019**	Dec. 31, 2018
Acquisition of intangible assets	984	1,548
Acquisition of property, plant, and equipment	159	144
Operating lease (IAS 17)[1]		561
Other financial obligations	**1,143**	**2,253**

[1] Previous year's figure was restated.

Obligations to acquire intangible assets existed in particular owing to contingent considerations within the scope of in-licensing and research and development collaborations. In these agreements, Merck has entered into an obligation to make milestone payments once specific targets have been reached. In the not very likely event that all contract partners achieve all of their milestones, Merck would be obligated to pay up to € 984 million (December 31, 2018: € 1,548 million) for the acquisition of intangible assets. The decrease compared to 2018 is mainly attributable to the restructuring of the collaboration with F-Star Delta Ltd., United Kingdom (see Note (6) "Collaboration agreements"). The table above does not contain any other financial obligations from possible future sales-based license fees and milestone payments.

The expected maturities of the obligations to acquire intangible assets were as follows:

€ million	**Dec. 31, 2019**	Dec. 31, 2018
Within 1 year	55	61
In 1–5 years	159	710
After more than 5 years	770	776
Obligations to acquire intangible assets	**984**	**1,548**

Other financial obligations were recognized at nominal value.

Due to the initial application of IFRS 16 and the associated accounting changes, the maturities of the obligations from lease agreements are only shown here for 2018. For details see Note (45) "Effects from new accounting standards and other presentation changes":

DECEMBER 31, 2018

€ million	Under 1 year	In 1–5 years	After more than	**Total**
Present value of future payments from finance leases	2	2	–	4
Interest component of finance leases	–	–	–	–
Future finance lease payments	**2**	**2**	**–**	**4**
Future operating lease payments[1]	**115**	**308**	**138**	**561**

[1] Previous year's figure was restated.

Other Disclosures

(45) Effects from new accounting standards and other presentation changes

Changes to accounting and measurement policies resulting from IFRS 16 "Leases"

Merck applied the accounting standard IFRS 16 "Leases" for the first time as of January 1, 2019. IFRS 16 replaces IAS 17 "Leases" and the corresponding interpretations. For transitioning to IFRS 16, Merck applied the modified retrospective method with recognition of the cumulative transition effect as of January 1, 2019. Prior-year comparative figures were not restated.

IFRS 16 introduces a uniform lessee accounting model that requires lessees to recognize all leases in the consolidated balance sheet. This model mandates that right-of-use assets be recognized for identified assets and lease liabilities recognized for entered payment obligations. The new lease accounting regulations affect Merck as a lessee, in particular regarding leased real estate and vehicles. Rules governing lessor accounting of leases remain largely unchanged. However, this business has no material relevance for Merck. Furthermore, the new provisions of IFRS 16 on sale and leaseback accounting have no impact on the consolidated financial statements.

Lease liabilities – recognized for leases with Merck as a lessee – are to be measured at the present value of the outstanding lease payments in accordance with IFRS 16. The weighted average interest rate used to discount the leases existing as of January 1, 2019, amounted to 2.8%. The present value of outstanding lease payments adjusted for directly attributable costs was also used to recognize the right-of-use asset. Prepayments and liabilities related to previous periods were also still taken into consideration. When remaining lease terms are determined at first-time application, the probability that purchase, extension, or termination options will be exercised is assessed based on current knowledge. These assessments were discretionary.

According to IFRS 16, right-of-use assets are recognized within property, plant and equipment, using the same line item that would have been used if the underlying asset had been purchased by Merck. Interest expenses from the unwinding of the discount on lease liabilities are recognized in the financial result in accordance with IFRS 16; this differs from the previous accounting method in accordance with IAS 17, according to which operating lease expenses were recognized in full in the respective functional costs.

This had the following effects on the consolidated balance sheet:

€ million	**Jan. 1, 2019**
Property, plant and equipment	
Land, land rights, and buildings	384
Plant and machinery	17
Other facilities, operating and office equipment	67
Total right-of-use assets	**467**
Other current non-financial assets	**-2**
Non-current financial debt	
Lease liabilities	349
Current financial debt	
Lease liabilities	116
Total lease liabilities	**465**

The following shows a reconciliation from the payment obligation for operating leases (IAS 17) as of December 31, 2018, to the opening balance for lease liabilities as of January 1, 2019:

€ million	Jan. 1, 2019
Payment obligations for operating leases as of December 31, 2018 (IAS 17)[1]	**561**
Practical expedient for leasing low-value assets	-54
Minimum lease payments (nominal value) of the liabilities from finance leases as of December 31, 2018	4
Variable lease payments depending on an index or an installment	19
Lease payments based on renewal options classified as sufficiently probable as of January 1, 2019	1
Lease payments based on termination options classified as not sufficiently probable as of January 1, 2019	27
Service agreements outside of the scope of IFRS 16	-33
Undiscounted lease liabilities as of January 1, 2019	**525**
Discount	-56
Lease liability as of January 1, 2019	**469**
Present value of the lease liabilities from finance leases as of December 31, 2018	-4
Additional lease liabilities from the first-time application of IFRS 16 as of January 1, 2019	**465**

[1] Previous year's figure was restated.

Merck made use of the following practical expedients of IFRS 16:

- right-of-use assets, including the corresponding liabilities, from leases of low-value assets are not be recognized in the consolidated balance sheet;
- leases of intangible assets within the scope of IAS 38 are not recognized in accordance with IFRS 16;
- for right-of-use assets – except land, land rights, and buildings – Merck does not separate non-lease components from lease components;
- leases that were previously subject to IAS 17 and the corresponding interpretations will continue to be treated as leases under IFRS 16;
- at first-time application, no impairment tests for right-of-use assets were carried out – instead, Merck charged provisions for onerous contracts against the respective right-of-use assets;
- at first-time application, directly attributable costs incurred at contract inception were not taken into consideration;
- if renewal or termination options existed, the term was determined retroactively;
- for right-of-use assets and the lease liabilities of leases classified as finance leases under IAS 17, the carrying amounts were retained on the date of first-time application.

Merck did not apply the practical expedient regarding leases with a term of less than 12 months.

Other presentational changes

To improve comparability and transparency, the presentation of functional costs in the consolidated income statement and the consolidated balance sheet classification were adjusted. The changes in the consolidated income statement concern the functional presentation of expenses and income from so-called "adjustments" which were previously included in other operating income and other operating expenses. The "adjustments" are now presented directly in the respective functional cost in order to make the connection to functional cost of the relevant expenses and income directly apparent. In the consolidated balance sheet, the other assets and other liabilities are assigned to financial and non-financial assets and liabilities in accordance with their nature. Contract assets are now presented as a separate balance sheet item. Furthermore, trade accounts receivable and other receivables were combined. Under Group equity, reserves were divided into capital reserves and retained earnings.

The restated 2018 comparative figures in the consolidated income statement and consolidated balance sheet can be seen in the following tables.

Effects of new accounting standards and other presentation changes in the consolidated income statement and the consolidated balance sheet

The following table shows the effects of the aforementioned changes to accounting and measurement policies on the consolidated balance sheet.

€ million	**Dec. 31, 2018 (as reported)**	Reclassification Receivables/ liabilities	Reclassification Derivatives	Reclassification Non-financial assets/ liabilities	Reclassification Equity/ reserves	**Dec. 31, 2018 (after reclassification)**	Application of IFRS 16	**Jan. 1, 2019 (after adjustment)**
Non-current assets								
Goodwill	13,764	–	–	–	–	13,764	–	13,764
Other intangible assets	7,237	–	–	–	–	7,237	–	7,237
Property, plant and equipment	4,811	–	–	–	–	4,811	467	5,278
Other non-current financial assets	610	–	46	–	–	656	–	656
Other non-current receivables		17	–	–	–	17	–	17
Other non-current non-financial assets		–	–	76	–	76	–	76
Other non-current assets	138	-17	-46	-76	–			
Deferred tax assets	1,091	–	–	–	–	1,091	–	1,091
	27,652	**–**	**–**	**–**	**–**	**27,652**	**467**	**28,119**
Current assets								
Inventories	2,764	–	–	–	–	2,764	–	2,764
Trade accounts receivable	2,931	-2,931	–	–	–			
Trade and other current receivables		3,226	–	–	–	3,226	–	3,226
Contract assets		–	–	52	–	52	–	52
Other current financial assets	24	–	4	–	–	29	–	29
Other current non-financial assets		–	–	536	–	536	-2	534
Other current assets	886	-295	-4	-587				
Income tax receivables	460	–	–	–	–	460	–	460
Cash and cash equivalents	2,170	–	–	–	–	2,170	–	2,170
	9,236	–	–	–	–	**9,236**	**-2**	**9,234**
Total assets	**36,888**	–	–	–	–	**36,888**	**465**	**37,353**
Total equity								
Equity capital	565	–	–	–	–	565	–	565
Reserves	15,006	–	–	–	-15,006			
Capital reserves		–	–	–	3,814	3,814	–	3,814
Retained earnings		–	–	–	11,192	11,192	–	11,192
Gains/losses recognized in equity	1,629	–	–	–	–	1,629	–	1,629
Equity attributable to Merck KGaA shareholders	**17,200**	–	–	–	–	**17,200**	**–**	**17,200**
Non-controlling interests	33	–	–	–	–	33		33
	17,233	–	–	–	–	**17,233**	**–**	**17,233**

