Notes to the Consolidated Financial Statements

General Disclosures

(1) Company information

The accompanying consolidated financial statements as of December 31, 2018, have been prepared with MERCK Kommanditgesellschaft auf Aktien (Merck KGaA, Darmstadt, Germany), Frankfurter Strasse 250, 64293 Darmstadt, Germany, as parent company. Merck KGaA, Darmstadt, Germany, is registered under HRB 6164 with the Commercial Register of Darmstadt. In accordance with the provisions of the German financial reporting disclosure law (Publizitätsgesetz), consolidated financial statements are also prepared for E. Merck Kommanditgesellschaft (E. Merck KG, Darmstadt, Germany), Darmstadt, Germany, the ultimate parent company and general partner of Merck KGaA, Darmstadt, Germany, with an equity interest of 70.274% as of December 31, 2018 (December 31, 2017: 70.274%). These consolidated financial statements include Merck KGaA, Darmstadt, Germany, and its subsidiaries. The authoritative German versions of these financial statements are filed with the German Federal Gazette (Bundesanzeiger) and 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 in force on the reporting date as issued by the International Accounting Standards Board (IFRS and IAS) and 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 Notes (50) “Measurement policies” to (69) “Share-based compensation programs”.

Regulations applicable as of fiscal 2018 and other presentation and measurement changes

The following regulations take effect as of fiscal 2018:

- IFRS 9 “Financial Instruments”
- IFRS 15 “Revenue from Contracts with Customers”
- IFRIC 22 “Foreign Currency Transactions and Advance Consideration”
- Amendment to IAS 40 “Investment Property”
- Amendment to IFRS 2 “Share-based payment”
- Amendment to IFRS 4 “Insurance Contracts”
- Amendments to IFRS 15 ”Revenue from Contracts with Customers”
- Annual Improvements to IFRS 2014 – 2016 Cycle: Amendments to IFRS 1 “First-time Adoption of International Financial Reporting Standards” and to IAS 28 “Investments in Associates and Joint Ventures”

Please refer to Note (49) “Effects from new accounting standards and other presentation and measurement changes” for further details on first-time application effects of IFRS 9 and IFRS 15. Note (49) also comprises details on the following effects: adjustments of the consolidated balance sheet as of January 1, 2018, resulting from the application of IAS 29 “Financial Reporting in Hyperinflationary Economies” regarding Argentina, disclosure adjustments for interest and penalties related to income taxes, and adjustments of the consolidated income statement according to IFRS 5, effective for 2017, in connection with the disposal of the Consumer Health business.

The other new regulations applicable for the first time in fiscal 2018 did not have a material impact on the consolidated financial statements.

Regulations applicable as of fiscal 2019

The following standards will take effect as of fiscal 2019:

- IFRS 16 “Leases”
- IFRIC 23 “Uncertainty over Income Tax Treatments”
- Amendment to IAS 28 “Investments in Associates and Joint Ventures”
- Amendment to IFRS 9 “Financial Instruments”

We did not opt for early application of any of these standards. With the exception of IFRS 16, none of these rules is expected to have a significant effect on the consolidated financial statements.

IFRS 16 “Leases” replaces IAS 17 “Leases” and the corresponding interpretations. The Group applies the modified retrospective method to implement IFRS 16. The cumulative transition effects will be recognized as at the date of first-time application (January 1, 2019). Previous-year figures will not be 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 the Group as a lessee, in particular regarding leased real estate and vehicles. The lessor accounting regulations remain largely unchanged; this business has no material relevance for the Group.

Furthermore, the Groups's consolidated financial statements will not be affected by the new sale-and-lease-back regulations introduced per IFRS 16.

Lease liabilities – recognized for leases with the Group as a lessee – are measured at the present value of the future lease payments, discounted using the interest rate implicit in the lease, or the relevant incremental borrowing rate. The resulting amount is also used to recognize the right-of-use asset, adjusted by directly attributable costs, if applicable. Furthermore, prepayments as well as liabilities relating to fiscal 2018 are taken into account. 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 the latest insights. 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 the Group. Going forward, interest expenses from the unwinding of the discount on lease liabilities are recognized in the financial result; this differs from the previous accounting method, according to which operating lease expenses were recognized in full in the respective functional costs.

At the time these consolidated financial statements were prepared, and based on the knowledge and contractual status at that time, the Group expected the following impact on financial position and performance from the application of IFRS 16:

Consolidated Balance Sheet	The Group carried out a Group-wide analysis to establish the projected impact from the first-time application of IFRS 16. As of January 1, 2019, an increase in lease liabilities and corresponding right-of-use assets in the amount of € 470 million will be recognized. Financial liabilities will increase by 5.3% accordingly. As a result, the Groups's equity ratio will decline by about one percentage point (0.6%) according to our projections. The right-of-use assets to be recognized as of first-time application of IFRS 16 affect the following items within property, plant and equipment:
Consolidated Income Statement	Based on the leasing portfolio held at first-time application (January 1, 2019) and the latest contractual status, we expect for fiscal 2019 depreciation of about € 120 million, and corresponding interest expenses of about € 10 million. To date, expenses from operating lease agreements were recognized over the lease term, on a straight-line basis, in operating expenses. These changes in accounting principles will translate into improved KPIs. Based on the current contractual status, the operating result (EBIT) will improve by about € 10 million, and the EBITDA pre by about € 130 million. However, the first-time application of IFRS 16 will have no material impact on the business free cash flow (BFCF).
Consolidated Cash Flow Statement	The repayment components of about € 115 million included in the lease payments represent repayments of financial liabilities and are therefore recognized as cash flows from financing activities. To date, such repayment components were recognized within payments from operating lease agreements in cash flows from operating activities.

€ million

Non-current assets	**January 1, 2019**
Land, land rights and buildings, including buildings on third-party land	€ ~385 million
Plant and machinery	€ ~15 million
Other facilities, operating and office equipment	€ ~70 million

The Group will make use of the following practical expedients of IFRS 16:

- as before, right-of-use assets, including the corresponding liabilities, from leases of low-value assets will not be recognized in the consolidated balance sheet;
- leases of intangible assets within the scope of IAS 38 will not be recognized in accordance with IFRS 16;
- regarding all right-of-use assets – except land, land rights and buildings, including buildings on third-party land – the Group will not separate non-lease components from lease components;
- leases that were previously subject to IAS 17 and the corresponding interpretations, will be treated as leases under IFRS 16 as well;
- at first-time application, no impairment tests for right-of-use assets will be carried out – instead, the Group will charge provisions for onerous contracts against the respective right-of-use assets;
- at first-time application, directly attributable costs incurred at contract inception will not be taken into consideration.

The Group will not apply the practical expedient regarding leases with a term of less than 12 months.

Published accounting standards 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 IAS 1 "Presentation of Financial Statements"
- Amendment to IAS 8 "Accounting Policies, Changes in Accounting Estimates and Errors"
- Amendment to IAS 19 "Employee Benefits"
- Amendment to IFRS 3 "Business Combinations"
- Annual Improvements to IFRSs 2015–2017 Cycle
- Amendments to References to the Conceptual Framework in IFRS Standards

From today's perspective, the new rules are not expected to have any material effects on the consolidated financial statements.

The European Union announced on October 30, 2015, that it would not endorse the interim standard "IFRS 14 Regulatory Deferral Accounts" published by the International Accounting Standards Board on January 30, 2014. On December 17, 2015, the International Accounting Standards Board decided to defer the date of the mandatory first-time application of the amendments to the IAS 28 "Investments in Associates and Joint Ventures" and IFRS 10 "Consolidated Financial Statements" standards published on September 11, 2014, indefinitely.

(3) Management judgments and sources of estimation uncertainty

The preparation of the consolidated financial statements required the Group to make discretionary decisions and assumptions as well as estimates to a certain extent. The discretionary decisions, assumptions relating to the future and sources of estimation uncertainty described below are associated with the greatest potential effects on these consolidated financial statements.

Items	Discretionary scope/ estimation uncertainty	**Carrying amount Dec. 31, 2018 (€ million)**	See Note for details	Sensitivity analysis	IFRSs
Goodwill		13,764	→ 19	yes	
Determination of recoverable amount	high				IAS 36
Other intangible assets		7,237	→ 20	yes	
In-licensing of intangible assets	medium				IAS 38
Identification of impairments (or reversal of impairments)	medium				IAS 36
Determination of amortization	medium				IAS 38
Property, plant and equipment		4,811	→ 21	no	
Identification of impairments (or reversal of impairments)	medium				IAS 36
Determination of depreciation	medium				IAS 16
Inventories		2,764	→ 23	no	
Identification of impairments (or reversal of impairments)	medium				IAS 2
Trade accounts receivable		2,931	→ 24, 38	yes	
Determination of impairment amount	medium				IFRS 9
Other financial assets			→ 34, 39	yes	
Determination of fair values of contingent considerations	high	259			IFRS 13
Determination of fair values of equity instruments	medium	274			IFRS 9, IFRS 13
Provisions for pensions and other post-employment benefits			→ 25	yes	
Determination of present value of defined-benefit obligations	medium	–4,719			IAS 19
Other provisions and contingent liabilities		–1,381	→ 26, 27	no	
Recognition and measurement of contingent liabilities	high				IAS 37
Recognition and measurement of other provisions	high				IAS 37
Determination of fair values of share-based compensation programs	medium				IFRS 2
Revenue recognition			→ 6, 8, 30	yes	
Determination of type and timing of revenue recognition (including upfront and milestone payments received)	medium				IFRS 15
Measurement of sales deductions, and refund liabilities	medium				IFRS 15
Income tax			→ 14	no	
Recognition and measurement of income tax liabilities	high	–1,176			IAS 12
Recognition and measurement of deferred taxes from temporary differences	medium				IAS 12
Recognition of deferred tax assets from loss carryforwards	medium	33			IAS 12
Assets held for sale		–	→ 5	no	
Date on which assets and liabilities are classified as “held for sale”	high				IFRS 5

Group Structure

(4) Changes in the scope of consolidation

The scope of consolidation changed as follows in the reporting period:

Consolidated subsidiaries as of December 31, 2017		**314**
Additions	Establishment	5
	Acquisitions	1
	Materiality	10
Retirements	Liquidations/mergers	– 16
	Divestments	– 13
	Immateriality	–
	Loss of control	–
Consolidated subsidiaries as of December 31, 2018		**301**
Non-consolidated subsidiaries as of December 31, 2017		59
Non-consolidated subsidiaries as of December 31, 2018		44

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 Group. Investments held in non-consolidated subsidiaries were disclosed under non-current financial assets (see Note (34) "Financial assets"). The list of non-consolidated subsidiaries mainly comprises non-operating shelf companies as well as entities subject to liquidation procedures, which are measured at fair value through other comprehensive income.

The list of shareholdings presents all of the companies included in the consolidated financial statements as well as all of the shareholdings of Merck KGaA, Darmstadt, Germany (see Note (70) "List of shareholdings").

(5) Acquisitions and divestments

DIVESTMENT OF CONSUMER HEALTH BUSINESS

On April 19, 2018, the Group signed an agreement on the divestment of its global Consumer Health business to The Procter & Gamble Company, United States, (P&G). The transaction was completed on December 1, 2018. The selling price was € 3.4 billion in cash before defined purchase price adjustments for transferred operating assets and borrowed capital, among other things. The purchase price adjustments will be made in the first half of 2019. The transaction was executed through the sale of shareholdings in multiple subsidiaries of the Group as well as by way of various asset sales. Apart from the commercial operations in 44 countries, the Consumer Health business also comprised two production facilities in Austria and India. Moreover, with respect to the transfer of the shareholdings in Merck Ltd., Mumbai, India, a former subsidiary of Merck KGaA, Darmstadt, Germany, the commercial operations of other business sectors were transferred as well, and immediately repurchased. About 3,300 employees transferred to P&G as part of the Consumer Health business divestment. In addition to the divestment agreement, the Group and P&G signed a number of manufacturing, supply and service agreements.

With the signing of the agreement to divest the Consumer Health business, in the opinion of the Executive Board the preconditions for classification as a discontinued operation pursuant to IFRS 5 were given. Until transaction closing, the parts of the Consumer Health business being transferred to P&G were disclosed in the consolidated balance sheet as assets held for sale and as liabilities directly related to assets held for sale.

In accordance with IFRS 5, the financial figures disclosed in these consolidated financial statements relate exclusively to continuing operations unless expressly stated otherwise. Supplies and services provided by the Group after the conclusion of the sale transaction according to contractual agreements were taken into account for the presentation of the reporting period and the prior-year period. The amounts of earnings contributions allocated to the Group's continuing operations are based on the anticipated transactions that will be made with the disposed business after the divestment. In accordance with IFRS 5, the prior-year consolidated balance sheet was not adjusted. The cash flows from the discontinued operation are shown under separate items in the consolidated cash flow statement. A

detailed reconciliation of the reporting components published in previous periods to the reporting components adjusted in accordance with IFRS 5 can be found in Note (49) “Effects from new accounting standards and other presentation and measurement changes”. The financial figures of discontinued operations are presented below:

€ million	2018	2017
Net sales	**748**	**809**
Expenses	–680	–709
Gain on the disposal of discontinued operation	2,614	–
Profit/loss of discontinued operation before income tax	**2,682**	**101**
Income tax on ordinary activities	–8	–43
Income tax on the gain on the disposal of discontinued operation	–370	–
Proift/loss of discontinued operation after income tax	**2,303**	**57**
thereof: attributable to shareholders of Merck KGaA, Darmstadt, Germany	2,281	53
thereof: attributable to non-controlling interests	22	4

Neither net gains nor losses on fair value measurement less costs to sell were recognized for fiscal 2018 or the previous year.

The following table provides the reconciliation from the disposal proceeds to the preliminary net gain from the disposal of discontinued operation before tax:

€ million	2018
Disposal proceeds	3,364
less: net assets divested	–606
Subtotal	2,758
Transaction costs related to the disposal	–103
Realized currency translation effects on equity	–41
Disposal gain before tax	**2,614**

Net assets divested comprised the following items:

€ million	Carrying amounts on the disposal date
Non-current assets	
Goodwill	251
Property, plant and equipment	84
Deferred tax assets	48
Other non-current assets	8
	391
Current assets	
Cash and cash equivalents	241
Inventories	43
Receivables	115
Other current assets	38
	436
Total assets	**827**
Non-current liabilities	
Provisions for pensions and other post-employment benefits	46
Other non-current liabilities and provisions	7
	54
Current liabilities	
Trade accounts payable	60
Other current liabilities and provisions	14
	75
Total liabilities	**128**
Net assets divested (including non-controlling interests)	699
thereof: non-controlling interests	93
Net assets divested	**606**

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – ASSETS HELD FOR SALE, DISPOSAL GROUPS AND DISCONTINUED OPERATIONS

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 significant discretionary judgment. Even in the case of an existing management decision to review a disposal, an assessment subject to uncertainties has to be made as to the probability that a corresponding disposal will occur during the year or not.

Regarding the divestment of the Consumer Health business, material information was made available to potential buyers first in fiscal 2018, using electronic data rooms. It was only on the basis of this information that potential buyers were able to submit binding offers that were analyzed by the Group based on its price expectations.

During the subsequent negotiations with potential buyers, the negotiating parties were able to define the transaction in more specific terms, i.e. material changes to the disposal plan were not unlikely at the balance sheet date (December 31, 2017). Against this background at December 31, 2017, the Executive Board did not consider the divestment of the Consumer Health business within the next twelve months as highly probable.

DIVESTMENT OF FLOW CYTOMETRY BUSINESS

On October 18, 2018, the Group signed an agreement with Luminex Corporation, United States, concerning the divestment of the flow cytometry business. These business activities comprised the flow cytrometry platforms Amnis® and Guava® as well as the associated reagents under these brands. The disposal proceeds amounted to € 66 million (US$ 75 million), of which € 61 million (US$ 70 million) was paid in fiscal 2018. The remaining € 5 million will be paid in fiscal 2019. The transaction was completed on December 31, 2018. The business activities assigned to the Life Science business sector primarily consisted of the allocated goodwill as well as intangible assets and inventories. This divestment generated a disposal gain of € 9 million which was recognized in other operating income.

DIVESTMENT OF BIOSIMILARS BUSINESS IN PREVIOUS YEAR

On August 31, 2017, the Group completed the divestment of the Biosimilars business to subsidiaries of Fresenius SE & Co. KGaA. In addition to the divestment of the business activities, the contract parties entered into supply and services agreements, which include drug development support and manufacturing services. As compensation for the sale of the business activities, the Group received an upfront payment of € 156 million. According to the agreed terms of the transaction, the Group was entitled to future milestone payments of up to € 497 million, which were partly covered by services to be performed, as well as tiered royalties on product sales. The disposal gain amounted to € 319 million and was recorded under other operating income. Further information regarding the fair values determined in 2017 by an external expert for the contingent consideration components and the sensitivity analysis can be found in Note (39) "Information on fair value measurement".

In addition to the aforementioned consideration components, the Group received an advance payment of € 45 million for services to be performed at short notice which was recognized in the period in which the services were provided. Proceeds from the provision of services were mainly recognized as part of net sales.