Non-current liabilities								
Provisions for pensions and other post-employment benefits	2,336	–	–	–	–	2,336	–	2,336
Other non-current provisions	780	–	–	–	–	780	–	780
Non-current financial debt	6,681	–	–	–	–	6,681	349	7,030
Other non-current financial liabilities		13	20	–	–	33	–	33
Other non-current non-financial liabilities		–	–	19	–	19	–	19
Other non-current liabilities	52	-13	-20	-19	–			
Deferred tax liabilities	1,288	–	–	–	–	1,288	–	1,288
	11,138	–	–	–	–	**11,138**	**349**	**11,487**
Current liabilities								
Current provisions	600	–	–	–	–	600	–	600
Current financial debt	2,215	–	–	–	–	2,215	116	2,331
Other current financial liabilities		1,019	58	–	–	1,077	–	1,077
Trade and other current payables	1,766	–	–	–	–	1,766	–	1,766
Refund liabilities	472	–	–	–	–	472	–	472
Income tax liabilities	1,176	–	–	–	–	1,176	–	1,176
Other current non-financial liabilities		–	–	1,211	–	1,211	–	1,211
Other current liabilities	2,288	-1,019	-58	-1,211	–			
	8,517	**–**	**–**	**–**	**–**	**8,517**	**116**	**8,633**
Total equity and liabilities	**36,888**	**–**	**–**	**–**	**–**	**36,888**	**465**	**37,353**

CONSOLIDATED INCOME STATEMENT

	2018		
€ million	**as reported**	**changes in presentation**	**adjusted**
Net sales	**14,836**	**–**	**14,836**
Cost of sales	-5,382	–	-5,382
Gross profit	**9,454**	**–**	**9,454**
Marketing and selling expenses	-4,384	-13	-4,396
Administration expenses	-993	-190	-1,183
Research and development costs	-2,225	-2	-2,227
Other operating income and expenses	-126	205	79
Operating result (EBIT)[1]	**1,727**	**–**	**1,727**

[1] Not defined by International Financial Reporting Standards (IFRSs).

HEALTHCARE RESULTS OF OPERATIONS

	2018		
€ million	**as reported**	**changes in presentation**	**adjusted**
Net sales	**6,246**	**–**	**6,246**
Cost of sales	-1,425	–	-1,425
Gross profit	**4,820**	**–**	**4,820**
Marketing and selling expenses	-2,339	-10	-2,349
Administration expenses	-301	-28	-329
Research and development costs	-1,686	-1	-1,687
Other operating income and expenses	237	39	276
Operating result (EBIT)[1]	**731**	**–**	**731**

[1] Not defined by International Financial Reporting Standards (IFRSs).

LIFE SCIENCE RESULTS OF OPERATIONS

	2018		
€ million	as reported	changes in presentation	adjusted
Net sales	**6,185**	**–**	**6,185**
Cost of sales	-2,723	–	-2,723
Gross profit	**3,463**	**–**	**3,463**
Marketing and selling expenses	-1,775	-2	-1,777
Administration expenses	-282	-52	-335
Research and development costs	-249	-1	-251
Other operating income and expenses	-121	56	-65
Operating result (EBIT)[1]	**1,036**	**–**	**1,036**

[1] Not defined by International Financial Reporting Standards (IFRSs).

PERFORMANCE MATERIALS RESULTS OF OPERATIONS

	2018		
€ million	as reported	changes in presentation	adjusted
Net sales	**2,406**	**–**	**2,406**
Cost of sales	-1,231	–	-1,231
Gross profit	**1,175**	**–**	**1,175**
Marketing and selling expenses	-255	–	-255
Administration expenses	-90	-17	-107
Research and development costs	-242	–	-242
Other operating income and expenses	-81	16	-64
Operating result (EBIT)[1]	**508**	**–**	**508**

[1] Not defined by International Financial Reporting Standards (IFRSs).

(46) Related-party disclosures

Accounting and measurement policies

Related parties in respect of the Merck Group are E. Merck KG, Emanuel-Merck-Vermögens-KG and E. Merck Beteiligungen KG. Furthermore, direct or indirect subsidiaries of Merck KGaA, associates of the Merck Group, jointly controlled companies where the Merck Group is involved, as well as pension funds that are classified as defined benefit plans in accordance with IAS 19 are also related parties within the meaning of IAS 24. Members of the Executive Board and the Supervisory Board of Merck KGaA, the Executive Board and the Board of Partners of E. Merck KG as well as close members of their families are also related parties, as are companies controlled by this group of persons.

As of December 31, 2019, there were liabilities by Merck Financial Services GmbH, Merck KGaA and Merck & Cie, Switzerland, to E. Merck KG in the amount of € 1,320.0 million (December 31, 2018: € 1,331.6 million). The balances result mainly from mutual profit transfers between Merck KGaA and E. Merck KG as well as the profit transfer by Merck & Cie, Switzerland, to E. Merck KG.

These included financial liabilities of € 808.4 million (December 31, 2018: € 820.8 million), subject to standard market conditions. Neither collateral nor guarantees existed for any of the balances either in favor or to the disadvantage of the Merck Group.

From January to December 2019, Merck KGaA performed services for E. Merck KG with a value of € 1.2 million (2018: € 1.0 million) and for E. Merck Beteiligungen KG with a value of € 0.3 million (2018: € 0.3 million); Merck Real Estate GmbH performed services for Emanuel-Merck-Vermögens-KG with a value of € 0.2 million (2018: € 0.0 million). During the same period, E. Merck KG performed services for Merck KGaA with a value of € 0.5 million (2018: € 0.5 million).

As of December 31, 2019, there were receivables of € 5.4 million (December 31, 2018: € 12.0 million) and liabilities of € 5.9 million (December 31, 2018: € 10.1 million) vis-à-vis non-consolidated subsidiaries. From January to December 2019, the Merck Group generated revenues of € 0.1 million (December 31, 2018: € 0.1 million) with these companies. During the same period, expenses amounting to € 0.3 million (December 31, 2018: € 0.3 million) were incurred as a result of transactions with these companies.

Between January and December 2019, sales of € 0.0 million (2018: € 0.7 million) from supplies of goods resulted from transactions with Altmann-Analytik GmbH & Co. KG, Munich, whose managing director was a member of the Supervisory Board of Merck KGaA until April 26, 2019, and who also served as a member of the Board of Partners of E. Merck KG until January 27, 2019. In addition, there were receivables of € 0.0 million vis-à-vis this company as of December 31, 2019 (December 31, 2018: € 0.1 million).

Information on pension funds that are classified as defined benefit plans in accordance with IAS 19 can be found in Note (32) "Provisions for pensions and other post-employment benefits".

Information on Executive Board and Supervisory Board compensation can be found in Note (47) "Executive Board and Supervisory Board compensation". Activities above and beyond those set forth in Note (47) such as the provision of services or the granting of loans, between companies of the Merck Group and members of the Executive Board or the Supervisory Board of Merck KGaA, the Executive Board or the Board of Partners of E. Merck KG or members of their immediate families neither took place in 2019 nor 2018.

(47) Executive Board and Supervisory Board compensation

The compensation of the Executive Board of Merck KGaA is basically paid by the general partner, E. Merck KG. From January to December 2019, companies included in these consolidated financial statements recognized expenses of € 3.8 million (2018: € 3.2 million) for services rendered by members of the Executive Board of Merck KGaA at these companies.

From January to December 2019, fixed salaries of € 5.6 million (2018: € 5.9 million), variable compensation of € 15.3 million (2018: € 17.2 million), and additional benefits of € 0.8 million (2018: € 0.4 million) were recorded by E. Merck KG and by companies included in these consolidated financial statements for members of the Executive Board of Merck KGaA. Furthermore, additions to provisions at these companies also included expenses of € 7.1 million (2018: € 15.9 million) for the long-term incentive plan, and additions to pension provisions included current service costs of € 3.0 million (2018: € 3.1 million).

The compensation of the Supervisory Board amounting to € 880.8 thousand (2018: € 869.0 thousand) consisted of a fixed portion of € 823.8 thousand (2018: € 822.5 thousand) and meeting attendance compensation of € 57.0 thousand (2018: € 46.5 thousand).

Further individualized information and details can be found in the Compensation Report.

(48) Auditor's fees

The costs for the auditors (KPMG) of the financial statements of the Merck Group consisted of the following:

	2019		2018	
€ million	**Merck Group**	**thereof: KPMG AG Wirtschafts-prüfungs-gesellschaft, Germany**	Merck Group	thereof: KPMG AG Wirtschafts-prüfungs-gesellschaft, Germany
Audits of financial statements	9.6	2.8	10.0	3.5
Other audit-related services	0.7	0.3	0.4	0.2
Tax consultancy services	0.4	0.1	0.9	0.4
Other services	0.3	0.1	–	–
Total	**11.0**	**3.3**	**11.3**	**4.1**

Other audit-related services pertain to various statutory or contractually agreed audits. Tax consultancy services encompass services in connection with the preparation of tax returns for employees delegated abroad. Other services pertained to other consultancy services in regulatory and buisness matters.

(49) Corporate governance

The Statement of Compliance in accordance with section 161 of the German Stock Corporation Act (Aktiengesetz) was published in the corporate governance section of the website www.merckgroup.com/ investors → Corporate governance in March 2019 and thus made permanently available.

(50) Information on preparation and approval

The Executive Board of Merck KGaA prepared the consolidated financial statements on February 14, 2020, and approved them for forwarding to the Supervisory Board. The Supervisory Board is responsible for the examination of the consolidated financial statements and declaring whether it approves them.

Subsequent to February 14, 2020, the impact of the Covid-19 situation created the need to adapt the consolidated financial statements.
Accordingly, the consolidated financial statements were amended on May 12, 2020 and approved for forwarding to the Supervisory Board.

Scope of Consolidation

(51) Changes in the scope of consolidation

Accounting and measurement policies

Overall, the impact of subsidiaries not consolidated due to immateriality on net sales, profit after tax, assets, and equity was less than 1% relative to the entire Merck Group. Investments held in non-consolidated subsidiaries were disclosed under non-current financial assets (see Note (36) "Other financial assets").

The scope of consolidation changed as follows in the reporting period:

Consolidated subsidiaries as of Dec. 31, 2018		**301**
Additions	Companies established	3
	Acquisitions	42
	Materiality	3
Disposals	Liquidations/mergers	-14
	Divestments	–
	Immateriality	–
	Loss of control	–
Consolidated subsidiaries as of Dec. 31, 2019		**335**
Non-consolidated subsidiaries as of Dec. 31, 2018		44
Non-consolidated subsidiaries as of Dec. 31, 2019		33

The list of non-consolidated subsidiaries mainly comprises non-operating shelf companies as well as entities subject to liquidation procedures, which are subsequently measured at fair value through other comprehensive income.

The list of shareholdings presents all the companies included in the consolidated financial statements as well as all of the shareholdings of Merck KGaA (see Note (52) "List of shareholdings").

(52) List of shareholdings

The shareholdings of Merck KGaA as of December 31, 2019, are presented below, along with a list of the fair values for equity instruments subsequently measured at fair value through other comprehensive income.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)
I. Fully consolidated companies				
Germany				
Germany	Merck KGaA	Darmstadt	Parent company	
Germany	AB Allgemeine Pensions GmbH & Co. KG	Zossen	100.00	100.00
Germany	Allergopharma GmbH & Co. KG A)	Reinbek	100.00	
Germany	Allergopharma Verwaltungs GmbH A)	Darmstadt	100.00	100.00
Germany	AZ Electronic Materials GmbH	Darmstadt	100.00	
Germany	Biochrom GmbH A)	Berlin	100.00	
Germany	BSSN Software GmbH	Darmstadt	100.00	
Germany	BSSN UG (haftungsbeschränkt)	Darmstadt	100.00	100.00
Germany	Chemitra GmbH A)	Darmstadt	100.00	100.00
Germany	Emedia Export Company mbH	Gernsheim	100.00	
Germany	Litec-LLL GmbH A)	Greifswald	100.00	100.00
Germany	Merck 12. Allgemeine Beteiligungs-GmbH A)	Darmstadt	100.00	100.00
Germany	Merck 13. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	
Germany	Merck 15. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	
Germany	Merck 16. Allgemeine Beteiligungs-GmbH A)	Darmstadt	100.00	
Germany	Merck 20. Allgemeine Beteiligungs-GmbH A)	Darmstadt	100.00	
Germany	Merck 21. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	
Germany	Merck 24. Allgemeine Beteiligungs-GmbH A)	Darmstadt	100.00	100.00
Germany	Merck Accounting Solutions & Services Europe GmbH A)	Weiterstadt	100.00	100.00
Germany	Merck Chemicals GmbH A)	Darmstadt	100.00	
Germany	Merck China Chemicals Holding GmbH	Darmstadt	100.00	
Germany	Merck Consumer Health Holding Germany GmbH	Darmstadt	100.00	100.00
Germany	Merck Export GmbH A)	Darmstadt	100.00	100.00
Germany	Merck Financial Services GmbH	Darmstadt	100.00	100.00
Germany	Merck Financial Trading GmbH	Gernsheim	100.00	
Germany	Merck Healthcare Holding GmbH	Darmstadt	100.00	100.00
Germany	Merck Healthcare KGaA A)	Darmstadt	100.00	
Germany	Merck Holding GmbH	Gernsheim	100.00	100.00
Germany	Merck International GmbH	Darmstadt	100.00	100.00
Germany	Merck Internationale Beteiligungen GmbH	Darmstadt	100.00	
Germany	Merck Life Science Germany GmbH A)	Darmstadt	100.00	
Germany	Merck Life Science GmbH A)	Eppelheim	100.00	100.00
Germany	Merck Life Science Holding GmbH	Darmstadt	100.00	100.00
Germany	Merck Patent GmbH A)	Darmstadt	100.00	
Germany	Merck Performance Materials Germany GmbH A)	Darmstadt	100.00	
Germany	Merck Performance Materials GmbH	Wiesbaden	100.00	
Germany	Merck Performance Materials Holding GmbH	Darmstadt	100.00	100.00
Germany	Merck Real Estate GmbH A)	Darmstadt	100.00	100.00
Germany	Merck Schuchardt OHG	Hohenbrunn	100.00	100.00
Germany	Merck Serono GmbH A)	Darmstadt	100.00	100.00

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Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)
Germany	Merck Vierte Allgemeine Beteiligungsgesellschaft mbH	Gernsheim	100.00	
Germany	Merck Wohnungs- und Grundstücksverwaltungsgesellschaft mbH	Darmstadt	100.00	100.00
Germany	Millipart GmbH	Gernsheim	100.00	
Germany	Sigma-Aldrich Biochemie GmbH	Steinheim	100.00	
Germany	Sigma-Aldrich Chemie GmbH	Steinheim	100.00	
Germany	Sigma-Aldrich Chemie Holding GmbH	Taufkirchen	100.00	
Germany	Sigma-Aldrich Grundstücks GmbH & Co. KG	Steinheim	100.00	
Germany	Sigma-Aldrich Logistik GmbH	Steinheim	100.00	
Germany	Sigma-Aldrich Produktions GmbH	Steinheim	100.00	
Germany	Sigma-Aldrich Verwaltungs GmbH	Steinheim	100.00	100.00
Germany	Versum Materials Germany GmbH	Frankfurt am Main	100.00	
Other European countries				
Austria	Allergopharma Vertriebsgesellschaft m.b.H.	Vienna	100.00	
Austria	Merck Chemicals and Life Science GesmbH	Vienna	100.00	
Austria	Merck Gesellschaft mbH	Vienna	100.00	
Austria	Sigma-Aldrich Handels GmbH	Vienna	100.00	
Belgium	Merck Chemicals N.V./S.A.	Overijse	100.00	
Belgium	Merck N.V.-S.A.	Overijse	100.00	
Belgium	Sigma-Aldrich BVBA/SPRL	Overijse	100.00	
Bulgaria	Merck Bulgaria EAD	Sofia	100.00	
Croatia	Merck d.o.o.	Zagreb	100.00	
Czech Republic	Merck spol. s r.o.	Prague	100.00	
Czech Republic	Sigma-Aldrich spol. s r.o.	Prague	100.00	
Denmark	Merck A/S	Soborg	100.00	
Denmark	Merck Life Science A/S	Soborg	100.00	
Denmark	Survac ApS	Frederiksberg	100.00	100.00
Estonia	Merck Serono OÜ	Tallinn	100.00	
Finland	Merck Life Science OY	Espoo	100.00	
Finland	Merck OY	Espoo	100.00	
France	Gonnon S.A.S.	Lyon	100.00	
France	Merck Biodevelopment S.A.S.	Lyon	100.00	
France	Merck Chimie S.A.S.	Fontenay s/Bois	100.00	
France	Merck Performance Materials S.A.S.	Trosly-Breuil	100.00	
France	Merck S.A.	Lyon	99.85	
France	Merck Santé S.A.S.	Lyon	100.00	
France	Merck Serono S.A.S.	Lyon	100.00	
France	Millipore S.A.S.	Molsheim	100.00	
France	Sigma-Aldrich Chimie S.a.r.l.	Saint Quentin Fallavier	100.00	
France	Sigma-Aldrich Chimie SNC	Saint Quentin Fallavier	100.00	
France	Sigma-Aldrich Holding S.a.r.l.	Saint Quentin Fallavier	100.00	
Greece	Merck A.E.	Maroussi, Athens	100.00	
Hungary	BSSN Software Kft.	Budapest	100.00	
Hungary	Merck Kft.	Budapest	100.00	
Hungary	Sigma-Aldrich Kft.	Budapest	100.00	
Ireland	Merck Finance Limited	Carrigtwohill	100.00	
Ireland	Merck Millipore Ltd.	Carrigtwohill	100.00	
Ireland	Merck Serono (Ireland) Ltd.	Dublin	100.00	
Ireland	Millipore Cork Unlimited Company	Carrigtwohill	100.00	
Ireland	Shrawdine Limited	Arklow	100.00	
Ireland	Sigma-Aldrich Ireland Ltd.	Arklow	100.00	