ACQUISITIONS IN THE PREVIOUS YEAR

On May 8, 2017, the Group acquired all of the shares in Grzybowski Scientific Inventions Ltd. (GSI) headquartered in Evanston, United States. GSI developed Chematica, a computer-aided retro-synthesis tool. The software uses advanced reaction rules and proprietary algorithms to identify synthesis pathways that meet user-defined requirements. GSI was integrated into the Life Science business sector. The purchase price comprised fixed compensation of US$ 7 million (€ 7 million) as well as milestone payments of up to US$ 1 million (€ 1 million).

On September 15, 2017, the Group acquired a 100% interest in Natrix Separations, Inc. (Natrix). The company, which is headquartered in Burlington, Canada, supplies hydrogel membrane products for single-use chromatography. Natrix was integrated into the Life Science business sector. The purchase price comprised fixed compensation of around US$ 14 million (€ 12 million) as well as milestone payments of up to US$ 8 million (€ 7 million).

The purchase price allocations for GSI and Natrix remained unchanged compared to December 31, 2017. The most significant impact from the purchase price allocations resulted, in both cases, from the remeasurement of technology-related intangible assets.

(6) Collaborations of material significance

STRATEGIC ALLIANCE WITH PFIZER INC., UNITED STATES, TO CO-DEVELOP AND CO-COMMERCIALIZE ACTIVE INGREDIENTS IN IMMUNO-ONCOLOGY

On November 17, 2014, the Group formed a global strategic alliance with Pfizer Inc., United States, (Pfizer) to co-develop and co-commercialize the anti-PD-L1 antibody avelumab and an anti-PD-1 antibody contributed by Pfizer. In 2017, avelumab was approved for the first time under the trade name Bavencio® for the treatment of patients with metastatic Merkel cell carcinoma as well as patients with locally advanced or metastatic urothelial cancer. This antibody is also being studied in multiple broad-based clinical trials as a potential treatment for further tumor types. The active ingredient is to be developed as a single agent as well as in various combinations with a broad portfolio of approved and investigational active ingredients. The overriding objective of the strategic alliance is sharing the development risks and to accelerate 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, the Group realizes the vast majority of sales from the commercialization of Bavencio® while the Group 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 the Group. Pfizer also committed to make further payments of up to US$ 2 billion to the Group subject to the achievement of defined regulatory and commercial milestones. Based on the collaboration agreement, the Group additionally received the right to co-promote for multiple years Xalkori®

(crizotinib), 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 co-promotion of Xalkori®, the Group receives from Pfizer a profit share, which is reported in net sales. In 2018, this profit share income amounted to € 58 million (2017: € 72 million). At initial recognition, the right was measured at fair value by an independent external expert using the multi-period excess earnings method. The right was capitalized when it was granted and is being amortized over the term of the agreement. The residual book value of this intangible asset as of December 31, 2018, was € 68 million (December 31, 2017: € 93 million). An impairment loss of € 33 million was recognized for rights to Xalkori® in 2017.

On the date the collaboration agreement was entered into, both the upfront payment received and the value of the right to co-promote Xalkori® were recognized in the balance sheet as deferred income under other liabilities. Both amounts are being recognized as income on a pro rata basis over the expected period during which the Group is to meet certain obligations and will be presented under other operating income (2018: € 191 million/2017: € 191 million). In fiscal 2018, the Group generated sales of € 69 million with Bavencio® (2017: € 21 million) and recorded research and development expenses of € 313 million (2017: € 264 million). In addition, the Group recognized income in a mid double-digit million euro amount in return for waiving rights to Pfizer's anti-PD-1 antibody, which had previously been included in the collaboration agreement; this income was reported under other operating income (2017: income of € 124 million for milestone payments for regulatory approvals received).

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – COLLABORATION AGREEMENTS

In the past, the Group occasionally recognized income for upfront and milestone payments as well as license fees received under collaboration agreements.

In this context, the Group had to assess the extent to which the requirements of IFRS 15 had to be applied directly or indirectly.

If so, the Group had to determine whether the Group's contractually promised goods or services contained in the collaboration agreement could be separated or not.

For the immuno-oncology collaboration agreement entered into with Pfizer Inc., United States, in November 2014, the various promises to transfer goods or services could not be separated, meaning that the promises had to be accounted for in their entirety as a single performance obligation – as is customary for collaboration agreements in the pharmaceutical industry.

Furthermore, for identified performance obligations, the Group had to determine whether income had to be recognized over time or at a point in time. If income is recognized over time, management judgments are required as to the appropriate revenue recognition method and the period over which income is to be recognized.

In the case of the collaboration agreement with Pfizer, income had to be recognized over time, i.e. the upfront payment received had to be allocated over the period in which the main development activities were conducted. If the consideration received in this context and deferred as a liability had been recognized in the income statement over a shorter period reduced by six months, in fiscal 2018 this would have increased other operating income, and profit before income tax would therefore have increased by € 64 million (2017: € 38 million). Recognition over a period extended by six months would have lowered other operating income and profit before income tax by € 38 million (2017: € 27 million).

AGREEMENT WITH BRISTOL-MYERS SQUIBB COMPANY, UNITED STATES, FOR THE CO-COMMERCIALIZATION OF GLUCOPHAGE® IN CHINA

In December 2012, the Group established an agreement with Bristol-Myers Squibb Company, United States, (BMS) for the co-commercialization of the antidiabetic agent Glucophage® (active ingredient: metformin hydrochloride) for the treatment of type 2 diabetes in China. Based on this agreement, as of fiscal 2017 the Group took over the exclusive distribution of Glucophage® in China. Since then, the Group has recorded sales of Glucophage® in China and pays license fees to BMS. In fiscal 2018, sales generated with Glucophage® in China amounted to € 329 million (2017: € 279 million) and license payments to BMS were € 53 million (2017: € 44 million).

AGREEMENT WITH INTREXON CORPORATION, UNITED STATES, ON THE JOINT DEVELOPMENT AND COMMERCIALIZATION OF CAR-T CANCER THERAPIES

In March 2015, the Group 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 the Group exclusive access to Intrexon's proprietary and complementary suite of technologies to engineer T-cells with optimized and inducible gene expression. Based on this agreement, Intrexon was responsible for all platform and product developments until the investigational new drug application was submitted for regulatory approval. In 2015, the Group made an upfront cash payment of US$ 115 million to Intrexon, which was recognized as part of intangible assets not yet available for use (carrying amount as of December 31, 2017: € 104 million).

Effective December 28, 2018, the Group transferred the above-mentioned exclusive rights back to Intrexon on the basis of a contractual agreement. At the time the contract was signed, the Group was entitled to receive Intrexon common stock worth US$ 150 million in return for the assignment of rights. Due to the intention to hold the shares for the long term, the shares were classified as equity instruments subsequently measured at fair value through other comprehensive income. Furthermore, the agreement contained another investment by the Group, 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, the Group received a convertible note in an amount of US$ 25 million, with the option, under certain conditions, to acquire shares in either Intrexon or Precigen. The convertible note was classified as a debt instrument measured at fair value through profit or loss.

The closing conditions for the transaction to take effect, including the waiting period pursuant to the Hart-Scott-Rodino Antitrust Improvements Act (U.S. antitrust law) were met in fiscal 2018. The transaction led to the disposal of the intangible asset in an amount of € 104 million and to the recognition of a disposal gain, which was reported under other operating income.

DEVELOPMENT AGREEMENT WITH AVILLION LLP, UNITED KINGDOM, TO DEVELOP ANTI-IL-17-A/F NANOBODY®

On March 30, 2017, the Group announced an agreement with a subsidiary of Avillion LLP, United Kingdom, (Avillion) to develop the anti-IL-17-A/F Nanobody® M1095. The Group acquired full, exclusive rights to anti-IL-17-A/F Nanobody® through a global development and commercialization license from Ablynx nv, Belgium, in 2013. This Nanobody® is an investigational therapy which has completed Phase I development. As part of the cooperation, Avillion will be responsible for developing this anti-IL-17-A/F Nanobody® from Phase II through Phase III in plaque psoriasis. Avillion will also finance the clinical program through to regulatory submission. The drug candidate is currently in a Phase IIb trial that started on schedule in August 2018. During the development phase, the Group recognizes a financial liability for potential repayment obligations to Avillion and records a corresponding expense as research and development costs. Research and development costs in the low single-digit million euro range were incurred in fiscal 2018.

IMMUNO-ONCOLOGY COLLABORATION WITH F-STAR DELTA LTD., UNITED KINGDOM

On June 4, 2017, the Group announced a strategic collaboration with F-star Delta Ltd, United Kingdom, (F-star) for the development and commercialization of bispecific immuno-oncology antibodies. The Group has the option, upon delivery of pre-defined data packages by F-star, to fully acquire the company that owns five bispecific development programs, including F-star's lead asset FS118. In return, the Group made upfront payments to F-star and its shareholders totaling € 60 million, which were capitalized in 2017. Until the option can be exercised, the Group finances F-star's research and development activities and reports the corresponding expenses under research and development costs. In addition, since the collaboration began, the Group has made performance-related milestone payments of € 14 million, which have been capitalized. If the option is exercised and defined milestones are reached, the Group will incur further payment obligations.

DEVELOPMENT AGREEMENT WITH THE SFJ PHARMACEUTICALS GROUP, UNITED STATES, TO DEVELOP ABITUZUMAB

On May 2, 2018, the Group announced that it had signed an agreement with the SFJ Pharmaceuticals Group, United States, (SFJ) to develop abituzumab. Abituzumab is an investigational monoclonal antibody with potential for treating solid tumors such as colorectal cancer (mCRC). In a Phase II study of a patient population with KRAS wild-type mCRC, a subgroup of patients was identified as potentially benefiting from treatment with abituzumab in combination with Erbitux® and chemotherapy. SFJ will be responsible for Phase II and III development of abituzumab. During the development stages, the Group recognizes a financial liability for potential repayment obligations to SFJ and records a corresponding expense as research and development costs. No significant clinical development expenses were incurred in the 2018 reporting period.

Result from Operating Activities and Income Taxes

(7) Segment reporting

INFORMATION BY BUSINESS SECTOR[1]

	Healthcare		Life Science	
€ million	**2018**	2017	**2018**	2017
Net sales[2]	**6,246**	**6,190**	**6,185**	**5,882**
Intersegment sales	–	–	51	57
Operating result (EBIT)[3]	**731**	**1,337**	**1,036**	**834**
Depreciation and amortization	747	726	696	743
Impairment losses	13	53	23	3
Reversals of impairment losses	–	–87	–	–
EBITDA[3]	**1,492**	**2,028**	**1,755**	**1,580**
Adjustments[3]	63	–256	85	206
EBITDA pre (Segment result)[3]	**1,556**	**1,773**	**1,840**	**1,786**
EBITDA pre margin (in % of net sales)[3]	24.9%	28.6%	29.8%	30.4%
Assets by business sector	7,568	8,184	20,860	20,422
Liabilities by business sector	–2,893	–2,985	–1,333	–1,254
Investments in property, plant and equipment[4]	379	359	313	327
Investments in intangible assets[4]	59	310	19	55
Net cash flows from operating activities	1,159	1,629	1,621	1,516
Business free cash flow[3]	1,025	1,314	1,393	1,402

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".
[2] Excluding intersegment sales.
[3] Not defined by International Financial Reporting Standard (IFRSs).
[4] According to the consolidated cash flow statement.

INFORMATION BY COUNTRY AND REGION[1]

	Europe		thereof: Germany		thereof: Switzerland		**North America**	
€ million	**2018**	2017	**2018**	2017	**2018**	2017	**2018**	2017
Net sales by customer location[2]	4,559	4,406	1,002	945	211	223	3,818	3,810
Net sales by company location[2]	5,012	4,828	1,407	1,416	390	360	3,871	3,835
Goodwill and other intangible assets	5,562	6,537	575	614	2,124	2,839	14,868	14,694
Property, plant and equipment	3,031	2,895	1,503	1,385	647	623	1,024	927
Research and development costs	–1,938	–1,840	–920	–681	–902	–1,050	–186	–166
Number of employees	25,791	25,979	13,513	13,302	2,234	2,151	10,978	10,520

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".
[2] Excluding intersegment sales.

Performance Materials		Corporate and Other		**Group**	
2018	2017	**2018**	2017	**2018**	2017
2,406	**2,446**	**–**	**–**	**14,836**	**14,517**
–	–	–51	–57	–	–
508	**689**	**–548**	**–437**	**1,727**	**2,423**
240	232	60	41	1,743	1,742
21	26	–	4	58	86
–	–	–	–	–	–87
769	**947**	**–488**	**–391**	**3,528**	**4,164**
17	33	107	99	272	82
786	**980**	**–381**	**–292**	**3,800**	**4,246**
32.7%	40.1%	–	–	25.6%	29.3%
4,046	3,942	4,414	3,073	36,888	35,621
–489	–484	–14,940	–16,832	–19,655	–21,554
119	116	100	116	910	919
13	14	15	13	106	392
742	969	–1,303	–1,418	2,219	2,696
588	906	–497	–429	2,508	3,193

thereof: United States		**Asia-Pacific**		thereof: China		**Latin America**		**Middle East and Africa**		**Group**	
2018	2017	**2018**	2017	**2018**	2017	**2018**	2017	**2018**	2017	**2018**	2017
3,627	3,623	4,965	4,761	1,869	1,583	950	996	544	544	14,836	14,517
3,704	3,672	4,718	4,532	1,659	1,416	879	959	357	364	14,836	14,517
14,857	14,675	570	665	32	39	2	2	–	–	21,001	21,899
1,020	923	585	531	266	214	127	114	43	45	4,811	4,512
–185	–165	–69	–73	–30	–26	–17	–17	–14	–12	–2,225	–2,108
10,800	10,339	10,486	11,294	3,550	3,324	3,337	4,027	1,121	1,060	51,713	52,880

Segmentation was performed in accordance with the organizational and reporting structure of the Group that applied during 2018. The combination into segments is based on the business models of the business sectors and led to homogeneous risk structures within the segments. Resource allocation and the assessment of the earning power of the business sectors was performed by the Executive Board of Merck KGaA, Darmstadt, Germany, as the main decision-maker.

The Healthcare business sector comprises the businesses with prescription pharmaceuticals, allergy products and medical devices. The customers of this business sector mainly comprise wholesalers, hospitals and pharmacies. The Life Science business sector offers solutions to research and analytical laboratories in the pharmaceutical/biotechnology industry or in academic institutions, and customers manufacturing large- and small-molecule drugs. In accordance with the field of activity, the customers of this business sector largely 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 about the business sectors in the combined management report.

Corporate and Other included income and expenses, assets and liabilities as well as cash flows that could not be directly allocated to the reportable segments presented. This related mainly to central Group functions. Moreover, the column served the reconciliation to the Group numbers. As these are steered at Group level, the expenses and income as well as cash flows attributable to the financial result and income taxes were 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. However, they represent important variables used to steer the Group. To permit a better understanding of operational performance, EBITDA pre excludes depreciation and amortization, impairment losses, and reversals of impairment losses as well as the adjustments presented in the following. Among other things, business free cash flow is also used for internal target agreements.

Neither in 2018 nor in 2017 did any single customer account for more than 10% of Group sales. Transfer prices for intragroup net sales were determined on an arm's-length basis.

The following table presents the reconciliation of EBITDA pre of all operating businesses to the profit before income tax of the Group:

€ million	2018	2017[1]
EBITDA pre of the operating businesses[2]	**4,181**	**4,538**
Corporate and Other	–381	–292
EBITDA pre of the Group[2]	**3,800**	**4,246**
Depreciation/amortization/impairment losses/reversals of impairment losses	–1,801	–1,741
Adjustments[2]	–272	–82
Operating result (EBIT)[2]	**1,727**	**2,423**
Financial result	–266	–294
Profit before income tax	**1,461**	**2,129**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".
[2] Not defined by International Financial Reporting Standard (IFRSs).

The adjustments comprised the following:

€ million	2018	2017[1]
Restructuring expenses	–46	–61
Integration expenses/IT expenses	–142	–188
Gains (+)/losses (–) on the divestment of businesses	–25	310
Acquisition-related adjustments	–2	–63
Other adjustments	–58	–81
Adjustments before impairment losses/reversals of impairment losses[2]	**–272**	**–82**
Impairment losses	–55	–68
Reversals of impairment losses	–	87
Adjustments (total)[2]	**–327**	**–64**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".
[2] Not defined by International Financial Reporting Standard (IFRSs).

The adjustments recognized under integration and IT expenses in the amount of € 142 million (2017: € 188 million) mainly result from expenses for ERP systems (2018: € 50 million/2017: € 64 million) and the integration of the Sigma-Aldrich Corporation, United States (2018: € 66 million/2017: € 95 million). These amounts were recorded under other operating expenses.

Losses on the divestment of businesses in the amount of € 25 million (2017: gains on the divestment of businesses of € 310 million) were mainly attributable to the subsequent measurement of contingent considerations received in connection with the divestment of the Biosimilars business in the previous year, and were included in other operating expenses.