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Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)
Ireland	Silverberry Limited	Arklow	100.00	
Ireland	Versum Materials Ireland Limited	Dublin	100.00	
Italy	Allergopharma S.r.l.	Rome	100.00	
Italy	Istituto di Ricerche Biomediche Antoine Marxer RBM S.p.A.	Colleretto Giacosa	100.00	
Italy	Merck Life Science S.r.l.	Milan	100.00	
Italy	Merck S.p.A.	Milan	100.00	
Italy	Merck Serono S.p.A.	Rome	99.74	
Italy	Versum Materials Italia S.r.l.	Milan	100.00	
Latvia	Merck Serono SIA	Riga	100.00	
Lithuania	Merck Serono, UAB	Vilnius	100.00	
Luxembourg	Mats Finance S.a.r.l.	Luxembourg	100.00	
Luxembourg	Merck Chemicals Holding S.a.r.l.	Luxembourg	100.00	
Luxembourg	Merck Finance S.a.r.l.	Luxembourg	100.00	
Luxembourg	Merck Finanz S.a.r.l.	Luxembourg	100.00	
Luxembourg	Merck Holding S.a.r.l.	Luxembourg	100.00	
Luxembourg	Merck Invest SCS	Luxembourg	100.00	
Luxembourg	Merck Re S.A.	Luxembourg	100.00	100.00
Luxembourg	Millipore International Holdings, S.a.r.l.	Luxembourg	100.00	
Luxembourg	Sigma-Aldrich Global S.a.r.l.	Luxembourg	100.00	
Luxembourg	Sigma-Aldrich S.a.r.l.	Luxembourg	100.00	
Malta	Merck Capital Holding Ltd.	Pietà	100.00	
Malta	Merck Capital Ltd.	Pietà	100.00	
Netherlands	Merck B.V.	Schiphol-Rijk	100.00	
Netherlands	Merck Chemicals B.V.	Amsterdam Zuidoost	100.00	
Netherlands	Merck Europe B.V.	Amsterdam	100.00	
Netherlands	Merck Holding Netherlands B.V.	Schiphol-Rijk	100.00	
Netherlands	Merck Ventures B.V.	Amsterdam	100.00	
Netherlands	Merck Window Technologies B.V.	Veldhoven	100.00	100.00
Netherlands	Serono Tri Holdings B.V.	Schiphol-Rijk	100.00	
Netherlands	Sigma-Aldrich B.V.	Zwijndrecht	100.00	
Netherlands	Sigma-Aldrich Chemie N.V.	Zwijndrecht	100.00	
Netherlands	Versum Materials Asia B.V.	Utrecht	100.00	
Netherlands	Versum Materials Holdings Nederland B.V.	Utrecht	100.00	
Netherlands	Versum Materials International B.V.	Utrecht	100.00	
Netherlands	Versum Materials Netherlands B.V.	Utrecht	100.00	
Netherlands	Versum Materials Netherlands International B.V.	Utrecht	100.00	
Netherlands	Versum Materials Pacific B.V.	Utrecht	100.00	
Norway	Merck Life Science AS	Oslo	100.00	
Poland	Merck Business Solutions Europe Sp.z.o.o.	Wroclaw	100.00	
Poland	Merck Sp.z.o.o.	Warsaw	100.00	
Poland	Sigma-Aldrich Sp.z.o.o.	Poznan	100.00	
Portugal	Laquifa Laboratorios S.A.	Algés	100.00	
Portugal	Merck, S.A.	Algés	100.00	
Romania	Merck Romania S.R.L.	Bucharest	100.00	
Russia	Merck LLC	Moscow	100.00	
Russia	Sigma-Aldrich Rus LLC	Moscow	100.00	
Serbia	Merck d.o.o. Beograd	Belgrade	100.00	
Slovakia	Merck spol. s r.o.	Bratislava	100.00	
Slovakia	Sigma-Aldrich, spol. s r.o.	Bratislava	100.00	
Slovenia	Merck d.o.o.	Ljubljana	100.00	
Spain	Merck Chemicals and Life Science S.A.U.	Madrid	100.00	
Spain	Merck Life Science S.L.U.	Madrid	100.00	
Spain	Merck, S.L.U.	Madrid	100.00	
Sweden	Merck AB	Solna	100.00	

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Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)
Sweden	Merck Chemicals and Life Science AB	Solna	100.00	
Sweden	Sigma-Aldrich Sweden AB	Stockholm	100.00	
Switzerland	Allergopharma AG	Therwil	100.00	
Switzerland	Ares Trading SA	Aubonne	100.00	
Switzerland	Merck & Cie	Altdorf	51.63	51.63
Switzerland	Merck (Schweiz) AG	Zug	100.00	
Switzerland	Merck Performance Materials (Schweiz) AG	Schaffhausen	100.00	
Switzerland	Merck Serono SA	Coinsins	100.00	
Switzerland	SeroMer Holding SA	Coinsins	100.00	
Switzerland	Sigma-Aldrich (Switzerland) Holding AG	Buchs	100.00	
Switzerland	Sigma-Aldrich Chemie GmbH	Buchs	100.00	
Switzerland	Sigma-Aldrich International GmbH	Buchs	100.00	
Switzerland	Sigma-Aldrich Production GmbH	Buchs	100.00	
Turkey	Merck Ilac Ecza ve Kimya Ticaret AS	Istanbul	100.00	
United Kingdom	BioControl Systems Limited	London	100.00	
United Kingdom	BioReliance Limited	Aberdeen	100.00	
United Kingdom	BioReliance U.K. Acquisition Limited	London	100.00	
United Kingdom	Epichem Group Limited	Gillingham	100.00	
United Kingdom	Merck Chemicals Ltd.	Gillingham	100.00	
United Kingdom	Merck Holding Ltd.	Feltham	100.00	
United Kingdom	Merck Investments Ltd.	Feltham	100.00	
United Kingdom	Merck Serono Europe Ltd.	Feltham	100.00	
United Kingdom	Merck Serono Ltd.	Feltham	100.00	
United Kingdom	Millipore (U.K.) Limited	Feltham	100.00	
United Kingdom	Millipore UK Holdings LLP	Feltham	100.00	
United Kingdom	SAFC Biosciences Limited	Gillingham	100.00	
United Kingdom	SAFC Hitech Limited	Gillingham	100.00	
United Kingdom	Sigma-Aldrich Company Limited	Gillingham	100.00	
United Kingdom	Sigma-Aldrich Financial Services Limited	Gillingham	100.00	
United Kingdom	Versum Materials UK Limited	London	100.00	
North America				
Canada	EMD Chemicals Canada Inc.	Oakville	100.00	
Canada	EMD Crop BioScience Canada Inc.	Toronto	100.00	
Canada	EMD Inc.	Mississauga	100.00	
Canada	Millipore (Canada) Ltd.	Oakville	100.00	
Canada	Natrix Separations, Inc.	Burlington	100.00	
Canada	Sigma-Aldrich Canada Co.	Oakville	100.00	
United States	Aldrich Chemical Co. LLC	Milwaukee	100.00	
United States	Aldrich Chemical Foreign Holding LLC	St. Louis	100.00	
United States	Aldrich-APL, LLC	Urbana	100.00	
United States	Allergopharma USA, Inc.	Alexandria	100.00	
United States	BioControl Systems, Inc.	Wilmington	100.00	
United States	BioReliance Corporation	Rockville	100.00	
United States	Cell Marque Corporation	Rocklin	100.00	
United States	Cerilliant Corporation	Round Rock	100.00	
United States	Dynaloy, LLC	Wilmington	100.00	
United States	Electron Transfer Technologies, Inc.	West Trenton	100.00	
United States	EMD Accounting Solutions & Services America, Inc.	Rockland	100.00	
United States	EMD Digital Inc.	Burlington	100.00	
United States	EMD Finance LLC	Wilmington	100.00	
United States	EMD Group Holding, Inc.	Wilmington	100.00	
United States	EMD Holding Corp.	Rockland	100.00	
United States	EMD Millipore Corporation	Burlington	100.00	
United States	EMD Performance Materials Corp.	Philadelphia	100.00	

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Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)
United States	EMD Serono Holding, Inc.	Rockland	100.00	
United States	EMD Serono Research & Development Institute, Inc.	Billerica	100.00	
United States	EMD Serono, Inc.	Rockland	100.00	
United States	FloDesign Sonics, Inc.	Wilbraham	100.00	
United States	Grzybowski Scientific Inventions Ltd.	Evanston	100.00	
United States	Intermolecular, Inc.	Wilmington	100.00	
United States	J. C. Schumacher Company	Los Angeles	100.00	
United States	Millipore Asia Ltd.	Wilmington	100.00	
United States	Millipore UK Holdings I, LLC	Wilmington	100.00	
United States	Millipore UK Holdings II, LLC	Wilmington	100.00	
United States	Ormet Circuits, Inc.	San Diego	100.00	
United States	Research Organics, LLC	Cleveland	100.00	
United States	SAFC Biosciences, Inc.	Lenexa	100.00	
United States	SAFC Carlsbad, Inc.	Carlsbad	100.00	
United States	SAFC, Inc.	Madison	100.00	
United States	Serono Laboratories, Inc.	Rockland	100.00	
United States	Sigma Chemical Foreign Holding LLC	St. Louis	100.00	
United States	Sigma Redevelopment Corporation	St. Louis	100.00	
United States	Sigma-Aldrich Co. LLC	St. Louis	100.00	
United States	Sigma-Aldrich Corporation	St. Louis	100.00	
United States	Sigma-Aldrich Foreign Holding Co.	St. Louis	100.00	
United States	Sigma-Aldrich Manufacturing LLC	St. Louis	100.00	
United States	Sigma-Aldrich Missouri Insurance Company	St. Louis	100.00	
United States	Sigma-Aldrich Research Biochemicals, Inc.	Natick	100.00	
United States	Sigma-Aldrich RTC, Inc.	Laramie	100.00	
United States	Sigma-Aldrich, Inc.	Milwaukee	100.00	
United States	Sigma-Genosys of Texas LLC	The Woodlands	100.00	
United States	Supelco, Inc.	Bellefonte	100.00	
United States	Versum Materials Formulations and Technology, LLC	Wilmington	100.00	
United States	Versum Materials Manufacturing Company, LLC	Wilmington	100.00	
United States	Versum Materials Technology LLC	Wilmington	100.00	
United States	Versum Materials US International, Inc.	Wilmington	100.00	
United States	Versum Materials US LLC	Wilmington	100.00	
United States	Versum Materials, Inc.	Wilmington	100.00	
Asia-Pacific (APAC)				
Australia	Merck Healthcare Pty. Ltd.	Macquarie Park	100.00	
Australia	Merck Pty. Ltd.	Bayswater	100.00	
Australia	Proligo Australia Pty. Ltd.	Macquarie Park	100.00	
Australia	SAFC Biosciences Pty. Ltd.	Macquarie Park	100.00	
Australia	Sigma-Aldrich Oceania Pty. Ltd.	Macquarie Park	100.00	
Australia	Sigma-Aldrich Pty. Ltd.	Macquarie Park	100.00	
China	Beijing Skywing Technology Co., Ltd.	Beijing	100.00	
China	Merck Chemicals (Shanghai) Co., Ltd.	Shanghai	100.00	
China	Merck Display Materials (Shanghai) Co., Ltd.	Shanghai	100.00	
China	Merck Electronic Materials (Suzhou) Ltd.	Suzhou	100.00	
China	Merck Holding (China) Co., Ltd.	Shanghai	100.00	
China	Merck Innovation Hub (Guangdong) Co., Ltd.	Guangzhou	100.00	
China	Merck Life Science Ltd.	Hong Kong	100.00	
China	Merck Life Science Technologies (Nantong) Co., Ltd.	Nantong	100.00	
China	Merck Ltd.	Hong Kong	100.00	
China	Merck Management Consulting (Shanghai) Co., Ltd.	Shanghai	100.00	
China	Merck Performance Materials Hong Kong Ltd.	Hong Kong	100.00	
China	Merck Pharmaceutical (HK) Ltd.	Hong Kong	100.00	
China	Merck Pharmaceutical Distribution (Jiangsu) Co., Ltd.	Nantong	100.00	