The majority of other adjustments in the amount of € 58 million (2017: € 81 million) was related to the activities on the occasion of the company's 350th anniversary (2018: € 31 million/2017: € 62 million).

The adjustments were included in the consolidated income statement under cost of sales as well as under other operating expenses and income, and were allocable to functional costs as follows:

€ million 2018	thereof: cost of sales	thereof: marketing and selling expenses	thereof: administration expenses	thereof: research and development costs	thereof: other operating income and expenses	**Total**
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[1]	**–45**	**–13**	**–190**	**–2**	**–23**	**–272**
Impairment losses	–18	–14	–19	–	–3	–55
Reversals of impairment losses	–	–	–	–	–	–
Adjustments (total)[1]	**–63**	**–27**	**–209**	**–2**	**–26**	**–327**

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

€ million 2017	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	–5	–12	–41	–	–3	–61
Integration expenses/IT expenses	–31	–21	–131	–1	–3	–188
Gains (+)/losses (–) on the divestment of businesses	–	–	–	–	310	310
Acquisition-related adjustments	–1	–	–5	–	–56	–63
Other adjustments	–13	–10	–42	–5	–11	–81
Adjustments before impairment losses/ reversals of impairment losses[2]	**–50**	**–43**	**–219**	**–5**	**235**	**–82**
Impairment losses	–6	–33	–	–16	–14	–68
Reversals of impairment losses	87	–	–	–	–	87
Adjustments (total)[2]	**31**	**–76**	**–219**	**–21**	**222**	**–64**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".
[2] Not defined by International Financial Reporting Standards (IFRSs).

Business free cash flow was determined as follows:

€ million	**2018**	2017[1]
EBITDA pre[2]	**3,800**	**4,246**
Investments in property, plant and equipment, software as well as advance payments for intangible assets	–932	–1,012
Changes in inventories	–214	–18
Changes in trade accounts receivable as well as receivables from royalties and licenses	–145	–22
Elimination first-time consolidation of BioControl Systems	–	–2
Business free cash flow[2]	**2,508**	**3,193**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".
[2] Not defined by International Financial Reporting Standard (IFRSs).

(8) Net sales

The following tables present a more detailed breakdown of net sales from contracts with customers by business sector.

€ million/in %	2018							
Net sales by nature of the products	**Healthcare**		**Life Science**		**Performance Materials**		**Group**	
Goods	6,085	98%	5,413	87%	2,404	100%	13,902	94%
Equipment/hardware	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-commercialisation 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 (APAC)	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 (MEA)	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/in %	2018	
Oncology	**944**	**15%**
thereof: Erbitux®	816	13%
thereof: Bavencio®	69	1%
Neurology & Immunology	**1,529**	**24%**
thereof: Rebif®	1,438	23%
thereof: Mavenclad®	90	1%
Fertility	**1,162**	**19%**
thereof: Gonal-f®	708	11%
General Medicine & Endocrinology	**2,341**	**38%**
thereof: Glucophage®	733	12%
thereof: Concor®	475	8%
thereof: Euthyrox®	363	6%
thereof: Saizen®	234	4%
Other	**270**	**4%**
Total	**6,246**	**100%**

LIFE SCIENCE

€ million/in %	2018	
Process Solutions	2,487	40%
Research Solutions	2,048	33%
Applied Solutions	1,650	27%
Total	**6,185**	**100%**

PERFORMANCE MATERIALS

€ million/in %	2018	
Display Solutions	1,332	55%
Surface Solutions	476	20%
Semiconductor Solutions	596	25%
Other	1	–
Total	**2,406**	**100%**

Further income was reported within other operating income. This relates in particular to income from upfront and milestone payments as well as royalty and license income not generated in the course of ordinary activities.

Group net sales stood at € 14,836 million in fiscal 2018, out of which an amount of € 557 million was recognized over time. Over-time revenue recognition related mainly to net sales from services and from customer-specific equipment/hardware in the Life Science business sector.

As of December 31, 2018, future income from concluded contracts with an originally expected contract term of more than one year amounted to € 294 million, of which € 191 million will be recognized in other operating income. The Group expects to generate the majority of income from these contracts in 2019 and 2020.

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – REVENUE RECOGNITION

Sales deductions

The Group granted its customers various kinds of rebates and discounts. In addition, expected customer refund claims, state compulsory charges as well as rebates from health plans and programs are also deducted from sales. The most significant portion of these deductions from sales was attributable to the Healthcare business sector. The most substantial sales deductions in this business sector were attributable to health plans and programs in the United States. The measurement of sales deductions and the corresponding refund liabilities required extensive estimates.

The measurement of sales deductions and refund liabilities resulting from expected rebates and discounts took

- historical experience,
- pricing information as well as
- expected product growth rates

into consideration.

The measurement of sales deductions and refund liabilities resulting from rights of return took

- historical return rates of individual product groups,
- information from distributors on inventory levels as well as
- publicly available information on product sales from sector-specific service providers (Healthcare business sector)

into consideration.

Changes in estimates of the parameters listed above have an impact on the net sales recognized in the respective adjustment period. Further information can be found in Note (30) “Refund liabilities”.

(9) Cost of sales

Cost of sales primarily included the cost of manufactured products sold as well as merchandise sold. Cost comprises the following items: directly attributable costs, such as cost of materials, or personnel and energy costs; depreciation and amortization; overheads attributable to the production process; inventory impairments and impairment reversals. Cost of sales included amortization of intangible assets (excluding amortization of internally generated or separately acquired software) in the amount of € 175 million (2017: € 179 million).

(10) Marketing and selling expenses

Marketing and selling expenses comprised the following items:

€ million	2018	2017[1]
Sales force	–913	–918
Internal sales services	–808	–795
Sales promotion	–509	–504
Logistics	–702	–649
Amortization of intangible assets[2]	–975	–1,014
Royalty and license expenses	–213	–224
Other marketing and selling expenses	–263	–245
Marketing and selling expenses	**–4,384**	**–4,349**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".
[2] Excluding amortization of internally generated or separately acquired software.

Amortization of intangible assets was mainly attributable to customer relationships, marketing authorizations, licenses and similar rights, brands and trademarks, which could be functionally allocated to Marketing and Selling.

€ 84 million (2017: € 90 million) of royalty and license expenses related to the commercialization of Erbitux®, and € 53 million (2017: € 44 million) to the license expenses for Glucophage® in China with the distribution partner Bristol-Myers Squibb.

(11) Research and development costs

Subsidies received and reimbursements made resulted in net expenses of € 1 million in 2018 (2017: net income of € 29 million) recognized in research and development costs. These expenses comprised reimbursements from governmental institutions as well as repayments of previously recognized governmental subsidies with a total net amount of € 4 million (2017: net income of € 6 million). The reimbursements recognized in the previous year mainly referred to the strategic alliance with Pfizer Inc., United States, in the field of immuno-oncology.

(12) Other operating income

Other operating income was as follows:

€ million	2018	2017[1]
Income from upfront payments, milestone payments, rights and royalties	368	564
Gains on disposal of businesses and non-current assets	83	350
Gains from the release of provisions for litigation	21	10
Income from miscellaneous services	15	10
Income from the revaluation of contingent considerations	1	–
Reversal of impairment losses on financial assets[2]		91
Reversal of impairment losses on non-financial asset	–	87
Remaining other operating income	138	100
Other operating income	**627**	**1,212**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".
[2] Given the first-time application of IFRS 9, effective January 1, 2018, reversals of impairment losses on financial assets are offset against impairment losses on financial assets, and disclosed separately in the consolidated income statement.

Income from upfront payments, milestone payments, rights and royalties of € 368 million (2017: € 564 million) primarily resulted from the collaboration agreement entered into with Pfizer Inc., United States, in the field of immuno-oncology in 2014. This related to the pro rata recognition of deferred income in the amount of € 191 million (2017: € 191 million) (see Note (6) "Collaborations of material significance"). Furthermore, the Group recognized a milestone payment of € 50 million for the submission of an application; the corresponding drug candidate was sold to BioMarin Pharmaceutical Inc., United States, in 2016. License income was mainly due to the licenses granted for interferon beta products (Biogen Inc., United States), which amounted to € 79 million in the year under review (2017: € 87 million).

The gains on disposal of businesses and non-current assets of € 83 million in 2018 (2017: € 350 million) were 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, the Group 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. The gains recognized in the previous year were mainly attributable to the divestment of the Biosimilars business (€ 319 million).

Remaining other operating income in a mid double-digit million euro amount was generated from payment claims resulting from the waiver of rights to an anti PD-1 antibody previously included in the strategic alliance with Pfizer Inc., United States, (see Note (6) "Collaborations of material significance") and from the reversal of a provision for insurance obligations.

(13) Other operating expenses

The breakdown of other operating expenses was as follows:

€ million	2018	2017[1]
Integration expenses/IT expenses	–104	–156
Litigation	–74	–108
Exchange rate differences from operating activities (net)	–62	–3
Impairment losses on non-financial assets	–58	–86
Non-income related taxes	–53	–54
Profit share expenses	–46	–27
Restructuring expenses	–45	–64
Premiums, fees and contributions	–36	–38
Expenses for the revaluation of contingent considerations	–31	–2
Expenses for the company's 350-year anniversary (including employee bonus)	–31	–40
Project expenses	–25	–7
Expenses for miscellaneous services	–23	–13
Losses on disposal of businesses and non-current assets	–6	–23
Acquisition expenses	–2	–6
Impairment losses on financial assets[2]		–36
Remaining other operating expenses	–185	–218
Other operating expenses	**–780**	**–880**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".
[2] Given the first-time application of IFRS 9, effective January 1, 2018, impairment losses on financial assets are offset against reversals of impairment losses on financial assets, and disclosed separately in the consolidated income statement.

Integration and IT expenses amounting to € 104 million (2017: € 156 million) were incurred for the global harmonization of the IT landscape and in connection with the integration of acquired and existing businesses.

Litigation expenses amounting to € 74 million (2017: € 108 million) arose primarily from additions to provisions for legal disputes (see Note (26) "Other provisions").

Impairments of non-financial assets amounted to € 58 million (2017: € 86 million), € 20 million of which were attributable to a technology in the Performance Materials business sector and € 19 million of which were attributable to software modules in the Life Science business sector which are not further developed and no longer used (see Note (20) "Other intangible assets").

Restructuring expenses in the amount of € 45 million (2017: € 64 million) resulted, among other things, from the adjustment of corporate structures in Darmstadt and Gernsheim. In addition, the Group incurred further expenses from the relocation of the shared service organization. In the previous year, restructuring expenses also arose in connection with the planned closure of German sites of the Life Science business sector.

The expenses for the revaluation of contingent considerations in the amount of € 31 million (2017: € 2 million) were mainly attributable to value changes (recognized through profit or loss) of the variable consideration resulting from the divestment of the Biosimilars business in the previous year.

Remaining other operating expenses included, among others, special environmental protection costs as well as personnel expenses not allocable to the functional areas. This item also included the expense for the donation of Cesol® 600 tablets containing the active ingredient praziquantel to the World Health Organization (WHO) and expenses for insurance services.

The restructuring expenses and impairment losses contained in other operating expenses as well as the expenses for company's 350-year anniversary anniversary were allocated to the functional costs as follows:

	Restructuring expenses		Impairment losses on non-financial assets		Expenses for company's 350-year anniversary (including employee bonus)	
€ million	**2018**	2017[1]	**2018**	2017[1]	**2018**	2017[1]
Cost of sales	–	–	–23	–6	–	–
Marketing and selling expenses	–6	–17	–15	–33	–1	–12
Administration expenses	–39	–45	–19	–	–30	–21
Research and development costs	–	–	–	–33	–	–5
Other operating expenses	–	–3	–	–14	–	–1
Total	**–45**	**–64**	**–58**	**–86**	**–31**	**–40**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

(14) Income tax

€ million	**2018**	2017[1]
Current income taxes in the period	–579	–694
Income taxes for previous periods	–79	–14
Deferred taxes in the period	290	1,137
Income taxes	**–368**	**428**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

TAX RECONCILIATION

The following table presents the tax reconciliation from theoretical income tax expense to 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.

€ million	2018	2017[1]
Profit before income tax	1,461	2,129
Tax rate	31.7%	31.7%
Theoretical income tax expense	–463	–675
Tax rate differences	150	263
Tax effect of companies with a negative contribution to consolidated profit	–37	–71
Income tax for previous periods	–79	–14
Tax credits	52	193
Tax effect on tax loss carryforwards	34	–
Tax effect of non-deductible expenses/tax-free income/other tax effects	–25	732
thereof: from the US tax reform (deferred taxes on temporary differences)	–	619
thereof: from the US tax reform (deferred taxes on oustide basis differences)	–	401
thereof: from the US tax reform (one-time transition tax on foreign earnings)	–	–114
Income tax expense according to consolidated income statement	**–368**	**428**
Tax ratio according to consolidated income statement	25.2%	–20.1%

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

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 for previous periods recognized in fiscal 2018 resulted mainly from completed tax audits and mutual agreement procedures, and from additions to provisions for tax audits.

IMPACT OF TAX REFORM IN THE UNITED STATES IN 2017

The Tax Cuts and Jobs Act became effective in the US on December 22, 2017, and introduced new rules on the taxation of profits of foreign subsidiaries. This resulted in additional taxation of past profits and led to an increase in the current tax expense of the previous year by € 114 million. Please refer to the tax reconciliation of the previous year for further information on material effects from the US tax reform.

DEFERRED TAXES (CONSOLIDATED INCOME STATEMENT)

The reconciliation between deferred taxes in the consolidated balance sheet and deferred taxes in the consolidated income statement is presented in the following table:

€ million	2018	2017[1]
Change in deferred tax assets (consolidated balance sheet)	–15	93
Change in deferred tax liabilities (consolidated balance sheet)	201	1,235
Changes from reclassification into assets held for sale	–30	–41
Deferred taxes credited/debited to equity	–2	15
Changes in scope of consolidation/currency translation/other	135	–164
Deferred taxes (consolidated income statement)	**290**	**1,137**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

As in the previous year, changes in scope of consolidation/currency translation/other mainly resulted from exchange rate fluctuations between the euro and the U.S. dollar.

CHANGES IN TAX LOSS CARRYFORWARDS

Tax loss carryforwards were structured as follows:

	Dec. 31, 2018			Dec. 31, 2017		
€ million	Germany	Abroad	Total	Germany	Abroad	Total
Tax loss carryforwards	118	1,069	**1,187**	117	1,054	**1,171**
Tax loss carry forwards for which a deferred tax asset is recognized	59	152	**211**	56	160	**216**
Tax loss carry forwards for which no deferred tax asset is recognized	59	917	**976**	61	894	**955**
Potential deferred tax assets for tax loss carry forwards	27	254	**281**	19	269	**288**
Recognized deferred tax assets on tax loss carryforwards	9	24	**33**	7	25	**32**
Not recognized deferred tax assets on tax loss carryforwards	18	230	**248**	12	244	**256**

The vast majority of the tax loss carryforwards either has no expiry date or can be utilized for up to 20 years. In 2018, the income tax expense was reduced by € 34 million (2017: € 0 million) due to the utilization of tax loss carryforwards from prior years for which no deferred tax asset had been recognized in prior periods.

DEFERRED TAXES (CONSOLIDATED BALANCE SHEET)

Deferred tax assets and liabilities correspond to the following balance sheet items:

	Dec. 31, 2018		Dec. 31, 2017	
€ million	Assets	Liabilities	Assets	Liabilities
Intangible assets	119	1,479	111	1,555
Property, plant and equipment	34	84	23	98
Current and non-current financial assets	12	3	5	41
Inventories	564	18	554	14
Current and non-current receivables/other assets	25	5	21	2
Provisions for pensions and other post-employment benefits	454	37	485	92
Other provisions	236	66	190	35
Liabilities	67	12	69	9
Tax loss carryforwards	33	–	32	–
Tax refund claims/other	60	98	58	86
Deferred taxes (before offsetting)	**1,606**	**1,803**	**1,548**	**1,931**
Offset deferred tax assets and liabilities	–515	–515	–442	–442
Deferred taxes (consolidated balance sheet)	**1,091**	**1,288**	**1,106**	**1,489**

Deferred tax liabilities from outside basis differences for planned dividend payouts were recorded in the amount of € 30 million (December 31, 2017: € 17 million). Temporary differences relating to the retained earnings of subsidiaries, for which no deferred taxes are recognized, amounted to € 9,934 million (December 31, 2017: € 2,856 million).

INCOME TAX RECEIVABLES AND INCOME TAX LIABILITIES

Income tax receivables amounted to € 460 million (December 31, 2017: € 490 million). Tax receivables resulted primarily from tax prepayments that exceeded the actual amount of tax payable for 2018 and prior fiscal years, and from refund claims for prior years.

As of December 31, 2018, income tax liabilities, including provisions for uncertain tax obligations, amounted to € 1,176 million (December 31, 2017: € 1,016 million).

The disclosure of interest and penalties related to income taxes was adjusted with retrospective effect as of January 1, 2017, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – INCOME TAXES

The calculation of the reported assets and liabilities from current and deferred income taxes required extensive discretionary judgments, assumptions and estimates.

The recognized income tax liabilities and provisions were partially based on estimates and interpretations of tax laws and ordinances in different jurisdictions.

With regard to 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 particularly related to deferred taxes recognized in the context of the acquisitions of the Sigma-Aldrich Corporation, the Millipore Corporation, Serono SA, and AZ Electronic Materials S.A.

The recognition of deferred tax assets from loss carryforwards required an estimate of the probability of the future realizability of loss carryforwards. The following influencing factors were taken into account as part of this assessment:

- results history,
- results planning and
- the existing tax planning of the respective Group company.

(15) Cost of materials

Material costs in 2018 amounted to € 2,598 million (2017: € 2,322 million) and were largely reported under cost of sales.

(16) Personnel expenses/headcount

Personnel expenses comprised the following:

€ million	2018	2017
Wages and salaries	4,111	3,953
Compulsory social security contributions and special financial assistance	619	586
Pension expenses	295	304
Personnel expenses (including Consumer Health)	**5,024**	**4,843**
Consumer Health	204	211
Personnel expenses (as reported in the functional costs)	**4,820**	**4,632**

Personnel expenses comprised expenses of € 91 million (2017: € 86 million) for defined contribution plans which are funded exclusively using external funds and therefore do not represent any obligation for the Group other than making contribution payments. In 2017, this included an amount of € 1 million attributable to the Consumer Health business. In addition, employer contributions amounting to € 81 million (2017: € 76 million) were transferred to the German statutory pension insurance system and € 44 million (2017: € 46 million) to statutory pension insurance systems abroad. Each of these total transfer amounts included an amount of € 1 million attributable to the Consumer Health business (2017: € 2 million).

Effective December 31, 2018, the number of employees at Group stood at 51,713 (December 31, 2017: 52,880 employees). The previous year's figure included all employees at the Consumer Health business.

The following table provides the number of employees by function (annual average):

	2018		2017	
	Total	thereof: Consumer Health[1]	Total	thereof: Consumer Health
Production	16,239	623	15,570	680
Administration	9,856	160	9,272	197
Research and Development	7,243	146	6,786	143
Supply Chain	4,012	191	3,726	172
Marketing and Sales	15,445	1,973	15,073	2,253
Other	965	7	1,563	11
Average number of employees	**53,760**	**3,100**	**51,990**	**3,456**

[1] The average number of employees of the Consumer-Health-business during the time of affiliation to the group from January to November 2018 was 3,358.

(17) Earnings per share

Basic earnings per share are calculated by dividing the profit after tax (net income of the Group) attributable to the shareholders of Merck KGaA, Darmstadt, Germany, 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 capital is not represented by shares. The share capital of € 168 million was divided into 129,242,252 shares. Accordingly, the general partner's capital of € 397 million was divided into 305,535,626 theoretical shares. Overall, equity capital thus amounted to € 565 million or 434,777,878 theoretical shares outstanding. The weighted average (basic) number of shares in 2018 was likewise 434,777,878.

The calculation of diluted earnings per share had to take into account a potential dilution effect that arose from the free grant of shares of Merck KGaA, Darmstadt, Germany, to eligible employees on the occasion of the 350th anniversary of the company. The shares required for this were purchased on the market. Pursuant to IAS 33, this led to an increase of 17,924 in the weighted average (diluted) number of shares to 434,795,802 shares. However, this did not lead to an arithmetical dilution effect on the indicator so that diluted earnings per share corresponded to basic earnings per share.

(18) Net cash flows from operating activities

In 2018, tax payments totaled € 900 million (2017: € 702 million). Tax refunds totaled € 65 million (2017: € 73 million). Interest paid totaled € 286 million (2017: € 297 million). Interest received amounted to € 34 million (2017: € 28 million).

In the previous year, the changes of other assets and liabilities included the adjustment of deferred taxes as a result of the U.S. tax reform.

In the period under review, the neutralization of the profits/losses from the disposal of assets and other disposals mainly comprised the gain from the divestment of the Consumer Health business; in the previous year, this item mainly comprised the gain from the divestment of the Biosimilars business.

Operating Assets, Liabilities and Contingent Liabilities

(19) Goodwill

	Goodwill			
€ million	Healthcare	Life Science	Performance Materials	**Total**
Cost as at January 1, 2017	**1,811**	**11,752**	**1,452**	**15,015**
Changes in scope of consolidation	–	17	–	17
Additions	–	–	–	–
Disposals	–	–	–	–
Transfers	–	–	–	–
Classification as held for sale or transfer to a disposal group	–25	–	–	–25
Currency translation	–1	–1,250	–174	–1,425
December 31, 2017	**1,785**	**10,519**	**1,278**	**13,582**
Accumulated amortization and impairment losses, January 1, 2017	**–**	**–**	**–**	**–**
Changes in scope of consolidation	–	–	–	–
Impairment losses	–	–	–	–
Disposals	–	–	–	–
Transfers	–	–	–	–
Reversals of impairment losses	–	–	–	–
Classification as held for sale or transfer to a disposal group	–	–	–	–
Currency translation	–	–	–	–
December 31, 2017	**–**	**–**	**–**	**–**
Net carrying amount as of December 31, 2017	**1,785**	**10,519**	**1,278**	**13,582**
Cost as at January 1, 2018[1]	**1,785**	**10,519**	**1,278**	**13,582**
Changes in scope of consolidation	–	–	–	–
Additions	–	–	–	–
Disposals	–	–	–	–
Transfers	–	–	–	–
Classification as held for sale or transfer to a disposal group	–251	–31	–	–282
Currency translation	–1	408	57	464
December 31, 2018	**1,534**	**10,896**	**1,334**	**13,764**
Accumulated amortization and impairment losses, January 1, 2018	**–**	**–**	**–**	**–**
Changes in scope of consolidation	–	–	–	–
Impairment losses	–	–	–	–
Disposals	–	–	–	–
Transfers	–	–	–	–
Reversals of impairment losses	–	–	–	–
Classification as held for sale or transfer to a disposal group	–	–	–	–
Currency translation	–	–	–	–
December 31, 2018	**–**	**–**	**–**	**–**
Net carrying amount as of December 31, 2018	**1,534**	**10,896**	**1,334**	**13,764**

[1] Values effective January 1, 2018, have been adjusted, see Note (49) “Effects from new accounting standards and other presentation and measurement changes”.

Goodwill was incurred mainly in connection with the acquisitions of the Sigma-Aldrich Corporation, AZ Electronic Materials S.A., the Millipore Corporation and Serono SA. The changes in goodwill caused by foreign exchange rates resulted almost exclusively from translating the goodwill from the acquisitions of the Sigma-Aldrich Corporation, AZ Electronic Materials S.A. and the Millipore Corporation, which were partially denominated in U.S. dollars, into the reporting currency.

In the Healthcare business sector, the reclassifications to assets held for sale were attributable to the divestment of the Consumer Health business to The Procter & Gamble Company, United States, and in the Life Science business sector to the divestment of the flow cytometry business Amnis® and Guava® to the Luminex Corporation, United States (see Note (5) "Acquisitions and divestments").

As in 2017, goodwill was not subject to impairment in fiscal 2018.

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – GOODWILL

The determination of the recoverable amount is subject to management judgements and estimation uncertainties.

When conducting the impairment tests the following parameters were used:

Measurement basis	Value in use
Impairment test level	Healthcare (excluding Consumer Health) Consumer Health[1] (previous year) Life Science Performance Materials
Planning basis	Most recent financial medium-term planning approved by the Executive Board and used for internal purposes
Detailed planning period	4 years
Key assumptions	Net cash flows Long-term growth rate after the detailed planning period Discount rate after tax (weighted average cost of capital – WACC)
Determination of the value of the key assumptions	Net cash flows • Sales growth Based on internal planning, taking into consideration internal and external market information and market estimations, i.e. regarding market shares, excluding possible approvals of new compounds from the development pipeline and other expansion investments • Profit margins Based on past experiences, adjusted for expected changes
	Long-term growth rate after the detailed planning period Based on long-term inflation expectations and expected long-term sector growth
	Discount rate after taxes (weighted average cost of capital – WACC) • Cost of equity Risk-free interest rate: Derived from the returns of long-term government bonds Beta factor: Derived from the respective peer group Market risk premium: Range as recommended by the Technical Committee for Business Valuation and Commerce of the Institute of Public Auditors in Germany (Institut der Wirtschaftsprüfer e.V. – IDW) • Cost of debt and capital structure Derived from market data and the respective peer group

[1] At the date of the impairment test in the previous year, Consumer Health was not classified as a discontinued operation pursuant to IFRS 5.

The long-term growth rates and weighted average costs of capital (WACC) used to conduct the goodwill impairment tests were as follows:

	Goodwill		Long-term growth rate		Cost of capital after tax		Cost of capital before tax	
€ million/in%	**2018**	2017	**2018**	2017	**2018**	2017	**2018**	2017
Healthcare (excluding Consumer Health)	1,534	1,534	0.00%	0.00%	6.4%	6.7%	8.5%	8.9%
Consumer Health[1]		251		2.00%		6.6%		8.2%
Life Science	10,896	10,519	1.75%	1.75%	7.2%	6.8%	8.8%	8.4%
Performance Materials	1,334	1,278	0.50%	0.50%	5.8%	5.9%	7.4%	7.5%

[1] At the date of the impairment test in the previous year, Consumer Health was not classified as a discontinued operation pursuant to IFRS 5.

Net cash flows were discounted using cost of capital after tax. The aforementioned cost of capital before tax was subsequently derived iteratively. All of the aforementioned assumptions are considered a source of estimation uncertainty due to their inherent uncertainty.

In all the impairment tests performed, the recoverable amount was more than 10% higher than the carrying amount of the respective cash-generating unit or group of cash-generating units. Irrespective of this, the planning data used were checked for plausibility against externally available forecasts and the recoverable amounts determined were validated using valuation 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 an impairment would need to be recognized as a result of the impairment tests:

	Decrease in long-term growth rate		Increase in cost of capital after tax		Decrease in net cash flows	
	2018	2017	**2018**	2017	**2018**	2017
	in percentage points		in percentage points		in %	
Healthcare (excluding Consumer Health)	> 2	> 2	> 2	> 2	> 5	> 5
Consumer Health[1]		> 2		> 2		> 5
Life Science	1.2	> 2	0.9	1.8	> 5	> 5
Performance Materials	> 2	> 2	> 2	> 2	> 5	> 5

[1] At the date of the impairment test in the previous year, Consumer Health was not classified as a discontinued operation pursuant to IFRS 5.

The lower sensitivity of the impairment test for the cash-generating unit Life Science regarding changes in the long-term growth rate and the capital costs declined compared to 2017. This was due to an increase in weighted average costs of capital (WACC) on account of the higher beta factor of individual entities in the peer group. The resulting effects more than offset the increase in net cash flows during the detailed planning period compared to the previous period.

(20) Other intangible assets

€ million	Customer relationships, brands and trademarks	Marketing authorizations, patents, licenses, similar rights and other		Software and software in development	Advance payments	Total
		Finite useful life	Not yet available for use			
Cost at January 1, 2017	**8,011**	**10,824**	**766**	**639**	**–**	**20,239**
Changes in scope of consolidation	–1	21	–	–	–	20
Additions	–	24	263	110	1	398
Disposals	–	–1	–5	–27	–	–32
Transfers	–2	6	–8	8	–2	4
Classification as held for sale or transfer to a disposal group	–	–	2	–	–	2
Currency translation	–838	–190	–1	–25	–	–1,053
December 31, 2017	**7,171**	**10,685**	**1,017**	**705**	**–**	**19,577**
Accumulated amortization and impairment losses, January 1, 2017	**–1,560**	**–7,759**	**–585**	**–356**	**–**	**–10,259**
Changes in scope of consolidation	–	–	–	–	–	–
Amortization	–451	–751	–	–41	–	–1,243
Impairment losses	–	–50	–17	–	–	–67
Disposals	–	1	5	27	–	33
Transfers	–	2	–	–2	–	1
Reversals of impairment losses	–	17	–	–	–	17
Classification as held for sale or transfer to a disposal group	–	–	–	–	–	–
Currency translation	142	100	1	15	–	258
December 31, 2017	**–1,868**	**–8,438**	**–596**	**–357**	**–**	**–11,260**
Net carrying amounts as of December 31, 2017	**5,303**	**2,246**	**421**	**348**	**–**	**8,317**
Cost at January 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
Classification as held for sale or transfer to a disposal group	–29	–51	–	–7	–	–87
Currency translation	265	71	–	6	–	342
December 31, 2018	**7,402**	**10,739**	**885**	**755**	**–**	**19,780**
Accumulated amortization and impairment losses, January 1, 2018	**–1,868**	**–8,438**	**–596**	**–357**	**–**	**–11,260**
Changes in scope of consolidation	–	–	–	–	–	–
Amortization	–427	–747	–	–57	–	–1,231
Impairment losses	–	–21	–	–19	–	–40
Disposals	5	14	–	7	–	26
Transfers	–	–1	–	–	–	–
Reversals of impairment losses	–	–	–	–	–	–
Classification as held for sale or transfer to a disposal group	24	38	–	2	–	65
Currency translation	–61	–40	–	–3	–	–104
December 31, 2018	**–2,326**	**–9,195**	**–596**	**–426**	**–**	**–12,544**
Net carrying amounts as of December 31, 2018	**5,076**	**1,543**	**289**	**329**	**–**	**7,237**

The carrying amounts of customer relationships, brands and trademarks as well as marketing authorizations, patents, licenses, similar rights and other were attributable to the business sectors as follows:

€ million	Remaining useful life in years	Healthcare	Life Science	Performance Materials	**Total Dec. 31, 2018**	Total Dec. 31, 2017
Customer relationships, brands and trademarks		**–**	**4,914**	**162**	**5,076**	**5,303**
Customer relationships	0.5 – 18.9	–	4,108	155	4,263	4,422
thereof: acquisition of Sigma-Aldrich Corporation	17.9 – 18.9	–	3,495	1	3,496	3,693
thereof: acquisition of Millipore Corporation	0.5 – 8.5	–	569	–	569	681
Brands and trademarks	4.5 – 8.9	–	806	7	813	881
thereof: acquisition of Sigma-Aldrich Corporation	8.9	–	655	–	655	695
Marketing authorizations, patents, licenses, similar rights and other						
Finite useful life	**–**	**561**	**329**	**653**	**1,543**	**2,246**
Marketing authorizations						
Rebif®	1.0	369	–	–	369	737
Xalkori®	3.0	68	–	–	68	93
Saizen®	1.0	31	–	–	31	62
Gonal-f®	–	–	–	–	–	95
Other marketing authorizations	–	32	–	–	32	49
Patents, licenses and similar rights	0.5 – 14.3	–	323	643	966	1,156
thereof: acquisition of AZ Electronic Materials S. A.	2.3 – 14.3	–	–	616	616	741
Others	–	61	6	10	77	54
Not yet available for use	**–**	**285**	**4**	**–**	**289**	**421**

The net carrying amount of capitalized customer relationships, disclosed under customer relationships, brands and trademarks, amounting to € 5,076 million (December 31, 2017: € 5,303 million), mainly included the identified and capitalized intangible assets in connection with the acquisition of the Sigma-Aldrich Corporation, AZ Electronic Materials S. A., the Millipore Corporation, and Serono SA. These acquisitions account for the majority of marketing authorizations, patents, licenses, similar rights and other with finite useful lives (€ 1,543 million; December 31, 2017: € 2,246 million). The impairment losses on market authorizations, patents, licenses, similar rights and other with finite useful lives in the amount of € 21 million (2017: € 50 million) in 2018 was essentially related to a technology in the Performance Materials business sector. In 2017, an impairment loss was recognized for the co-promotion right Xalkori® in the Healthcare business sector (€ 33 million) and for technologies no longer used in the Performance Materials business sector (€ 17 million). These impairments were recognized in the consolidated income statement in impairment losses on non-financial assets under other operating expenses.

The additions to marketing authorizations, patents, licenses, similar rights and other not yet available for use amounted to € 35 million in fiscal 2018 (2017: € 263 million) and were attributable almost entirely to the Healthcare business sector. The disposals of marketing authorizations, patents, licenses, similar rights and other that were not yet available for use mainly referred to the transfer of rights to develop and commercialize T-cell cancer therapies (CAR-T) (€ 104 million) to the collaboration partner Intrexon Corporation, United States (see Note (6) “Collaborations of material significance”).

The additions to software and software in development in the amount of € 55 million (2017: € 110 million) were mainly attributable to new ERP developments.

The impairment losses recognized for software and software in development in the amount of € 19 million (2017: € 0 million) were attributable to software modules not further developed and used in the Life Science business sector. The impairment was recognized in the consolidated income statement in impairment losses on non-financial assets under other operating expenses.

The reclassifications to assets held for sale were made in connection with the divestment of the Consumer Health business and of the flow cytrometry platforms Amnis® and Guava® (see Note (5) “Acquisitions and divestments”).