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Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)
China	Merck Pharmaceutical Manufacturing (Jiangsu) Co., Ltd.	Nantong	100.00	
China	Merck Serono (Beijing) Pharmaceutical Distribution Co., Ltd.	Beijing	100.00	
China	Merck Serono (Beijing) Pharmaceutical R&D Co., Ltd.	Beijing	100.00	
China	Merck Serono Co., Ltd.	Beijing	100.00	
China	SAFC Hitech (Shanghai) Co., Ltd.	Shanghai	100.00	
China	Sigma-Aldrich (Shanghai) Trading Co., Ltd.	Shanghai	100.00	
China	Sigma-Aldrich (Wuxi) Life Science & Technology Co., Ltd.	Wuxi	100.00	
China	Versum Materials (Dalian) Co., Ltd.	Dalian	100.00	
China	Versum Materials (Shanghai) Co., Ltd.	Shanghai	100.00	
India	Merck Life Science Pvt. Ltd.	Mumbai	100.00	
India	Merck Performance Materials Pvt. Ltd.	Mumbai	100.00	
India	Merck Specialities Pvt. Ltd.	Mumbai	100.00	
India	Sigma-Aldrich Chemicals Private Limited	Bangalore	100.00	
Indonesia	P.T. Merck Chemicals and Life Sciences	Jakarta	100.00	
Indonesia	P.T. Merck Tbk.	Jakarta	86.65	
Japan	BioReliance K.K.	Tokyo	100.00	
Japan	Merck Biopharma Co., Ltd.	Tokyo	100.00	
Japan	Merck Ltd.	Tokyo	100.00	
Japan	Merck Performance Materials Ltd.	Tokyo	100.00	
Japan	Sigma-Aldrich Japan G.K.	Tokyo	100.00	
Japan	Versum Materials Japan Inc.	Kawasaki	100.00	
Malaysia	Merck Sdn Bhd	Petaling Jaya	100.00	
Malaysia	Sigma-Aldrich (M) Sdn Bhd	Kuala Lumpur	100.00	
Malaysia	Versum Materials Malaysia Sdn Bhd	Kuala Lumpur	100.00	
New Zealand	Merck Ltd.	Auckland	100.00	
New Zealand	Sigma-Aldrich New Zealand Co.	Auckland	100.00	
Philippines	Merck Business Solutions Asia Inc.	Bonifacio Global City	99.99	
Philippines	Merck Inc.	Bonifacio Global City	100.00	
Singapore	Merck Performance Materials Pte. Ltd.	Singapore	100.00	
Singapore	Merck Pte. Ltd.	Singapore	100.00	
Singapore	Sigma-Aldrich Pte. Ltd.	Singapore	100.00	
Singapore	Versum Materials Singapore International Pte. Ltd.	Singapore	100.00	
Singapore	Versum Materials Singapore Pte. Ltd.	Singapore	100.00	
South Korea	Merck Electronic Materials Ltd.	Seoul	100.00	
South Korea	Merck Ltd.	Seoul	100.00	
South Korea	Merck Performance Materials Ltd.	Pyeongtaek-shi	100.00	
South Korea	Sigma-Aldrich Korea Ltd.	Yongin City	100.00	
South Korea	Versum Materials ADM Korea Inc.	Ansan-si	100.00	
South Korea	Versum Materials HYT Inc.	Ansan-si	100.00	
South Korea	Versum Materials Korea Inc.	Siheung-si	100.00	
South Korea	Versum Materials Korea Technology Inc.	Ansan-si	100.00	
South Korea	Versum Materials PM Korea Inc.	Ulsan	100.00	
South Korea	Versum Materials SPC Korea Ltd.	Pyeongtaek-shi	100.00	
Taiwan	Merck Ltd.	Taipei	100.00	
Taiwan	Merck Performance Materials Ltd.	Taipei	100.00	
Taiwan	SAFC Hitech Taiwan Co. Ltd.	Kaohsiung	100.00	
Taiwan	Versum Materials Taiwan Co., Ltd.	Taipei	74.00	
Thailand	Merck Ltd.	Bangkok	45.11	
Vietnam	Merck Vietnam Ltd.	Ho Chi Minh City	100.00	
Latin America				
Argentina	Merck S.A.	Buenos Aires	100.00	

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Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)
Argentina	Sigma-Aldrich de Argentina S.r.l.	Buenos Aires	100.00	
Brazil	Merck S.A.	Rio de Janeiro	100.00	
Brazil	Sigma-Aldrich Brasil Ltda.	São Paulo	100.00	
Chile	Merck S.A.	Santiago de Chile	100.00	
Chile	Sigma-Aldrich Quimica Ltda.	Santiago de Chile	100.00	
Colombia	Merck S.A.	Bogota	100.00	
Ecuador	Merck C.A.	Quito	100.00	
Guatemala	Merck, S.A.	Guatemala City	100.00	
Mexico	Merck Biopharma Distribution S.A. de C.V.	Mexico City	100.00	
Mexico	Merck, S.A. de C.V.	Mexico City	100.00	
Mexico	Sigma-Aldrich Quimica, S. de R.L. de C.V.	Toluca	100.00	
Panama	Mesofarma Corporation	Panama City	100.00	
Peru	Merck Peruana S.A.	Lima	100.00	
Uruguay	ARES Trading Uruguay S.A.	Montevideo	100.00	
Middle East and Africa (MEA)				
Egypt	Merck Ltd.	Cairo	100.00	
Israel	Inter-Lab Ltd.	Yavne	100.00	
Israel	InterPharm Laboratories Ltd.	Yavne	100.00	
Israel	Merck Serono Ltd.	Herzliya Pituach	100.00	
Israel	PMatX Ltd.	Yavne	90.00	
Israel	QLight Nanotech Ltd.	Jerusalem	100.00	
Israel	Sigma-Aldrich Israel Ltd.	Rehovot	100.00	
Israel	Versum Materials Israel Ltd.	Tel Aviv	100.00	
Kenya	Merck Healthcare and Life Science Limited	Nairobi	100.00	
South Africa	Merck (Pty) Ltd.	Halfway House	100.00	
South Africa	Sigma-Aldrich (Pty) Ltd.	Kempton Park	100.00	
Tunisia	Merck Promotion SARL	Tunis	100.00	
Tunisia	Merck SARL	Tunis	100.00	
United Arab Emirates	Merck Serono Middle East FZ-Ltd.	Dubai	100.00	

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Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)	Fair value as of Dec. 31, 2019 (€ million)	Fair value as of Dec. 31, 2018 (€ million)
II. Subsidiaries not consolidated for reasons of materiality						
Germany						
Germany	AB Pensionsverwaltung GmbH	Zossen	100.00	100.00	< 0.5	< 0.5
Germany	Merck 25. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 26. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 27. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 28. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 29. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 30. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 31. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 36. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 37. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 38. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 39. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 40. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Germany	Merck 41. Allgemeine Beteiligungs-GmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Other European countries						
Greece	Sigma-Aldrich (OM) Ltd.	Athens	100.00		< 0.5	< 0.5
Ireland	SAFC Arklow Ltd.	Arklow	100.00		< 0.5	< 0.5
Russia	Chemical Trade Limited LLC	Moscow	100.00		< 0.5	< 0.5
Russia	MedChem Limited	Moscow	100.00		< 0.5	< 0.5
Russia	SAF-LAB LLC	Moscow	100.00		< 0.5	< 0.5
Switzerland	iOnctura SA	Plan-les-Ouates	73.60		B)	B)
United Kingdom	Merck Cross Border Trustees Ltd.	Feltham	100.00		< 0.5	< 0.5
United Kingdom	Merck Ltd.	Feltham	100.00		< 0.5	< 0.5
United Kingdom	Merck Pension Trustees Ltd.	Feltham	100.00		< 0.5	< 0.5
United Kingdom	Sigma Chemical Co. Ltd.	Gillingham	100.00		< 0.5	< 0.5
North America						
United States	Fluka Chemical Corp.	St. Louis	100.00		< 0.5	< 0.5
United States	TocopheRx, Inc.	Burlington	100.00		B)	B)
Asia-Pacific (APAC)						
Australia	Biochrom Australia Pty. Ltd.	Bayswater	100.00		< 0.5	< 0.5