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – OTHER INTANGIBLE ASSETS

In-licensing of intangible assets

The Group is regularly a partner of research and development collaborations with research institutions, biotechnology companies or other contract parties. These collaborations are aimed at developing marketable products. The Group also enters into in-licensing agreements regarding intellectual property of contract partners. Such agreements typically involve making upfront payments and payments for the achievement of certain milestones related to development and commercialization. In this context, the Group has to judge to what extent upfront or milestone payments represent remuneration for services received (research and development costs) or whether such payments result in an in-licensing of an intangible asset that has to be capitalized. This assessment is regularly subject to judgment.

Identification of impairment or reversals of impairment

Discretionary decisions were required in the identification of objective evidence of impairment as well as in the identification of a reversal of impairment of other intangible assets. External and internal information was used to identify indications of impairment and reversals of impairment. For example, the closure of a site or the approval of a competing product in the Healthcare business sector can be an indicator of impairment.

Determination of impairment amount

Substantial assumptions and estimates were required to determine the appropriate level of amortization of other intangible assets. This related in particular to the determination of the underlying remaining useful life, which the Group reviews regularly and adjusts if necessary. The Group considered factors including the typical product life cycles for each asset and publicly available information about the estimated useful lives of similar assets.

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 € 117 million lower in fiscal 2018 (2017: € 120 million).

In fiscal 2018, a reduction of the useful life of the intangible asset reported in connection with the drug Rebif® by one year would have lowered profit before income tax by € 369 million (2017: € 184 million). An extension of the useful life by one year would have increased profit before income tax by € 123 million (2017: € 92 million).

(21) Property, plant and equipment

€ million	Land, land rights and buildings, including buildings on third-party land	Plant and machinery	Other facilities, operating and office equipment	Construction in progress and advance payments to vendors and contractors	Total
Cost at January 1, 2017	**3,391**	**4,068**	**1,136**	**807**	**9,402**
Changes in the scope of consolidation	49	2	–24	–	28
Additions	30	54	35	818	936
Disposals	–50	–142	–34	–16	–241
Transfers	184	258	96	–543	–5
Classification as held for sale or transfer to a disposal group	41	–2	–	–	39
Currency translation	–131	–103	–33	–40	–306
December 31, 2017	**3,514**	**4,136**	**1,176**	**1,026**	**9,852**
Accumulated depreciation and impairment losses January 1, 2017	**–1,361**	**–2,949**	**–858**	**–4**	**–5,171**
Changes in the scope of consolidation	–31	2	21	–	–9
Depreciation	–147	–266	–103	–	–516
Impairment losses	–2	–2	–	–	–5
Disposals	39	138	32	–	209
Transfers	–	–	–	–	–
Reversals of impairment losses	35	35	–	–	69
Classification as held for sale or transfer to a disposal group	–41	1	–	–	–40
Currency translation	37	63	21	–	122
December 31, 2017	**–1,472**	**–2,978**	**–886**	**–4**	**–5,340**
Net carrying amounts as of December 31, 2017	**2,042**	**1,158**	**291**	**1,022**	**4,512**
Cost at January 1, 2018[1]	**3,517**	**4,136**	**1,178**	**1,026**	**9,857**
Changes in the scope of consolidation	–	–	–	–	–
Additions	16	41	47	786	890
Disposals	–14	–64	–46	–28	–152
Transfers	319	237	140	–696	–
Classification as held for sale or transfer to a disposal group	–43	–69	–20	–2	–134
Currency translation	43	31	6	10	90
December 31, 2018	**3,837**	**4,313**	**1,305**	**1,096**	**10,551**
Accumulated depreciation and impairment losses January 1, 2018[1]	**–1,474**	**–2,978**	**–887**	**–4**	**–5,343**
Changes in the scope of consolidation	–	–	–	–	–
Depreciation	–156	–246	–115	–	–517
Impairment losses	–12	–3	–1	–2	–18
Disposals	11	59	42	2	116
Transfers	24	–	–24	–	–
Reversals of impairment losses	–	–	–	–	–
Classification as held for sale or transfer to a disposal group	13	40	13	–	66
Currency translation	–16	–23	–5	–	–44
December 31, 2018	**–1,609**	**–3,150**	**–977**	**–4**	**–5,740**
Net carrying amounts as of December 31, 2018	**2,228**	**1,163**	**328**	**1,092**	**4,811**

[1] Values effective January 1, 2018, have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

In fiscal 2018, material additions to construction in progress were attributable to the construction of a pharma packaging center, investments into the administrative buildings at the Darmstadt site as well as the expansion of US and Chinese production capacities in the Life Science business sector. Furthermore, the Group invested in its pharmaceutical production facilities and logistic hub in China. Additional investments were made into our laboratory, production and logistic facilities in China, Italy and Germany.
Reclassifications from construction in progress were mainly attributable to the completion of the expansion of the Group's global headquarters at the Darmstadt site, and to the completion of the pharma packaging center.

In 2018, impairment losses amounted to € 18 million (2017: € 5 million). These were attributable primarily to assets allocated to the Healthcare business sector, and mainly referred to buildings and production facilities. Reversals of impairment losses were insignificant overall. In 2017 impairment losses for the biopharmaceutical production facility in Corsier-sur-Vevey (Switzerland) were reversed in the amount of € 69 million to depreciated cost. The decision to reverse the impairment loss was due to improved expectations for the capacity utilization of the production facility, particularly owing to the approvals of the immune-oncology medicine Bavencio®, which is to be produced in this facility. An impairment loss of € 165 million was originally recognized for the facility in 2011.

The reclassifications to assets held for sale were made in connection with the divestment of the Consumer Health business (see Note (5) "Acquisitions and divestments").

The carrying amounts of assets classified as finance leases were as follows:

€ million	Dec. 31, 2018	Dec. 31, 2017
Land and buildings	8	5
Other property, plant and equipment	1	1
Net carrying amount of assets classified as finance lease	**9**	**5**

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – PROPERTY, PLANT AND EQUIPMENT

Identification of impairment or reversals of impairment
Discretionary decisions were required in the identification of objective evidence of impairment as well as in the identification of a reversal of impairment of property, plant and equipment. External and internal information was used in this context. For example, the closure of a site can be an indicator of impairment.

Determination of impairment amount
Substantial assumptions and estimates were required to determine the appropriate level of amortization of property, plant and equipment. The underlying remaining useful life of property, plant and equipment was reviewed regularly by the Group and adjusted if necessary. The Group considered factors including the typical product life cycles for each asset and publicly available information about the estimated useful lives of similar assets.

(22) Other assets

Other assets comprised:

	Dec. 31, 2018			Dec. 31, 2017		
€ million	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Subsequent measurement at amortized cost						
Other receivables	295	17	312	247	29	276
Subsequent measurement at fair value through profit or loss						
Derivatives without a hedging relationship (operational)	–	45	45	–	46	46
Derivatives with a hedging relationship (operational)	4	1	4	30	15	45
Financial items	**299**	**63**	**361**	**277**	**91**	**367**
Receivables from non-income related taxes	318	8	326	239	38	277
Prepaid expenses	117	5	121	99	8	107
Contract assets[1]	52	1	52			
Assets from defined benefit plans	7	–	7	1	–	1
Remaining other assets[1]	94	62	156	115	69	184
Non-financial items	**587**	**76**	**663**	**454**	**114**	**568**
Other assets	**886**	**138**	**1,024**	**731**	**205**	**936**

[1] Due to the first-time application of IFRS 15 as of January 1, 2018, contract assets included in other assets in 2017 were reported separately as of January 1, 2018; see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

Other receivables were subsequently measured at amortized cost and mainly contained claims from service agreements in connection with the divested Consumer Health business, which the Group continues to fulfill for the acquiring party. In the previous year, other receivables mainly comprised current receivables from related parties resulting from refund claims to companies from taxes paid for the account of such companies.

Other receivables also comprised license receivables in the amount of € 29 million (December 31, 2017: € 28 million).

For further information on impairment losses and credit risks from financial items associated with other assets, please refer to Note (38) "Management of financial risks". Please refer to Note (49) "Effects from new accounting standards and other presentation and measurement changes" for further details on the first-time application effects of IFRS 9 regarding the classification and measurement of financial assets.

The following table provides details on contract assets representing completed performances not yet invoiced:

	Contract assets		
€ million	Current	Non-current	**Total**
January 1, 2018	35	–	35
Additions	94	1	95
Reclassification to receivables	–78	–	–78
Reclassification from non-current to current	–	–	–
Classification as held for sale or transfer to disposal group	–	–	–
Currency effects	1	–	1
Changes in scope of consolidation/other	–1	–	–1
December 31, 2018	**52**	**1**	**52**

(23) Inventories

This item comprises the following items:

€ million	**Dec. 31, 2018**	Dec. 31, 2017
Raw materials and supplies	510	481
Work in progress	834	795
Finished goods/goods for resale	1,420	1,355
Inventories	**2,764**	**2,632**

The increase in inventories in 2018 was due to the overall accelerating business volume in all three business sectors.

Impairments of inventories in 2018 amounted to € 183 million (2017: € 144 million); reversals amounted to € 77 million (2017: € 110 million).

The increase in impairment losses was attributable in particular to the realignment of the Performance Materials business sector. In addition, quality-related write-downs increased in the Healthcare business sector.

As of the balance sheet date, no inventories were pledged as security for liabilities.

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – INVENTORIES

Identification of impairments or reversal of impairments
Discretionary decisions were required in the identification of impairment as well as in the identification of a reversal of impairment of inventories. There were estimation uncertainties with respect to the calculation of the net realizable value. It was determined, in particular, on the basis of information on changes in selling and procurement prices and on the expected cost of completion.

(24) Trade accounts receivable

€ million	Dec. 31, 2018	Dec. 31, 2017
Subsequently measured at amortized cost	2,983	3,290
Subsequently measured at fair value through other comprehensive income	21	–
Gross trade accounts receivable	**3,004**	**3,290**
Allowances on receivables subsequently measured at amortized cost	–73	–367
Allowances on receivables subsequently measured at fair value through other comprehensive income	–	–
Net trade accounts receivable	**2,931**	**2,923**

In the period from January 1 to December 31, 2018, trade accounts receivable in Italy with a nominal value of € 28 million (2017: € 25 million) were sold for € 28 million (2017: € 24 million). The sold receivables did not involve any further rights of recovery against the Group.

The following table provides details on the development of trade accounts receivable before loss allowances during the period under review:

€ million	Gross trade accounts receivable
December 31, 2017	**3,290**
Adjustment on initial application of IFRS 9	–9
Adjustment on initial application of IFRS 15	–4
January 1, 2018	**3,277**
Additions	16,395
thereof: attributable to performance obligations satisfied in prior periods	1
Customer payments/defaults	–16,590
Currency effects	6
Classification as held for sale or transfer to disposal group	–86
Change in scope of consolidation/other	3
December 31, 2018	**3,004**

For further information on loss allowances as well as credit and market risks affecting trade accounts receivable, please refer to Note (38) “Management of financial risks”, section “Credit risks”. Please refer to Note (49) “Effects from new accounting standards and other presentation and measurement changes” for further details on the first-time application effects of IFRS 9 regarding the classification and measurement of financial assets.

(25) Provisions for pensions and other post-employment benefits

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 many years now 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, 2018	Dec. 31, 2017
Present value of all defined benefit obligations	**4,719**	**4,707**
Fair value of the plan assets	–2,391	–2,452
Funded status	**2,328**	**2,255**
Effects of asset ceilings	1	1
Net defined benefit liability recognized in the balance sheet	**2,329**	**2,256**
Assets from defined benefit plans	7	1
Provisions for pensions and other post-employment benefits	**2,336**	**2,257**

The calculation of the defined benefit obligations was based on the following actuarial parameters:

	Germany		Switzerland		United Kingdom		Other countries	
	2018	2017	**2018**	2017	**2018**	2017	**2018**	2017
Discount rate	1.97%	1.90%	1.00%	0.70%	2.95%	2.56%	3.16%	2.99%
Future salary increases	2.51%	2.51%	1.74%	1.80%	2.00%	2.00%	3.21%	3.66%
Future pension increases	1.75%	1.75%	–	–	2.94%	3.04%	1.77%	1.94%

These were average values weighted by the present value of the respective benefit obligation.

The defined benefit obligations were based on the following types of benefits provided by the respective plan:

	Dec 31, 2018				
€ million	Germany	Switzerland	United Kingdom	Other countries	**Total**
Benefit based on final salary					
Annuity	2,602	1	450	84	3,137
Lump sum	–	–	–	93	93
Installments	1	–	–	–	1
Benefit not based on final salary					
Annuity	563	777	–	67	1,407
Lump sum	–	–	6	33	39
Installments	6	–	–	–	6
Other	–	–	–	10	10
Medical plan	–	–	–	26	26
Present value of defined benefit obligations	**3,172**	**778**	**456**	**313**	**4,719**
Fair value of the plan assets	**1,137**	**656**	**450**	**148**	**2,391**

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, comprised 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 on the basis of a defined benefit expense and an age-dependent annuity table. Statutory minimum funding obligations did not exist.

Pension obligations in Switzerland comprised old-age, disability and surviving dependent benefits regulated by law. The employer and the employees made contributions to the plans. The Group 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. The Group had to observe the existing statutory minimum funding obligations.

The following table shows the development of the net defined benefit liability recognized in the balance sheet:

€ million	Present value of the defined benefit obligations	Fair value of the plan assets	Effects of the asset ceilings	**Net defined benefit liability**
January 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 translation differences recognized in income	–17	14	–	–3
Other effects recognized in income	3	–	–	3
Items recognized in income	**–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
Remeasurements of plan assets				
Actuarial gains (+)/losses (–) arising from experience adjustments	–	–115	–	–115
Changes in the effects of the asset ceilings				
Actuarial gains (+)/losses (–)	–	–	–	–
Actuarial gains (+)/losses (–)	**81**	**–115**	**–**	**–34**
Pension payments	124	–49	–	75
Employer contributions	–	48	–	48
Employee contributions	–14	14	–	–
Payment transactions	**110**	**13**	**–**	**123**
Changes in the 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**
December 31, 2018	**–4,719**	**2,391**	**–1**	**–2,329**

€ million	Present value of the defined benefit obligations	Fair value of the plan assets	Effects of the asset ceilings	**Net defined benefit liability**
January 1, 2017	**–4,698**	**2,386**	**–1**	**–2,313**
Current service cost	–160	–	–	–160
Interest expense	–86	–	–	–86
Interest income	–	43	–	43
Plan administration costs recognized in income	–	–2	–	–2
Past service cost	–8	–	–	–8
Gains (+) or losses (–) on settlement	–	–	–	–
Currency translation differences recognized in income	40	–33	–	7
Other effects recognized in income	–3	–2	–	–5
Items recognized in income	**–217**	**6**	**–**	**–211**
thereof: attributable to the divested Consumer Health business	–8	3	–	–5
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	8	–	–	8
Actuarial gains (+)/losses (–) arising from experience adjustments	7	–	–	7
Remeasurements of plan assets				
Actuarial gains (+)/losses (–) arising from experience adjustments	–	121	–	121
Changes in the effects of the asset ceilings				
Actuarial gains (+)/losses (–)	–	–	–	–
Actuarial gains (+)/losses (–)	**20**	**121**	**–**	**141**
Pension payments	127	–51	–	76
Employer contributions	–	36	–	36
Employee contributions	–13	13	–	–
Payment transactions	**114**	**–2**	**–**	**112**
Changes in the scope of consolidation	–	–	–	–
Reclassification to liabilities directly related to assets held for sale	20	–14	–	6
Currency translation differences recognized in equity	67	–46	–	21
Other changes	–13	1	–	–12
Other	**74**	**–59**	**–**	**15**
December 31, 2017	**–4,707**	**2,452**	**–1**	**–2,256**

With the exception of 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 were allocated to the individual functional areas in the consolidated income statement.

The actual loss on plan assets amounted to € 73 million in 2018 (2017: return of € 164 million).

The development of cumulative actuarial gains (+) and losses (–) was as follows:

€ million	2018	2017
Cumulative actuarial gains (+)/losses (–) recognized in equity, January 1	**–1,668**	**–1,820**
Currency translation differences	–	11
Remeasurements of defined benefit obligations		
Actuarial gains (+)/losses (–) arising from changes in demographic assumptions	–40	5
Actuarial gains (+)/losses (–) arising from changes in financial assumptions	139	8
Actuarial gains (+)/losses (–) arising from experience adjustments	–18	7
Remeasurements of plan assets		
Actuarial gains (+)/losses (–) arising from experience adjustments	–115	121
Effects of the asset ceilings		
Actuarial gains (+)/losses (–)	–	–
Reclassification within retained earnings	65	–
Cumulative actuarial gains (+)/losses (–) recognized in equity, December 31	**–1,637**	**–1,668**

Plan assets for funded defined benefit obligations primarily comprised fixed-income securities, stocks, and investment funds. They did not directly include financial instruments issued by Group companies or real estate used by Group companies.