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Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)	Fair value as of Dec. 31, 2019 (€ million)	Fair value as of Dec. 31, 2018 (€ million)
Latin America						
Dominican Republic	Merck Dominicana, S.R.L.	Santo Domingo	100.00		< 0.5	< 0.5
Middle East and Africa (MEA)						
Algeria	MDCA Pharma Promotion SARL	Hydra	49.00		< 0.5	–
Morocco	Merck Maroc S.A.R.L.	Casablanca	100.00		< 0.5	< 0.5
Nigeria	Merck Pharmaceutical and Life Sciences Ltd.	Lagos	100.00		< 0.5	< 0.5
III. Majority interest in non-controlled companies						
Germany						
Germany	Merck Foundation gGmbH	Darmstadt	100.00	100.00	< 0.5	< 0.5
Latin America						
Venezuela	Merck S.A.	Caracas	100.00		< 0.5	< 0.5
Venezuela	Representaciones MEPRO S.A.	Caracas	100.00		< 0.5	< 0.5
IV. Associated companies not accounted for using the equity method for reasons of materiality						
Other European countries						
Netherlands	Calypso Biotech B.V.	Amsterdam	38.81		B)	B)
Switzerland	Asceneuron SA	Lausanne	25.35		B)	B)
Switzerland	CAMAG Chemie-Erzeugnisse und Adsorptionstechnik AG	Muttenz	39,11%		2	2
Switzerland	Vaximm AG	Basel	22.06		B)	B)
North America						
United States	Prolog Healthy Living Fund, L.P.	St. Louis	38.32		C)	C)
United States	Prolog Healthy Living Fund II, L.P.	St. Louis	50.58		C)	C)
V. Other equity positions						
Germany						
Germany	Alcan Systems GmbH	Darmstadt	< 20.00		B)	B)
Germany	Azelis Deutschland Kosmetik GmbH	Sankt Augustin	< 20.00		2	2
Germany	InfraServ GmbH & Co. Wiesbaden KG	Wiesbaden	< 20.00		6	2
Germany	Inuru GmbH	Berlin	< 20.00		< 0.5	< 0.5
Germany	IOmx Therapeutics AG	Martinsried	< 20.00		B)	B)
Germany	LegenDairy Foods GmbH	Berlin	< 20.00		B)	–
Germany	pharma mall Gesellschaft für Electronic Commerce mbH	Sankt Augustin	< 20.00		1	1
Germany	PharmLog Pharma Logistik GmbH	Bönen	< 20.00		3	3
Germany	PrintCity GmbH & Co. KG	Neuried	< 20.00	< 20.00	< 0.5	< 0.5
Other European countries						
Belgium	ReWind Therapeutics N.V.	Leuven-Heverlee	< 20.00		B)	B)
Finland	Abacus Diagnostica OY	Turku	< 20.00		< 0.5	< 0.5

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Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)	Fair value as of Dec. 31, 2019 (€ million)	Fair value as of Dec. 31, 2018 (€ million)
Finland	Forendo Pharma OY	Turku	< 20.00		B)	B)
France	Aveni S.A.S.	Massy	< 20.00		B)	B)
France	DNA Script S.A.S.	Paris	< 20.00		B)	B)
Netherlands	Mosa Meat B.V.	Maastricht	< 20.00		B)	B)
Netherlands	SynAffix B.V.	Nijmegen	< 20.00		B)	B)
Sweden	Galecto Biotech AB	Lund	< 20.00		B)	B)
Switzerland	FoRx Therapeutics AG	Basel	< 20.00		B)	–
Switzerland	Inthera Bioscience AG	Schlieren	23.28		B)	B)
Switzerland	ObsEva SA	Cologny	< 20.00		B)	B)
United Kingdom	Artios Pharma Limited	Cambridge	< 20.00		B)	B)
United Kingdom	F-Star Therapeutics Limited	Cambridge	< 20.00		B)	–
United Kingdom	Macrophage Pharma Limited	Berkhamsted	< 20.00		B)	B)
United Kingdom	Peratech HoldCo Limited	Brompton-on-Swale	< 20.00		B)	B)
United Kingdom	Storm Therapeutics Limited	London	< 20.00		B)	B)
North America						
United States	Akili Interactive Labs, Inc.	Boston	< 20.00		B)	B)
United States	Akrevia Therapeutics LLC	Cambridge	< 20.00		B)	–
United States	Allozyne, Inc.	Seattle	< 20.00		< 0.5	< 0.5
United States	Altoida, Inc.	Suwanee	< 20.00		B)	–
United States	ApoGen Biotechnologies, Inc.	Seattle	< 20.00		B)	B)
United States	Biolinq Inc.	San Diego	< 20.00		B)	B)
United States	Bird Rock Bio, Inc.	La Jolla	< 20.00		B)	B)
United States	ElectronInks Inc.	Austin	< 20.00		B)	–
United States	Hydrochlor, LLC	Wilmington	50.00		D)	–
United States	Immunitas Therapeutics, Inc.	Wilmington	< 20.00		B)	–
United States	Indi Molecular, Inc.	Culver City	< 20.00		B)	B)
United States	Intrexon Corporation	Germantown	< 20.00		101	118
United States	Kraig Biocraft Laboratories, Inc.	Ann Arbor	< 20.00		< 0.5	< 0.5
United States	Lumiode, Inc.	New York	< 20.00		B)	B)
United States	MemryX Inc.	Ann Arbor	< 20.00		B)	–
United States	Neurable Inc.	Boston	< 20.00		B)	–
United States	Pacific Light & Hologram, Inc.	Wilmington	< 20.00		B)	–
United States	Plexium Inc.	Wilmington	< 20.00		B)	–
United States	Progyny, Inc.	Menlo Park	< 20.00		B)	B)
United States	Raze Therapeutics, Inc.	Cambridge	< 20.00		B)	B)
United States	Ribometrix Inc.	Durham	< 20.00		B)	B)
United States	Riffyn, Inc.	Oakland	< 20.00		B)	–
United States	Sonde Health, Inc.	Boston	< 20.00		B)	–
United States	Telios Pharma, Inc.	Wilmington	< 20.00		9	–
United States	Tioga Pharmaceuticals, Inc.	San Diego	< 20.00	< 20.00	< 0.5	< 0.5
Asia-Pacific (APAC)						
Australia	Immutep Limited	Sydney	< 20.00		< 0.5	< 0.5
Japan	Showa Denko Versum Materials 2 Co., Ltd.	Tokyo	35.00		D)	–
Latin America						
Cayman Islands	CLEARInk Displays, Ltd.	Grand Cayman	< 20.00		B)	–

Footnotes on page 305

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA (%)	Fair value as of Dec. 31, 2019 (€ million)	Fair value as of Dec. 31, 2018 (€ million)
Middle East and Africa (MEA)						
Algeria	Novapharm Production SARL	Wilaya de Tipiza	20.00		1	< 0.5
Israel	ARTSaVIT Ltd.	Yavne	< 20.00		B)	B)
Israel	Explore Bio 1 Ltd.	Yavne	20.00		B)	B)
Israel	MediSafe Project Ltd.	Haifa	< 20.00		B)	B)
Israel	Metabomed Ltd.	Yavne	< 20.00		B)	B)
Israel	Pantheon Biosciences Ltd.	Yavne	< 20.00		B)	B)
Israel	Pilltracker 2015 Ltd.	Tel Aviv	< 20.00		B)	–
Israel	PxE Computational Imaging Ltd.	Lachish Darom	< 20.00		B)	–
Israel	Sentaur Bio Ltd. (formerly Explore Bio 3 Ltd.)	Yavne	22.50		B)	B)
Israel	Wiliot Ltd.	Caesarea	< 20.00		B)	B)

A) Companies opting for exemption as provided for by Section 264 (3) and Section 264b of the German Commercial Code.
B) Companies which are affiliates from the Merck Ventures B.V. portfolio. As of December 31, 2019, the fair value of the M Ventures portfolio amounted to €275 million (December 31, 2018: €145 million).
C) Closed-end funds classified as debt in accordance with IFRS 9.
D) This is an affiliate within the meaning of IFRS 11 (joint activity).

Darmstadt, February 14, 2020 / May 12, 2020

Stefan Oschmann

Udit Batra

Kai Beckmann

Belén Garijo

Marcus Kuhnert

Responsibility Statement

To the best of our knowledge, and in accordance with the applicable reporting principles, the consolidated financial statements of the Merck Group give a true and fair view of the assets, liabilities, financial position and profit or loss of the Group, and the combined management report includes a fair view of the development and performance of the business and the position of the Group, together with a description of the material opportunities and risks associated with the expected development of the Group.

Darmstadt, February 14, 2020 / May 12, 2020

Addendum to the consolidated financial statements and the combined management report regarding subsequent events:
The events subsequent to the balance sheet date relate to the impact of the Covid-19 pandemic and the resulting addenda to the section entitled "General Disclosures – Subsequent events" of the notes to the consolidated financial statement as well as to the sections entitled "Report on Risks and Opportunities – Overall view of the risk and opportunity situation and management assessment", section „Report on Expected Developments – Forecast for the Merck Group" and section "Additional Information on Merck KGaA in accordance with the German Commercial Code (HGB) – Forecast for Merck KGaA" of the combined management report.

Darmstadt, May 12, 2020

Stefan Oschmann

Udit Batra

Kai Beckmann

Belén Garijo

Marcus Kuhnert

Independent Auditor's Report

To MERCK Kommanditgesellschaft auf Aktien, Darmstadt

Report on the Audit of the Consolidated Financial Statements and of the Combined Management Report

Opinions

We have audited the consolidated financial statements of MERCK Kommanditgesellschaft auf Aktien, and its subsidiaries (the Group), which comprise the consolidated balance sheet as of December 31, 2019, the consolidated income statement, the consolidated statement of comprehensive income, consolidated statement of changes in net equity and consolidated cash flow statement for the financial year from January 1, 2019, to December 31, 2019, and notes to the consolidated financial statements, including a summary of significant accounting policies. In addition, we have audited the combined management report of MERCK Kommanditgesellschaft auf Aktien for the financial year from January 1, 2019, to December 31, 2019. In accordance with German legal requirements, we have not audited the components of the combined management report specified in the "Other Information" section of our auditor's report.

In our opinion, on the basis of the knowledge obtained in the audit,

- the accompanying consolidated financial statements comply, in all material respects, with the IFRSs as adopted by the EU, and the additional requirements of German commercial law pursuant to Section 315e (1) HGB [Handelsgesetzbuch: German Commercial Code] and, in compliance with these requirements, give a true and fair view of the assets, liabilities, and financial position of the Group as of December 31, 2019, and of its financial performance for the financial year from January 1, 2019, to December 31, 2019, and
- the accompanying combined management report as a whole provides an appropriate view of the Group's position. In all material respects, this combined management report is consistent with the consolidated financial statements, complies with German legal requirements and appropriately presents the opportunities and risks of future development. Our opinion on the combined management report does not cover the content of the components of the combined management report specified in the "Other Information" section of the auditor's report.