The plan assets serve exclusively to meet the defined benefit obligations. Covering the benefit obligations with financial assets represents a means of providing for future cash outflows, which occur in some countries (e.g. Switzerland and the United Kingdom) on the basis of legal requirements and in other countries (e.g. Germany) on a voluntary basis.

Both the benefit obligations as well as the plan assets are subject to fluctuations over time. This could lead to (an increase in) underfunding. Depending on the statutory regulations, it could become necessary in some countries to reduce underfunding through additions of liquid assets. 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 (e.g. life expectancy, inflation rates).

In order to minimize fluctuations of the net defined benefit liability recognized in the balance sheet, in managing its plan assets, the Group also pays attention to potential fluctuations in liabilities. The portfolio is structured in such a way that, in the ideal case, assets and defined benefit obligations develop in opposite directions when exposed to exogenous factors – in particular 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, 2018			Dec. 31, 2017		
€ 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	147	–	147	77	–	77
Equity instruments	592	–	592	814	–	814
Debt instruments	993	–	993	957	–	957
Direct investments in real estate	–	105	105	–	94	94
Investment funds	458	–	458	420	1	421
Insurance contracts	–	77	77	–	81	81
Other	19	–	19	8	–	8
Fair value of the plan assets	**2,209**	**182**	**2,391**	**2,276**	**176**	**2,452**

Employer contributions to plan assets and direct payments to beneficiaries will probably amount to around € 33 million and € 74 million, respectively, in the subsequent year. The weighted duration amounted to 20 years.

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – PROVISIONS FOR PENSIONS AND OTHER POST-EMPLOYMENT BENEFITS

Determination of present value of defined-benefit obligations
The determination of the present value of the obligation from these defined benefit pension plans primarily requires discretionary judgment as regards the selection of methods to determine discount rates as well as estimates of future salary increases and future pension increases. The actuarial assumptions which are used as the basis for the calculation of the defined benefit obligation, e.g. discount rates, salary and pension trends, were determined on a country-by-country basis in line with the economic conditions prevailing in each country; the latest country-specific actuarial mortality table was used in each case. 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" from one of the three rating agencies Standard & Poor's, Moody's or Fitch, and a euro swap rate of adequate duration served as the basis for the data.

The following overview shows how the present value of all defined benefit obligations would have been impacted by changes to relevant ctuarial assumptions.

€ million	Dec. 31, 2018	Dec. 31, 2017
Increase (+)/decrease (–) in present value of all defined benefit obligations if		
the discount rate is 50 basis points higher	–435	–438
the discount rate is 50 basis points lower	503	508
the expected rate of future salary increases is 50 basis points higher	151	155
the expected rate of future salary increases is 50 basis points lower	–130	–133
the expected rate of future pension increases is 50 basis points higher	251	256
the expected rate of future pension increases is 50 basis points lower	–196	–198

To determine the sensitivities, in principle each of the observed parameters was varied while keeping the measurement assumptions otherwise constant. The amounts for social security vary in line with the salary trend.

(26) Other provisions

Other provisions developed as follows:

€ million	Litigation	Restructuring	Personnel	Environmental protection	Acceptance and follow-on obligations	Interest and penalties related to income taxes	Other	**Total**
January 1, 2018	**526**	**92**	**254**	**137**	**26**	**43**	**166**	**1,245**
Additions	65	30	203	9	15	13	176	511
Utilizations	–22	–22	–78	–8	–3	–	–40	–174
Release	–21	–9	–66	–2	–7	–10	–90	–206
Interest portion	11	–	2	2	–	–	–	14
Currency translation	–1	–	5	–	–	–	2	6
Changes in scope of consolidation/other	–	–	–1	–	–1	–	–	–2
Reclassification to liabilities directly related to assets held for sale	–6	–1	–4	–	–	–	–3	–15
December 31, 2018	**551**	**90**	**316**	**137**	**30**	**46**	**211**	**1,381**
thereof: current	182	32	112	26	19	46	184	600
thereof: non-current	370	58	203	111	11	–	27	780

LITIGATION

As of December 31, 2018, the provisions for legal disputes amounted to € 551 million (December 31, 2017: € 526 million). The legal matters described below represented the most significant legal risks.

Product-related and patent disputes

Rebif®: The Group 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 the Group and other pharmaceutical companies for infringement of this patent. The Group defended itself against all allegations and brought a countersuit claiming that the patent was invalid and not infringed by the Group's actions. In the first instance, a jury recognized the invalidity of the patent. This jury verdict was overturned by a first-instance federal judge in September 2018. For the time being, the patent is thus deemed to be legally valid and to have been infringed. The Group filed a complaint with the CAFC (second instance) against the first-instance ruling in October 2018. In this context, the Group recognized provisions in a three-digit million euro amount. Cash outflow is not expected to occur within the next 12 months.

PS-VA liquid crystals mixtures: In the Performance Materials business sector, the Group is involved in a legal dispute with JNC Corporation, Japan, (JNC). JNC claims that by manufacturing and marketing certain liquid crystals mixtures, the Group has infringed JNC patents. JNC asserts its claims in court in various jurisdictions. In two JNC patent infringement cases, a first-instance and a second-instance decision, respectively, were taken in the Group's favor, against which JNC has appealed or is highly likely to appeal.

The Group maintains that JNC's patent infringement assertion is invalid owing to relevant prior art and has filed the corresponding nullity actions, which in three cases were already successful in first-instance proceedings. JNC has filed complaints in each case. In a correction trial in Korea, a decision in favor of JNC was issued in the second instance. Both the Group and the Korean Patent Office have filed complaints with the Korean High Civil Court.

In this context, the Group recognized provisions in a double-digit million euro amount. Cash outflow within the next 12 months is considered possible at present.

Antitrust and other proceedings

Antitrust review proceedings for the Sigma-Aldrich acquisition: On July 6, 2017, the Group 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 the Group of its preliminary conclusion that the Group 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 the Group 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, the Group 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. The Group 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. In this context, the Group recognized provisions in a mid double-digit million euro amount. An outflow of resources is expected in 2019.

Paroxetine: In connection with the divested generics business, the Group is subject to antitrust investigations by the British Competition and Market Authority (CMA) in the United Kingdom. In March 2013, the authorities informed the Group 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. The Group, 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 the Group. On February 11, 2016, the CMA imposed a fine in this matter. The Group 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.

In addition to provisions for the mentioned litigation, provisions existed as of the balance sheet date for various other pending legal disputes.

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – OTHER PROVISIONS FOR LEGAL DISPUTES

The assessment of the recognition obligation and the measurement of provisions for legal disputes was subject to estimation uncertainty to a particular extent. The main factors used to assess the recognition obligation in relation to provisions for legal disputes were

- the validity of the arguments put forward by the opposing party and
- the legal situation and current legislation in comparable proceedings in the jurisdiction in question.

The main parameters when determining the amount of provisions were

- the duration of proceedings in pending litigation,
- the likelihood of possible outcomes of the proceedings,
- the license rate to be applied (in patent disputes) and
- the discount rate to be used.

To assess a recognition obligation in relation to provisions and to quantify pending outflows of resources, the Group drew on the knowledge of the legal department as well as outside counsel. In spite of this, both the assessment of the existence of a present obligation and the estimate of the probability of a future outflow of resources were highly subject to uncertainty.

RESTRUCTURING

Restructuring provisions mainly included commitments to employees in connection with restructuring projects and provisions for related onerous contracts.

The additions to restructuring provisions in the amount of € 30 million were mainly attributable to the relocation of shared service functions in Finance from Darmstadt to Wrocław, Poland, and Manila, the Philippines, and to the reorganization of the distribution structure in the Healthcare business sector in Southern Europe. Outflows of resources are expected within the next three years.

The utilization of restructuring provisions in the amount of € 22 million was mainly attributable to the "Fit for 2018" transformation and growth program, which was introduced in 2012. The provisions in this context mainly consist of commitments to employees from partial and early retirement arrangements. Further cash outflows within the scope of the "Fit for 2018" program are largely expected in 2019.

Besides the aforementioned programs, the restructuring provisions also comprise obligations from the Life Science business sector, which will make relocations and gradually close operations in the course of the years 2019 to 2022 at various German sites.

PROVISIONS FOR EMPLOYEE BENEFITS/SHARE-BASED PAYMENT

Provisions for employee benefits include obligations from long-term variable compensation programs. More information on these compensation programs can be found in Note (69) "Share-based compensation programs". The following table presents the key parameters as well as the development of the potential number of Share Units of Merck KGaA, Darmstadt, Germany, (MSUs) for the individual tranches:

	2016 tranche	2017 tranche	2018 tranche
Performance cycle	Jan. 1, 2016 – Dec. 31, 2018	Jan. 1, 2017 – Dec. 31, 2019	Jan. 1, 2018 – Dec. 31, 2020
Term	3 years	3 years	3 years
Reference price of shares of Merck KGaA, Darmstadt, Germany, in € (60-day average share price of Merck KGaA, Darmstadt, Germany, prior to the start of the performance cycle)	87.92	95.63	91.73
DAX® value (60-day average of the DAX® prior to the start of the performance cycle)	10,669.76	10,822.06	13,089.39
Potential number of MSUs			
Potential number offered for the first time in 2016	763,463	–	–
Forfeited	24,392	–	–
Dec. 31, 2016	739,071	–	–
Potential number offered for the first time in 2017	–	853,624	–
Forfeited	31,105	24,897	–
Dec. 31, 2017	707,966	828,727	–
Potential number offered for the first time in 2018	–	–	891,345
Forfeited	47,676	13,988	37,953
Transferred as part of the disposal of Consumer Health	16,336	39,889	23,760
Dec. 31, 2018	**643,954**	**774,850**	**829,632**

The value of the provisions was € 114 million as of December 31, 2018 (December 31, 2017: € 45 million). Net expenses of € 92 million were incurred in fiscal 2018 (2017: net income of € 13 million). The three-year tranche issued in 2015 ended at the end of 2017; an amount of € 23 million was paid out in 2018.

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – SHARE-BASED COMPENSATION PROGRAMS

The measurement of long-term share-based compensation programs implies extensive estimation uncertainty. The two main parameters in the measurement of the long-term share-based compensation programs in the form of cash-settled share-based compensation programs are long-term indicators of company performance and price fluctuations of shares of Merck KGaA, Darmstadt, Germany, in relation to the DAX®.

The amount recognized in the consolidated balance sheet as of December 31, 2018, as non-current provisions, which comprises the 2017 and 2018 tranches from long-term variable compensation programs, amounted to € 54 million (December 31, 2017: 2016 and 2017 tranches € 22 million). The following overview shows the amounts by which the non-current provisions would have been impacted by changes in the DAX® (increase or decrease by 10%, respectively) and the closing price of shares of Merck KGaA, Darmstadt, Germany, as of December 31, 2018 (increase or decrease by 10%, respectively). The amounts stated would have led to a corresponding reduction or increase in profit before income tax.

€ million		Increase (+)/decrease (–) of the provision	
		Dec. 31, 2018	Dec. 31, 2017
Variation of share price of Merck KGaA, Darmstadt, Germany	+10%	14	15
	–10%	–15	–2
Variation of DAX® value	+10%	–10	–
	–10%	8	16

Sensitivities were determined on the basis of the respective parameters in question, with all other measurement assumptions remaining unchanged. The 2016 tranche reported under current provisions will not be subject to any value fluctuations between December 31, 2018, and the payout date and was therefore not included in the sensitivity analysis (December 31, 2017: 2015 tranche).

Provisions for employee benefits included an amount of € 51 million for the promise of a one-time bonus for employees on the occasion of the company's 350th anniversary, which was recognized in 2017 and paid out in 2018.

Provisions for employee benefits also included 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.

With respect to provisions for pensions and other post-employment benefits, see Note (25) "Provisions for pensions and other post-employment benefits".

ENVIRONMENTAL PROTECTION

Provisions for environmental protection, particularly for obligations from soil remediation and groundwater protection, mainly existed in connection with the crop protection business in Germany and Latin America that was discontinued in 1987.

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – OTHER PROVISIONS FOR ENVIRONMENTAL PROTECTION

The calculation of the present value of the future settlement amount of provisions for environmental protection required estimates to be made of

- the future settlement date,
- the actual severity of the identified contamination,
- the applicable remediation methods,
- the associated future costs, and
- the discount rate.

The measurement was carried out regularly in consultation with independent experts.

ACCEPTANCE AND FOLLOW-ON OBLIGATIONS

Provisions for acceptance and follow-on obligations primarily took into account 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. In previous periods, such items were disclosed in income tax liabilities in full.

For further information on these disclosure changes, please refer to Note (49) "Effects from new accounting standards and other presentation and measurement changes".

MISCELLANEOUS OTHER PROVISIONS

Miscellaneous other provisions mainly comprised provisions for warranty obligations and for uncertain commitments from contributions, fees and other duties.

(27) Contingent liabilities

€ million	Dec. 31, 2018	Dec. 31, 2017
Contingent liabilities from legal disputes and tax matters	47	66
Other contingent liabilities	1	1

Contingent liabilities from legal disputes included potential obligations, for which the probability of occurrence, or an outflow of resources, did not suffice to recognize a provision as of the balance sheet date. These 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 was possible that the Group 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 were contingent liabilities from various legal disputes with Merck & Co., Inc. of the United States (outside the United States and Canada: Merck Sharp & Dohme Corp. (MSD)), among other things due to breach of the co-existence agreement between the two companies and/or trademark/name right infringement regarding the use of the designation “Merck”. In this context, the Group 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 taken into account in the table presented above.

Contingent liabilities from tax matters included various non-German income and non-income-related tax matters that were mainly attributable to the determination of earnings under tax law, customs regulations and excise tax matters.

SIGNIFICANT MANAGEMENT JUDGEMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – CONTINGENT LIABILITIES

Identification and measurement

The identification and measurement of contingent liabilities are largely subject to management judgments and estimation uncertainties. The most important parameters used in the measurement of contingent liabilities are the estimated amounts and probabilities of individual proceeding outcomes that are considered possible.

(28) Other liabilities

Other liabilities comprised the following:

	Dec. 31, 2018			Dec. 31, 2017		
€ million	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Other financial liabilities	1,019	13	1,032	1,038	21	1,059
thereof: payroll liabilies	172	–	172	174	–	174
thereof: interest accruals	94	–	94	95	–	95
Liabilities from derivatives with a hedging relationship (operative)	58	20	78	25	18	43
Financial items	**1,077**	**33**	**1,110**	**1,063**	**39**	**1,102**
Accruals for personnel expenses	687	–	687	665	–	665
Contract liabilities[1]	332	4	336			
Liabilities from non-income related taxes	171	15	186	144	5	150
Deferred income[1]	21	–	21	303	211	514
Other non-financial liabilities	–	–	–	–	99	99
Non-financial items	**1,211**	**19**	**1,230**	**1,112**	**315**	**1,427**
Other liabilities	**2,288**	**52**	**2,341**	**2,175**	**354**	**2,529**

[1] Due to the first-time application of IFRS 15 as of January 1, 2018, contract liabilities included in deferred income in 2017 were reported separately as of January 1, 2018; see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

As of December 31, 2018, other financial liabilities included liabilities to related companies amounting to € 511 million (December 31, 2017: € 584 million). These were profit entitlements of E. Merck KG, Darmstadt, Germany.

The following table provides details on the development of contract liabilities related to payments received before performance completion:

	Contract liabilities		
€ million	Current	Non-current	**Total**
January 1, 2018	**311**	**194**	**506**
Additions	410	2	412
Recognition of income/reversal	–582	–2	–583
Cumulative catch-up adjustments to revenue	–	–	–
Reclassification from non-current to current	193	–193	–
Reclassification to liabilities directly related to assets held for sale	–	–	–
Currency translation	2	–	2
Change in scope of consolidation/other	–2	2	–
December 31, 2018	**332**	**4**	**336**

Contract liabilities resulted mainly from the collaboration agreement with Pfizer Inc., United States, in immuno-oncology and were released further as planned on a pro-rata basis through profit or loss in other operating income in 2018.

As of January 1, 2018, contract liabilities amounted to € 506 million, of which € 299 million was recognized in fiscal 2018.

(29) Trade accounts payable

Trade accounts payable amounted to € 1,766 million (December 31, 2017: € 2,195 million). This item included accrued amounts of € 622 million (December 31, 2017: € 653 million) from outstanding invoices.

Given the first-time application of IFRS 15 as of January 1, 2018, some items previously recognized in trade accounts payable were reclassified into the consolidated balance sheet, in particular in refund liabilities. This led to a decline in trade accounts payable of € 434 million as of January 1, 2018 (see Note (49) "Effects from new accounting standards and other presentation and measurement changes").

(30) Refund liabilities

The following table shows the development of refund liabilities in the period under review:

	Rebates/bonus payments		Rights of return		
€ million	Total	thereof: United States	Total	thereof: United States	**Total**
January 1, 2018	**379**	**244**	**52**	**32**	**431**
Additions	1,273	951	44	23	1,317
Utilizations/reversals	–1,193	–902	–43	–22	–1,235
Cumulative catch-up adjustments to revenue	–31	–30	–3	–3	–34
thereof: attributable to performance obligations satisfied in prior periods	–25	–24	–3	–3	–28
Currency translation	12	12	1	1	13
Reclassification to liabilities directly related to assets held for sale	–16	–	–3	–	–19
Change in scope of consolidation/other	–1	–	–	–	–1
December 31, 2018	**423**	**274**	**49**	**31**	**472**

Besides regulatory discounts, rebates and bonus payments comprised discounts agreed upon with customers. The most significant portion of these deductions from sales was attributable to the Healthcare business sector and related to government rebate programs in the US.

Please refer to Note (8) "Net sales" for further information on judgments and sources of estimation uncertainty.

(31) Net cash flows from investing activities

The payments for investments in intangible assets primarily included payments for the development of ERP systems. In the previous year, this item included payments for a license agreement with Vertex Pharmaceuticals Inc., United States, for the acquisition of research programs in the area of oncology and immuno-oncology.

Net cash outflows from investments in current and non-current financial assets amounting to € 75 million (2017: € 219 million) mainly resulted from the purchase of short-term investments in securities not classified as cash and cash equivalents. In the previous year, this item included payments for the purchase of an equity instrument option.

Cash inflows from the divestment of assets held for sale essentially included the payment received from the divestment of the Consumer Health business, less transferred cash and cash equivalents, in the amount of € 3,052 million. To the extent that income tax payments were already included in the disposal gain, such payments were taken into account in the disclosed amount. In the previous year, the Group received an upfront payment of € 156 million associated with the divestment of the Biosimilars business.

Capital Structure, Investments and Financing Activities

(32) Financial result/net gains or losses from financial instruments

€ million	2018	2017[1]
Interest income and similar income	55	23
Income from fair value changes		
from debt instruments with subsequent measurement at fair value through profit or loss	5	
Income from the change of the fair value of share-based compensation programs	–	1
Currency differences from financing activities	16	27
Finance income	**77**	**51**
Interest expenses and similar expenses	–268	–294
Capitalized borrowing costs of qualifying assets		
in property, plant and equipment	7	5
in other intangible assets	8	7
Interest expenses from interest rate derivatives	–14	–13
Capital loss from disposal of debt instruments with subsequent measurement at amortized cost	–1	
Expenses from fair value changes		
from debt instruments with subsequent measurement at fair value through profit or loss	–2	
Expenses from fair value changes of share-based compensation programs	–15	–
Interest component of the additions to pension provisions and other non-current provisions	–56	–51
Other interest expenses	–1	–
Finance costs	**–343**	**–345**
Financial result	**–266**	**–294**

[1] Previous year's figures have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

The currency differences from financing activities mainly comprised gains or losses from hedging intragroup transactions in foreign currency.

The following table shows the development of net gains or losses, interest income or expenses as well as dividend income from financial instruments (excluding items recognized in other comprehensive income) in the period under review by measurement category:

			Interest result		Net gains and losses			
2018 € million	**Currency translation**	**Dividends**	Interest income	Interest expenses	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 liabilities								
Subsequent measurement at amortized cost	–54			–259				–
Subsequent measurement at fair value through profit or loss	–		–	–			735	

		Net gains and losses			
2017 € million	**Interest**	Impairment losses	Reversals of impairment losses	Fair value adjustments	Disposal gains/losses
Held for trading				–203	
Held to maturity	–	–	–		–
Loans and receivables	21	–39	97		–
Available for sale	5	–14	–		–1
Other liabilities	–294				–

In the table above, interest income or expenses related to derivatives without a hedging relationship are recognized within fair value adjustments. The currency translation result from equity instruments with subsequent measurement at fair value through other comprehensive income was recognized in other comprehensive income.

(33) Cash and cash equivalents

Cash and cash equivalents comprised the following items:

€ million	Dec. 31, 2018	Dec. 31, 2017
Cash, bank balances and checks	780	481
Short-term cash investments (up to 3 months)	1,391	108
Cash and cash equivalents	**2,170**	**589**

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 € 295 million (December 31, 2017: € 238 million). This relates mainly to cash and cash equivalents with subsidiaries which the Group only had restricted access to owing to foreign exchange controls.

The maximum default risk is equivalent to the carrying value of the cash and cash equivalents.

(34) Financial assets

	Dec. 31, 2018			Dec. 31, 2017		
€ million	Current	Non-current	Total	Current	Non-current	Total
Available-for-sale financial assets				35	420	454
Loans and receivables				47	12	59
Derivative assets (financial transactions)				9	13	22
Subsequent measurement at amortized cost	**1**	**9**	**10**			
Loans against third parties	1	9	9			
Subsequent measurement at fair value through other comprehensive income	**8**	**278**	**285**			
Equity instruments	–	274	274			
Debt instruments	8	4	12			
Subsequent measurement at fair value through profit and loss	**16**	**324**	**340**			
Equity instruments	–	–	–			
Contingent considerations	–	259	259			
Other debt instruments	–	50	50			
Derivatives without a hedging relationship (financial transactions)	16	14	30			
Financial assets	**24**	**610**	**635**	**90**	**444**	**535**

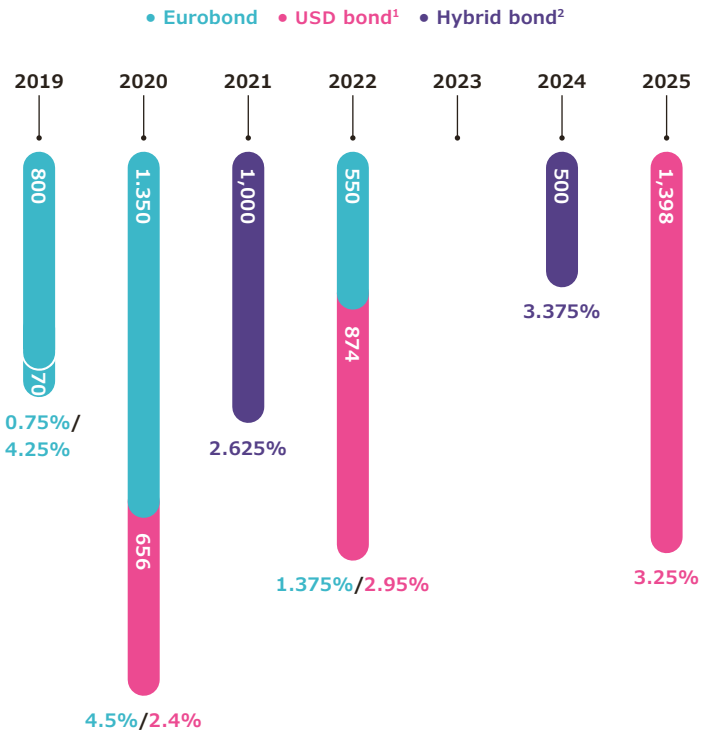
As in the previous year, contingent considerations were mainly attributable to the divestments of the Biosimilars business (see Note (5) “Acquisitions and divestments”) and Kuvan®. In the previous year, these items were disclosed as available-for-sale financial assets. The shares held in Intrexon Corporation, United States, acquired in fiscal 2018, were disclosed in equity instruments with subsequent measurement at fair value through other comprehensive income. Please refer to Note (70) “List of shareholdings” for a detailed list of all investments made in equity instruments with subsequent measurement at fair value through other comprehensive income. Given the Group’s intention to hold these items for the long term, they were classified as equity instruments and subsequently measured at fair value through other comprehensive income. For further information on impairment losses and credit risks associated with these items, please refer to Note (38) “Management of financial risks”. Please refer to Note (49) “Effects from new accounting standards and other presentation and measurement changes” for further details on the first-time application effects of IFRS 9 regarding the classification and measurement of financial assets.

(35) Financial liabilities/ capital management

The composition of financial liabilities as well as a reconciliation to net financial debt are presented in the following table:

	Dec. 31, 2018 € million	Dec. 31, 2017 € million	Maturity	Interest rate %	Nominal value million	Nominal value Currency
USD bond 2015/2018	–	335	March 2018	1.700%	400	USD
Eurobond 2015/2019	799	–	Sept. 2019	0.750%	800	€
Eurobond 2009/2019	70	–	Dec. 2019	4.250%	70	€
Bonds (current)	**869**	**335**				
Commercial paper	113	838				
Bank loans	370	803				
Liabilities to related parties	824	767				
Loans from third parties and other financial liabilities	20	19				
Liabilities from derivatives (financial transactions)	16	27				
Finance lease liabilities	2	1				
Current financial liabilities	**2,215**	**2,790**				
Eurobond 2015/2019	–	799	Sept. 2019	0.750%	800	€
Eurobond 2009/2019	–	70	Dec. 2019	4.250%	70	€
USD bond 2015/2020	655	626	March 2020	2.400%	750	USD
Eurobond 2010/2020	1,348	1,347	March 2020	4.500%	1,350	€
USD bond 2015/2022	872	833	March 2022	2.950%	1,000	USD
Eurobond 2015/2022	548	548	Sept. 2022	1.375%	550	€
USD bond 2015/2025	1,389	1,328	March 2025	3.250%	1,600	USD
Hybrid bond 2014/2074	994	992	Dec. 2074[1]	2.625%	1,000	€
Hybrid bond 2014/2074	498	497	Dec. 2074[2]	3.375%	500	€
Bonds (non-current)	**6,304**	**7,040**				
Bank loans	250	850				
Liabilities to related parties	–	–				
Loans from third parties and other financial liabilities	51	54				
Liabilities from derivatives (financial transactions)	73	86				
Finance lease liabilities	2	2				
Non-current financial liabilities	**6,681**	**8,033**				
Financial liabilities	**8,896**	**10,823**				
less:						
Cash and cash equivalents	2,170	589				
Current financial assets	24	90				
Net financial debt[3]	**6,701**	**10,144**				

[1] Merck KGaA, Darmstadt, Germany, 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 KGaA, Darmstadt, Germany, has the right to prematurely repay this tranche of the hybrid bond issued in December 2014 for the first time in December 2024.
[3] Not defined by International Financial Reporting Standard (IFRSs).



[1] The nominal volumes of bonds denominated in U.S. dollars were converted into euros at the closing rate on December 31, 2018.
[2] For the hybrid bonds repayment is assumed at the earliest possible date.

The Group repaid a USD bond with a volume of € 323 million in March 2018.

For the hybrid bond 2014/2074 issued by Merck KGaA, Darmstadt, Germany, in two tranches, the rating agencies Standard & Poor's, Moody's and Scope have given equity credit treatment to half of the issuance, thus making the issuance more favorable to the Group's credit rating than a classic bond issue. The bond is recognized in full as financial liabilities in the balance sheet.

The financial liabilities of the Group were not secured by liens or similar forms of collateral. The loan agreements do not contain any financial covenants. The Group's average borrowing cost as of the balance sheet date was 2.7% (December 31, 2017: 2.2%).

Information on liabilities to related parties can be found in Note (42) "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 the Group, for instance via bond issues. As of December 31, 2018, there were liabilities of € 2.77 billion (December 31, 2017: € 2.77 billion) from a debt issuance program most recently renewed in 2015. In addition, the Group had access to a commercial paper program to meet short-term capital requirements with a volume of € 2 billion, of which € 113 million had been utilized as of December 31, 2018 (December 31, 2017: € 838 million).

Loan agreements represent a further source of financing for the Group. At the balance sheet date, the bank financing commitments vis-à-vis the Group were as follows:

	Dec. 31, 2018		Dec. 31, 2017			
€ million	**Financing commitments from banks**	**Utilization**	Financing commitments from banks	Utilization	Interest	Maturity of financing commitments
Syndicated loan	2,000	–	2,000	–	variable	2020
Bilateral credit agreement with banks	–	–	700	700	variable	
Bilateral credit agreement with banks	–	–	400	400	variable	
Bilateral credit agreement with banks	250	250	250	250	variable	2022
Various bank credit lines	549	370	581	303	variable	<1 year
	2,799	**620**	**3,931**	**1,653**		

There are no indications that the availability of credit lines already extended was restricted.

(36) Equity

EQUITY CAPITAL

The total capital of the company consists of the share capital composed of shares and the equity interest held by the general partner E. Merck KG, Darmstadt, Germany. As of the balance sheet date, the company's share capital amounting to € 168 million was divided into 129,242,251 no-par value bearer shares plus one registered share and is disclosed as subscribed capital. Each share therefore corresponds to € 1.30 of the share capital. The amount resulting from the issue of shares by Merck KGaA, Darmstadt, Germany, exceeding the nominal amount was recognized in the capital reserves. The equity interest held by the general partner amounted to € 397 million. As in the prior year, the share capital did not change in fiscal 2018.

SHARE OF NET PROFIT OF E. MERCK KG, DARMSTADT, GERMANY

E. Merck KG, Darmstadt, Germany, and Merck KGaA, Darmstadt, Germany, engage in reciprocal net profit transfers. This makes it possible for E. Merck KG, Darmstadt, Germany, the general partner of Merck KGaA, Darmstadt, Germany, and the shareholders to participate in the net profit/loss of Merck KGaA, Darmstadt, Germany, in accordance with the ratio of the general partner's equity interest and the share capital (70.274% or 29.726% of the total capital).

The allocation of net profit/loss is based on the net income of both E. Merck KG, Darmstadt, Germany, and Merck KGaA, Darmstadt, Germany, 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, Darmstadt, Germany, which has to 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. The reciprocal net profit/loss transfer between E. Merck KG, Darmstadt, Germany, and Merck KGaA, Darmstadt, Germany, as stipulated by the Articles of Association was as follows:

		2018		2017	
€ million		E. Merck KG, Darmstadt, Germany	Merck KGaA, Darmstadt, Germany	E. Merck KG, Darmstadt, Germany	Merck KGaA, Darmstadt, Germany
Result of E. Merck KG, Darmstadt, Germany, before reciprocal profit transfer, adjusted for trade tax		–24	–	–16	–
Net income of Merck KGaA, Darmstadt, Germany, before reciprocal profit transfer		–	616	–	723
Corporation tax		–	20		56
Basis for appropriation of profits	**(100%)**	**–24**	**637**	**–16**	**780**
Profit transfer to E. Merck KG, Darmstadt, Germany Ratio general partner's capital to total capital	(70.274%)	447	–447	548	–548
Profit transfer from E. Merck KG, Darmstadt, Germany Ratio of share capital to total capital	(29.726%)	7	–7	5	–5
Corporation tax		–	–20	–	–56
Net income		**430**	**162**	**537**	**171**

The result of E. Merck KG, Darmstadt, Germany, on which the appropriation of profits adjusted for trade tax is based amounted to € –24 million (2017: € –16 million). This resulted in a profit/loss transfer to Merck KGaA, Darmstadt, Germany, of € –7 million (2017: € –5 million). The net income of Merck KGaA, Darmstadt, Germany, adjusted for corporation tax, on which the appropriation of its profit is based, amounted to € 637 million (2017: € 780 million). Merck KGaA, Darmstadt, Germany, transferred a gain in the amount of € 447 million of its profit to E. Merck KG, Darmstadt, Germany (2017: € 548 million). In addition, an expense from corporation tax charges amounting to € 20 million resulted (2017: expense of € 56 million).

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, Darmstadt, Germany. If the shareholders resolve to carry forward or to allocate to retained earnings a portion of net retained profit of Merck KGaA, Darmstadt, Germany, to which they are entitled, then E. Merck KG, Darmstadt, Germany, is obligated to allocate to the profit brought forward/retained earnings of Merck KGaA, Darmstadt, Germany, a comparable sum determined in accordance with the ratio of share capital to general partner's capital. This ensures that the retained earnings and the profit carried forward of Merck KGaA, Darmstadt, Germany, correspond to the ownership ratios of the shareholders on the one hand and E. Merck KG, Darmstadt, Germany, on the other hand. Consequently, for distributions to E. Merck KG, Darmstadt, Germany, only the amount is available that results after netting the profit transfer of Merck KGaA, Darmstadt, Germany, with the amount either allocated or withdrawn by E. Merck KG, Darmstadt, Germany, from retained earnings/profit carried forward. This amount corresponds to the amount that is paid as a dividend to the shareholders and reflects their pro rata shareholding in the company.

€ million	2018 E. Merck KG, Darmstadt, Germany	2018 Merck KGaA, Darmstadt, Germany	2017 E. Merck KG, Darmstadt, Germany	2017 Merck KGaA, Darmstadt, Germany
Net income	430	162	537	171
Profit carried forward previous year	60	25	39	16
Withdrawal from revenue reserves	–	–	–	–
Transfer to revenue reserves	–	–	–	–
Retained earnings Merck KGaA, Darmstadt, Germany		**187**		**187**
Withdrawal by E. Merck KG, Darmstadt, Germany	–430		–515	
Dividend proposal		–162		–162
Profit carried forward	**61**	**26**	**60**	**25**

For 2017, a dividend of € 1.25 per share was distributed. The dividend proposal for fiscal 2018 will again be € 1.25 per share, corresponding to a total dividend payment of € 162 million (2017: € 162 million) to shareholders. The amount withdrawn by E. Merck KG, Darmstadt, Germany, would amount to € 430 million (2017: € 515 million).