Pursuant to Section 322 (3) sentence 1 HGB, we declare that our audit has not led to any reservations relating to the legal compliance of the consolidated financial statements and of the combined management report.

Basis for the Opinions

We conducted our audit of the consolidated financial statements and of the combined management report in accordance with Section 317 HGB and EU Audit Regulation No 537/2014 (referred to subsequently as "EU Audit Regulation") and in compliance with German Generally Accepted Standards for Financial Statement Audits promulgated by the Institut der Wirtschaftsprüfer [Institute of Public Auditors in Germany] (IDW). Our responsibilities under those requirements and principles are further described in the "Auditor's Responsibilities for the Audit of the Consolidated Financial Statements and of the Combined Management Report" section of our auditor's report. We are independent of the group entities in accordance with the requirements of European law and German commercial and professional law, and we have fulfilled our other German professional responsibilities in accordance with these requirements. In addition, in accordance with Article 10 (2)(f) of the EU Audit Regulation, we declare that we have not provided

non-audit services prohibited under Article 5 (1) of the EU Audit Regulation. We believe that the evidence we have obtained is sufficient and appropriate to provide a basis for our opinions on the consolidated financial statements and on the combined management report.

Key Audit Matters in the Audit of the Consolidated Financial Statements

Key audit matters are those matters that, in our professional judgment, were of most significance in our audit of the consolidated financial statements for the financial year from January 1, 2019, to December 31, 2019. These matters were addressed in the context of our audit of the consolidated financial statements as a whole, and in forming our opinion thereon, we do not provide a separate opinion on these matters.

Acquisition of Versum Materials, Inc.

The accounting policies applied and disclosures on the acquisition are presented in the notes to the consolidated financial statements under note 5.

THE FINANCIAL STATEMENT RISK

On October 7, 2019, the Merck Group acquired Versum Materials, Inc. The purchase price in accordance to IFRS 3 amounted to EUR 5,198 million. Taking into account the net assets acquired in the amount of EUR 2,054 million, this results in goodwill in the amount of EUR 3,144 million.

The identifiable assets acquired and liabilities assumed are generally recognized at fair value pursuant to IFRS 3 on the date of acquisition. Merck engaged an external expert to assist in the identification and measurement of the identifiable assets acquired and the liabilities assumed.

The identification and measurement of assets acquired and liabilities assumed are complex and based on assumptions of management that require judgment. The significant assumptions are related to the projections of the acquired business' sales and margins, customers churn rate, license fee rates as well as the cost of capital.

There is the risk for the consolidated financial statements that the assets acquired and liabilities assumed are improperly identified or inaccurately measured. There is also the risk that the disclosures in the notes to the consolidated financial statements are not complete and accurate.

OUR AUDIT APPROACH

With the involvement of our own valuation experts, we have assessed the appropriateness of key assumptions and parameters as well as the identification and calculation methods used, among other things. For this purpose, we initially obtained an understanding of the acquisition by interviewing employees in the Finance and M&A departments as well as by assessing the relevant contracts.

We reconciled the total purchase price to the relevant agreements and evidence of payment.

We have assessed the competency, skills and objectivity of the independent expert engaged by Merck. Furthermore, we have assessed the process of the identification of the assets acquired and liabilities assumed in terms of conformity with the requirements of IFRS 3 on the basis of our knowledge of Merck’s business model. We have evaluated the measurement methods used for their compliance with the accounting policies.

We have discussed projected revenue and margin development with those responsible for planning. Furthermore, we have reconciled these with the budgets prepared by management and have assessed the consistency of the assumptions with external industry-specific market assessments, including analyst expectations. We compared the license fee rates utilized to measure certain intangible assets with benchmarks from relevant databases. We compared the assumptions and parameters underlying the capital costs, in particular the risk-free rate, the market risk premium and the beta factor, with our own assumptions and publicly available data. We involved our valuation experts in the audit team to assist with this.

To assess the computational accuracy of the measurement of the identified assets and liabilities, we used a risk-based audit approach to recalculate the Company's calculations on a sample basis.

In addition, we have assessed whether the disclosures in the notes regarding the acquisition are complete and appropriate.

OUR OBSERVATIONS

The approach used for identifying and measuring the assets acquired and liabilities assumed is appropriate and in line with the accounting policies to be applied. The key assumptions and parameters underlying the purchase price allocation are appropriate and the presentation of the acquisition in the notes to the consolidated financial statements is complete and appropriate.

Recognition and measurement of income tax liabilities and deferred tax liabilities

Explanatory notes on the recognition and measurement of income tax liabilities and deferred tax liabilities can be found in the notes to the consolidated financial statements under note 17.

THE FINANCIAL STATEMENT RISK

As of December 31, 2019, current income tax liabilities amount to EUR 1,402 million, and deferred tax liabilities amount to EUR 1,828 million.

Merck operates in different jurisdictions with different legal systems. The application of local regulations on income tax, tax incentives and transfer pricing rules is complex. The recognition and measurement of income tax liabilities require Merck to exercise judgment in assessing tax matters and to make estimates regarding uncertain tax positions.

The measurement of income tax liabilities and the assessment of unrecognized contingent tax liabilities are subject to judgment and estimation uncertainty. Merck routinely engages external experts to support its own risk assessment with expert opinions from tax specialists.

There is a risk for the financial statements that income tax liabilities and deferred tax liabilities are not fully recognized or not appropriately measured.

OUR AUDIT APPROACH

We involved our own specialists in international tax law into the audit team in order to evaluate Merck's assessment of tax risks and the related opinions of external experts engaged by Merck.

We obtained an understanding of existing tax risks through inquiry of management of the affected group companies and employees of the tax department. We assessed the competence, capabilities and objectivity of the external experts and evaluated their expert opinions.

In addition, we analyzed correspondence with the relevant tax authorities and assessed the assumptions underlying the determination of income tax liabilities based on our knowledge and experience of how the relevant legal requirements are currently applied by the tax authorities and courts. We scrutinized Merck´s approach regarding the recognition and measurement of deferred tax liabilities, based on laws and regulations enacted as of the reporting date, and performed recalculations.

OUR OBSERVATIONS

The valuation model and assumptions underlying the recognition and measurement of income tax liabilities are reasonable. The approach regarding the recognition and measurement of deferred tax liabilities is adequate.

Impairment testing of goodwill

Explanatory notes on the impairment tests can be found in the notes to the consolidated financial statements under note 18.

THE FINANCIAL STATEMENT RISK

The goodwill in the consolidated financial statements as of December 31, 2019 amounts to EUR 17,141 million (39,1% of the Group's total assets), with EUR 11,135 million of this attributable to Life Science and with EUR 4,472 million to Performance Materials. The goodwill of Life Science results especially from the acquisition of the Sigma-Aldrich Corporation, USA, in November 2015. Due to the acquisition of Versum Materials, Inc., USA, in October 2019 the goodwill of Performance Materials has increased significantly.

Goodwill is to be tested for impairment once a year, and may need be tested ad hoc if necessary. In performing the goodwill impairment test, Merck primarily determines the recoverable amount by means of the discounted cash flow method. The valuation model used to determine the recoverable amount is complex and the result of this valuation are highly dependent on the projection of future net cash flows (taking into account future revenue growth, profit margins and long-term growth rates) and the discount factor used, and therefore is subject to significant estimation uncertainty.

There is a risk for the financial statements that an existing goodwill impairment loss was not recognized as of the reporting date. In addition, there is a risk that the related disclosures in the notes to the consolidated financial statements are not complete and appropriate.

OUR AUDIT APPROACH

Using our own sensitivity analyses, we assessed the extent to which the goodwill of the cash-generating unit would still be sufficiently covered by the respective recoverable amount if assumptions and parameters underlying the calculations were to change in a manner that is deemed possible. On the basis of these analyses, our audit particularly focused on the cash-generating units Life Science and Performance Materials.

We reconciled the expected net cash flows underlying the recoverable amount calculations with the current medium-term plan approved by management. To assess the assumptions used in preparing the medium-term plan, we obtained an understanding of the planning process through discussions with company representatives, including corporate management and representatives from the corporate divisions and the research and development department, we assessed the plausibility and consistency of the explanations received with the projections, and we compared the assumptions used with the expectations of external analysts and sources.

As part of our audit of the discount factor, we analyzed the peer group used. With regard to other assumptions and parameters (e.g. risk-free interest rate, beta factor, market risk premium), we compared those assumptions and parameters with our own assumptions and publicly available data to assess whether these were appropriate and whether they were within the range of external recommendations, to the extent available. In addition, we verified the calculation model used to determine the discount factor.

We assessed the appropriateness of the valuation model used. To verify arithmetical accuracy, we used a risk-based audit approach to recalculate the Company’s calculations based on samples contained in the valuation model.

In addition, we assessed whether the Company's disclosures regarding the goodwill impairment test in the notes to the consolidated financial statements are complete and appropriate.

OUR OBSERVATIONS

The calculation method used for the goodwill impairment test is appropriate and in line with the applicable valuation principles. Overall, the assumptions and parameters used by management are balanced. The disclosures in the notes to the consolidated financial statements are complete and properly depict the judgment associated with the subsequent measurement of goodwill.

Other Information

Management is responsible for the other information. The other information comprises information in the combined management report, not required by law or DRS 20, and marked as unaudited.

The other information furthermore comprises the remaining parts of the annual report.

The other information do not comprise the consolidated financial statements, the audited parts of the combined management report and our auditor's report.

Our opinions on the consolidated financial statements and on the combined management report do not cover the other information, and consequently we do not express an opinion or any other form of assurance conclusion thereon.

In connection with our audit, our responsibility is to read the other information and, in so doing, to consider whether the other information

- is materially inconsistent with the consolidated financial statements, with the information in the combined management report audited for content or our knowledge obtained in the audit, or
- otherwise appears to be materially misstated.

Responsibilities of Management and the Supervisory Board for the Consolidated Financial Statements and the Combined Management Report

Management is responsible for the preparation of the consolidated financial statements that comply, in all material respects, with IFRSs as adopted by the EU, and the additional requirements of German commercial law pursuant to Section 315e (1) HGB and that the consolidated financial statements, in compliance with these requirements, give a true and fair view of the assets, liabilities, financial position, and financial performance of the Group. In addition, management is responsible for such internal control as they have determined necessary to enable the preparation of consolidated financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the consolidated financial statements, management is responsible for assessing the Group's ability to continue as a going concern. They also have the responsibility for disclosing, as applicable, matters related to going concern. In addition, they are responsible for financial reporting based on the going concern basis of accounting unless there is an intention to liquidate the Group or to cease operations, or there is no realistic alternative but to do so.

Furthermore, management is responsible for the preparation of the combined management report that, as a whole, provides an appropriate view of the Group's position and is, in all material respects, consistent with the consolidated financial statements, complies with German legal requirements, and appropriately presents the opportunities and risks of future development. In addition, management is responsible for such arrangements and measures (systems) as they have considered necessary to enable the preparation of a combined management report that is in accordance with the applicable German legal requirements, and to be able to provide sufficient appropriate evidence for the assertions in the combined management report.

The Supervisory Board is responsible for overseeing the Group's financial reporting process for the preparation of the consolidated financial statements and of the combined management report.

Auditor's Responsibilities for the Audit of the Consolidated Financial Statements and of the Combined Management Report

Our objectives are to obtain reasonable assurance about whether the consolidated financial statements as a whole are free from material misstatement, whether due to fraud or error, and whether the combined management report as a whole provides an appropriate view of the Group's position and, in all material respects, is consistent with the consolidated financial statements and the knowledge obtained in the audit, complies with the German legal requirements and appropriately presents the opportunities and risks of future development, as well as to issue an auditor's report that includes our opinions on the consolidated financial statements and on the combined management report.

Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Section 317 HGB and the EU Audit Regulation and in compliance with German Generally Accepted Standards for Financial Statement Audits promulgated by the Institut der Wirtschaftsprüfer (IDW) will always detect a material misstatement. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these consolidated financial statements and this combined management report.

We exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the consolidated financial statements and of the combined management report, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinions. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal controls.
- Obtain an understanding of internal control relevant to the audit of the consolidated financial statements and of arrangements and measures (systems) relevant to the audit of the combined management report in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of these systems.
- Evaluate the appropriateness of accounting policies used by management and the reasonableness of estimates made by management and related disclosures.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Group's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in the auditor's report to the related disclosures in the consolidated financial statements and in the combined management report or, if such disclosures are inadequate, to modify our respective opinions. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Group to cease to be able to continue as a going concern.
- Evaluate the overall presentation, structure and content of the consolidated financial statements, including the disclosures, and whether the consolidated financial statements present the underlying transactions and events in a manner that the consolidated financial statements give a true and fair view of the assets, liabilities, financial position and financial performance of the Group in compliance with IFRSs as adopted by the EU and the additional requirements of German commercial law pursuant to Section 315e (1) HGB.
- Obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Group to express opinions on the consolidated financial statements and on the combined management report. We are responsible for the direction, supervision and performance of the group audit. We remain solely responsible for our opinions.
- Evaluate the consistency of the combined management report with the consolidated financial statements, its conformity with [German] law, and the view of the Group's position it provides.
- Perform audit procedures on the prospective information presented by management in the combined management report. On the basis of sufficient appropriate audit evidence we evaluate, in particular, the significant assumptions used by management as a basis for the prospective information, and evaluate the proper derivation of the prospective information from these assumptions. We do not express a separate opinion on the prospective information and on the assumptions used as a basis. There is a substantial unavoidable risk that future events will differ materially from the prospective information.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with the relevant independence requirements, and communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, the related safeguards.

From the matters communicated with those charged with governance, we determine those matters that were of most significance in the audit of the consolidated financial statements of the current period and are therefore the key audit matters. We describe these matters in our auditor's report unless law or regulation precludes public disclosure about the matter.

Other Legal and Regulatory Requirements

Further Information pursuant to Article 10 of the EU Audit Regulation

We were elected as group auditor at the annual general meeting on April 26, 2019. We were engaged by the Supervisory Board on June 28, 2019. We have been the group auditor of MERCK Kommanditgesellschaft auf Aktien without interruption since the financial year 1995.

We declare that the opinions expressed in this auditor's report are consistent with the additional report to the Supervisory Board pursuant to Article 11 of the EU Audit Regulation (long-form audit report).

Information on the Supplementary Audit

We issue this auditor's report on the amended consolidated financial statements and amended combined management report on the basis of our statutory audit completed on February 17 2020 and our supplementary audit completed on May 13 2020, which concerned the amendment to disclosures in the notes to the consolidated financial statements and the combined management report due to the updated reporting on risks and opportunities and on expected developments. Please refer to the presentation of the amendments by the Executive Board in the amended notes to the consolidated financial statements, section "General Disclosures – Subsequent Events" and in the amended combined management report, section „Report on Risks and Opportunities – Overall view of the risk and opportunity situation and management assessment", section „Report on Expected Developments – Forecast for the Merck Group" and section „Additional Information on Merck KGaA in accordance with the German Commercial Code (HGB) – Forecast for Merck KGaA".

German Public Auditor Responsible for the Engagement

The German Public Auditor responsible for the engagement is Bodo Rackwitz.

Frankfurt am Main, 17 February 2020 / limited to the amendment referred to in the Information on the Supplementary Audit:

13 May 2020

KPMG AG
Wirtschaftsprüfungsgesellschaft
[Original German version signed by:]
[signature] Rackwitz
Wirtschaftsprüfer
[German Public Auditor]

[signature] Rienecker
Wirtschaftsprüferin
[German Public Auditor]

Business Development 2015 – 2019

This overview may include historically adjusted values in order to ensure comparability with the reporting period.

€ million	2015	2016	2017	2018	2019	Changein %
Results of operations						
Net sales	12,845	15,024	14,517	14,836	16,152	8.9%
Operating result (EBIT)[1]	1,843	2,481	2,423	1,727	2,120	22.8%
Margin (% of net sales)[1]	14.3%	16.5%	16.7%	11.6%	13.1%	
EBITDA[1]	3,354	4,415	4,164	3,528	4,066	15.3%
Margin (% of net sales)[1]	26.1%	29.4%	28.7%	23.8%	25.2%	
Adjustments[1]	276	75	82	272	318	16.9%
EBITDA pre[1]	3,630	4,490	4,246	3,800	4,385	15.4%
Margin (% of net sales)[1]	28.3%	29.9%	29.3%	25.6%	27.1%	
Profit before income tax	1,487	2,154	2,129	1,461	1,735	18.8%
Profit after tax	1,124	1,633	2,615	3,396	1,324	-61.0%
Earnings per share (in €)	2.56	3.75	5.99	7.76	3.04	-60.8%
Assets and liabilities						
Total assets	38,081	38,258	35,621	36,888	43,811	18.8%
Non-current assets	30,737	30,589	28,166	27,652	34,808	25.9%
thereof:						
Goodwill	14,492	15,015	13,582	13,764	17,141	24.5%
Other intangible assets	10,930	9,980	8,317	7,237	9,175	26.8%
Property, plant, and equipment	4,008	4,231	4,512	4,811	6,213	29.1%
Current assets	7,344	7,670	7,455	9,236	9,003	-2.5%
thereof:						
Inventories	2,610	2,609	2,632	2,764	3,342	20.9%
Trade receivables and other current receivables	2,890	3,161	3,170	3,226	3,488	8.1%
Cash and cash equivalents	832	939	589	2,170	781	-64.0%
Equity	12,855	14,050	14,066	17,233	17,914	4.0%
Financial liabilities	13,713	12,597	10,823	8,896	13,194	48.3%
Non-current	9,616	8,809	8,033	6,681	8,644	29.4%
Current	4,097	3,788	2,790	2,215	4,550	>100.0%
Liquidity						
Investments in intangible assets[2]	179	132	392	106	208	95.8%
Investments in property, plant, and equipment[2]	514	716	919	910	813	-10.7%
Business free cash flow[1]	2,766	3,318	3,193	2,508	2,732	8.9%
Net financial debt[1]	12,654	11,513	10,144	6,701	12,363	84.5%
Other key data						
Equity ratio (in %)[1]	33.8%	36.7%	39.5%	46.7%	40.9%	
Research and development costs[3]	1,709	1,976	2,108	2,227	2,268	1.8%
Dividend per share (in €)	1.05	1.20	1.25	1.25	1.30[4]	4.0%
Employees (number as of December 31)	49,613	50,348	52,880	51,713	57,036	10.3%

[1] Not defined by International Financial Reporting Standards (IFRSs).

[2] According to the consolidated cash flow statement.

[3] Fiscal 2018 has been adjusted, see Note (45) "Effects from new accounting standards and other presentation changes" in the Notes to the Consolidated Financial Statements.

[4] Proposal on the appropriation of profits for 2019.

FINANCIAL CALENDAR
for 2020

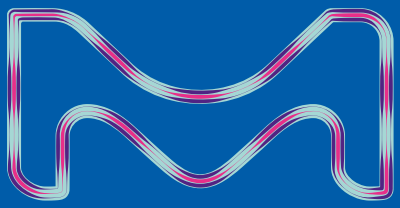
March
3/5/2020
Annual Press Conference

August
8/6/2020
Half-yearly Financial Report

May
5/14/2020
Quarterly Statement Q1

November
11/12/2020
Quarterly Statement Q3

May
5/28/2020
Annual General Meeting



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