APPROPRIATION OF PROFITS AND CHANGES IN RESERVES

€ million	2018 Merck & Cie, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany	2018 Merck KGaA, Darmstadt, Germany	2018 Total	2017 Merck & Cie, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany	2017 Merck KGaA, Darmstadt, Germany	2017 Total
Profit transfer to E. Merck KG, Darmstadt, Germany	–62	–447	–509	–63	–548	–611
Profit transfer from E. Merck KG, Darmstadt, Germany	–	–7	–7	–	–5	–5
Changes in reserves	–	1	1	–	22	22
Profit transfer to E. Merck KG, Darmstadt, Germany, including changes in reserves	**–62**	**–454**	**–515**	**–63**	**–531**	**–593**
Result of E. Merck KG, Darmstadt, Germany, before reciprocal profit transfer adjusted for trade tax		–24			–16	
Profit transfer to E. Merck KG, Darmstadt, Germany/withdrawal by E.Merck KG, Darmstadt, Germany	**–62**	**–430**		**–63**	**–515**	

Based on the assumed appropriation of profits, the profit transfer to E. Merck KG, Darmstadt, Germany, for 2018, including changes in reserves, amounted to € –515 million. This consisted of the profit transfer to E. Merck KG, Darmstadt, Germany (€ –447 million), the result transfer from E. Merck KG, Darmstadt, Germany, to Merck KGaA, Darmstadt, Germany (€ –7 million), the change in profit carried forward of E. Merck KG, Darmstadt, Germany, (€ 1 million) as well as the profit transfer from Merck & Cie, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany, to E. Merck KG, Darmstadt, Germany (€ –62 million). For 2017 the profit transfer to E. Merck KG, Darmstadt, Germany, including changes in reserves amounted to € –593 million. This consisted of the profit transfer to E. Merck KG,

Darmstadt, Germany (€ –548 million), the result transfer from E. Merck KG, Darmstadt, Germany, to Merck KGaA, Darmstadt, Germany (€ –5 million), the change in profit carried forward of E. Merck KG, Darmstadt, Germany, (€ 22 million) as well as the profit transfer from Merck & Cie, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany, to E. Merck KG, Darmstadt, Germany (€ –63 million).

Merck & Cie, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany, is a partnership under Swiss law that is controlled by Merck KGaA, Darmstadt, Germany, but distributes its operating result directly to E. Merck KG, Darmstadt, Germany. This distribution is a payment to shareholders and is therefore also presented under changes in equity.

The proposed withdrawal of E. Merck KG, Darmstadt, Germany, in the amount of € 430 million (2017: € 515 million) results from the total amount of the profit transfer to E. Merck KG, Darmstadt, Germany, including changes in reserves, and the result of E. Merck KG, Darmstadt, Germany, 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 Group as well as pro rata consolidation entries.

The net equity and profit attributable to non-controlling interests mainly related to the minority interests in the publicly traded company P.T. Merck Tbk, Jakarta, Indonesia, a subsidiary of Merck KGaA, Darmstadt, Germany, and in Merck Ltd., Bangkok, Thailand, a subsidiary of Merck KGaA, Darmstadt, Germany. As part of the divestment of the Consumer Health business with effect from December 1, 2018, the shareholdings in the publicly traded company Merck Ltd., Mumbai, India, a subsidiary of Merck KGaA, Darmstadt, Germany, were also divested; as of December 31, 2018, therefore, non-controlling interests in this company are only included in profit after tax and no longer in equity.

OTHER CHANGES IN EQUITY

On the occasion of the 350th anniversary of the company in 2018, a promise of a one-time grant in the form of shares of Merck KGaA, Darmstadt, Germany, in the amount of € 350 was made to employees of the Group in Germany. For the grant of shares of Merck KGaA, Darmstadt, Germany, in 2018, the required shares were purchased on the stock market by a third party on behalf of the Group and then transferred to the eligible employees. New shares were not issued. In fiscal 2018, in accordance with IFRS 2, the award led to personnel expenses of € 4 million as well as to a decline in retained earnings of € 1 million. In the previous year, personnel expenses of € 1 million and a corresponding increase in retained earnings in equity were recognized; the latter was recorded in the item “other” in the consolidated statement of changes in net equity.

(37) Derivative financial instruments

The following derivatives were held by the Group as of the balance sheet date:

DEC. 31, 2018

	Nominal volume	
€ million	Current	Non-current
Cash flow hedge	**1,573**	**366**
Interest	–	–
Currency	1,573	366
No hedge accounting	**5,286**	**1,100**
Interest	–	1,100
Currency	5,286	–
Equity	–	–
	6,859	**1,466**

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	Nominal volume	
€ million	Current	Non-current
Cash flow hedge	**1,898**	**1,360**
Interest	–	–
Currency	1,898	1,360
No hedge accounting	**4,376**	**1,100**
Interest	–	1,100
Currency	4,376	–
Equity	–	–
	6,274	**2,460**

Derivative financial instruments in connection with financial transactions are shown in financial assets and liabilities. Derivative financial instruments in connection with transactions in operating business are shown in other assets and other liabilities. As in the previous year, all hedging relationships were recognized at a point in time.

Netting of derivatives from an economic perspective was possible due to the existing framework agreements on derivatives trading that the Group 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 financial liabilities.

Fair value/carrying amount							
Positive market values				Negative market values			
Financial transactions		Operative transactions		Financial transactions		Operative transactions	
Current	Non-current	Current	Non-current	Current	Non-current	Current	Non-current
–	**–**	**4**	**1**	**–**	**–**	**58**	**20**
–	–	–	–	–	–	–	–
–	–	4	1	–	–	58	20
16	**14**	**–**	**45**	**16**	**73**	**–**	**–**
–	14	–	–	–	73	–	–
16	–	–	–	16	–	–	–
–	–	–	45	–	–	–	–
16	**14**	**4**	**46**	**16**	**73**	**58**	**20**

Fair value/carrying amount							
Positive market values				Negative market values			
Financial transactions		Operative transactions		Financial transactions		Operative transactions	
Current	Non-current	Current	Non-current	Current	Non-current	Current	Non-current
–	**–**	**30**	**15**	**–**	**–**	**25**	**18**
–	–	–	–	–	–	–	–
–	–	30	15	–	–	25	18
9	**13**	**–**	**46**	**27**	**86**	**–**	**–**
–	13	–	–	–	86	–	–
9	–	–	–	27	–	–	–
–	–	–	46	–	–	–	–
9	**13**	**30**	**62**	**27**	**86**	**25**	**18**

The following table presents the potential netting volume of the reported derivative assets and liabilities:

€ million Dec. 31, 2018	Gross presentation	Netting	Net presentation	Potential netting volume due to master netting agreements	Potential netting volume due to financial collateral	Potential net amount
Derivative financial assets	80	–	80	29	–	51
Derivative financial liabilities	–168	–	–168	–29	–	–139

€ million Dec. 31, 2017	Gross presentation	Netting	Net presentation	Potential netting volume due to master netting agreements	Potential netting volume due to financial collateral	Potential net amount
Derivative financial assets	113	–	113	60	–	54
Derivative financial liabilities	–155	–	–155	–60	–	–96

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 flow hedge		
€ million	Time value of options	Forward component of currency forwards	Intrinsic value of options	Spot component of currency forwards	Interest rate swaps
January 1, 2017	–		–	**–123**	**–68**
Adjustment due to mandatory retrospective adoption of IFRS 9[1]	3		–	–	–
January 1, 2017 (after adjustment)	**3**		**–**	**–123**	**–68**
Fair value adjustment (directly recognized in equity)	–5		5	85	–2
Reclassification to profit or loss	–		–	–1	13
Reclassification to assets	–		–	–	–
Tax effect	1		–2	–25	–4
December 31, 2017	**–1**		**3**	**–64**	**–60**
January 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
December 31, 2018	**–**	**–33**	**1**	**–81**	**–47**

[1] Effect of the first-time application of IFRS 9, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

(38) Management of financial risks

Market fluctuations with respect to foreign exchange and interest rates represent significant profit and cash flow risks for the Group. The Group aggregates these Group-wide risks and steers them centrally, partly by using derivatives. The Group uses scenario analyses to estimate existing risks of foreign exchange and interest rate fluctuations. The Group is not subject to any material risk concentration from financial transactions.

The Group uses marketable forward exchange contracts, options and interest rate 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 constant risk controls by Group Treasury. Speculation is prohibited. A 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 its international business focus, the Group 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. Foreign exchange risks from the following transactions are hedged through the use of forward exchange contracts and currency options:

- Forecast transactions in non-functional currency, the expected probability of which is very high for the next 36 months,
- Firm purchase commitments of the next 36 months in non-functional currency,
- Intragroup financing in non-functional currency as well as
- Receivables and liabilities against third parties in non-functional currency.

Forward exchange contracts are used to hedge foreign exchange risks arising from transactions already recognized in the balance sheet. Forecast transactions and firm purchase commitments in non-functional currency are hedged using forward exchange contracts and currency options which are due within the next 36 months.

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.

€ million Dec. 31, 2018		USD	CHF	CNY	TWD	JPY	KRW
Net exposure		**618**	**–274**	**741**	**153**	**132**	**163**
Exchange rate –10% (€ depreciation)	Consolidated income statement	–62	27	–74	–15	–13	–16
	Equity	–135	20	–9	–19	–11	–14
Exchange rate +10% (€ appreciation)	Consolidated income statement	62	–27	74	15	13	16
	Equity	110	–16	8	15	10	12

€ million Dec. 31, 2017		USD	CHF	CNY	TWD	JPY	KRW
Net exposure		**1,215**	**–184**	**449**	**135**	**75**	**115**
Exchange rate –10% (€ depreciation)	Consolidated income statement	–122	18	–45	–14	–8	–12
	Equity	–172	39	–44	–38	–19	–18
Exchange rate +10% (€ appreciation)	Consolidated income statement	122	–18	45	14	8	12
	Equity	147	–31	36	31	17	15

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 aforementioned currencies consisted of the following components:

- Planned cash flows in the next 12 months in the respective currency as well as
- Derivatives to hedge these planned cash flows, usually at a hedging ratio of 30% – 70%.

Balance sheet items in the aforementioned currencies were economically hedged in full in both 2018 and 2017 by derivatives if they did not correspond to the functional currency of the respective company.

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:

€ million Dec. 31, 2018	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 value (asset)	–	2	–	–	3	–
thereof: negative market value (liability)	–49	–3	–5	–8	–3	–10
Maturity date	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 January 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 hedged rate for the year (including forward points)	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 previously described transactional foreign exchange risks, the Group was exposed to currency translation risks since many of the subsidiaries of Merck KGaA, Darmstadt, Germany, 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 Group's net exposure to interest rate changes comprised the following:

€ million	**Dec. 31, 2018**	Dec. 31, 2017
Short-term or variable interest rate monetary deposits	2,196	684
Short-term or variable interest rate monetary borrowings	–2,465	–3,641
Net interest rate exposure	**–269**	**–2,957**

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	2018		2017	
Change in market interest rate	**+100 basis points**	**–100 basis points**	**+100 basis points**	**–100 basis points**
Effects on consolidated income statement	6	–9	–26	16
Effects on equity	–	–	–	–

SHARE PRICE RISKS

The shares in publicly listed companies amounting to € 134 million (December 31, 2017: € 16 million) are generally exposed to a risk of fluctuations in fair value. A 10% change in the value of the stock market would impact equity by € 13 million (December 31, 2017: € 2 million). This change in value would be recognized in equity.

LIQUIDITY RISKS

The risk that the Group 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 (35) "Financial liabilities/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:

		Cash flows <1 year		**Cash flows 1–5 years**		**Cash flows >5 years**	
€ million Dec. 31, 2018	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 payable	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 liabilities	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**

€ million Dec. 31, 2017	Carrying amount	Cash flows <1 year		Cash flows 1–5 years		Cash flows >5 years	
		Interest	Repayment	Interest	Repayment	Interest	Repayment
Bonds and commercial paper	8,213	210	1,171	590	5,234	143	1,839
Bank loans	1,653	18	803	4	850	–	–
Trade accounts payable	2,195	–	2,195	–	–	–	–
Liabilities to related parties	1,352	–	1,352	–	–	–	–
Other financial liabilities	474	–	453	–	21	–	–
Loans from third parties and other financial liabilities	73	1	19	4	54	–	–
Liabilities from derivatives	155	15	52	59	18	–	–
Finance lease liabilities	4	–	1	–	2	–	–
	14,120	**243**	**6,046**	**657**	**6,179**	**143**	**1,839**

CREDIT RISKS

Credit risk for the Group means the risk of a financial loss if a customer or other contract partner is not able to meet its contractual payment obligations. The Group is generally exposed to credit risks from existing trade accounts receivable other debt instruments, derivatives and contract assets.

According to IFRS 9, there is a rebuttable presumption that the credit risk has increased significantly when contractual payments are more than 90 days past due. The Group therefore analyzes all financial assets that are more than 90 days past due and examines whether there is objective evidence of impairment requiring additional risk provisions.

If the financial asset is subject to a significant default risk, the impairment booked for the expected credit risks is increased accordingly. A default generally exists when the debtor cannot fully meet its liabilities. By contrast, a debtor's creditworthiness is assumed to be impaired if there are objective indications of the debtor being in financial difficulties, such as the disappearance of an active market for its products or impending insolvency.

The Group derecognizes an asset if the likelihood of receiving payments from the debtor in question is considered to be negligible. In such a case the Group does not expect any material payments from derecognized assets. The Group does, however, also use legal means to recognize the existing entitlement to payment where possible.

On the balance sheet date, the theoretical maximum default risk corresponded to the net carrying amounts less any compensation from credit insurance.

The following table shows impairments for financial assets and contract assets as well as gains from their release recognized in the consolidated income statement for fiscal year 2018:

	2018
Impairment losses	**–77**
of trade accounts receivable	–75
of debt instruments subsequently measured at amortized cost	–2
of debt instruments subsequently measured at fair value through other comprehensive income	–
Reversal of impairment losses	**105**
of trade accounts receivable	69
of debt instruments subsequently measured at amortized cost	35
of debt instruments subsequently measured at fair value through other comprehensive income	–
Net impairment losses on financial assets	**27**

The above-described impairments for trade accounts receivable applied entirely to receivables resulting from contracts with customers. Reversals of impairment losses on debt instruments subsequently measured at amortized cost 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 accounts receivable is largely impacted by the specific circumstances of individual customers. The Group also takes into account 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 monitored using established credit management processes that take the individual customer risks into account. This is done in particular by analyzing the aging structure of trade accounts receivable. The Group continuously reviews and monitors open positions of all trading partners in the corresponding countries and takes risk-mitigating measures if necessary. If there is objective evidence that particular trade accounts receivable are fully or partially impaired, additional loss allowances are recognized to provide for expected credit defaults. The customer groups with comparable default risks to be taken into account are determined at the Group in accordance with the business sectors and location of the respective customers. Current macroeconomic expectations are also considered by taking into account country-specific ratings. For risk management purposes, the Group groups the existing trade accounts receivable based partly on the business sectors, as the customers' risk profiles within the respective business sector are regarded as comparable, and partly on credit ratings in the respective countries in which the Group operates and from which the receivables originate. The table below contains an overview of the credit risk by business sector and country rating as of December 31, 2018:

Dec. 31, 2018 € million	Healthcare	Life Science	Performance Materials	**Group**
External credit rating at least AA– (rating agency Standard & Poor's) or Aa3 (rating agency Moody's)	856	827	437	2,120
External credit rating at least BBB– (rating agency Standard & Poor's) or Baa3 (rating agency Moody's)	252	146	21	420
External credit rating lower than BBB– (rating agency Standard & Poor's) or Baa3 (rating agency Moody's)	427	36	2	465
Trade accounts receivable before impairment losses	**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 the Group.

Impairments based on expected credit losses for trade accounts receivable as of December 31, 2018, were as follows:

Dec. 31, 2018 € million	Not yet due	Overdue by 90 days	Overdue by 180 days	Overdue by 360 days	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

As of January 1, 2018, the date of first-time application of the impairment rules amended through IFRS 9, impairments based on expected credit losses for trade accounts receivable were as follows:

Jan. 1, 2018 € million	Not yet due	Overdue by 90 days	Overdue by 180 days	Overdue by 360 days	More than 360 days past due	**Total**
Expected loss rate	0.9%	1.3%	6.0%	14.1%	93.3%	
Trade accounts receivable before loss allowances	2,408	402	61	45	360	3,277
thereof: credit impaired	–	4	7	12	336	359
Loss allowances	**–22**	**–5**	**–4**	**–6**	**–336**	**–373**
thereof: credit impaired	–	–1	–2	–6	–325	–334

The corresponding loss allowances in 2018 developed as follows:

	Loss allowances of trade accounts receivable
December 31, 2017 – IAS 39	**–367**
Adjustment on initial application of IFRS 9	–6
January 1, 2018 – IFRS 9	**–373**
Additions	–75
Utilizations	308
Reversals	69
Classification as held for sale or transfer to disposal group	4
Currency effects	–7
Change in scope of consolidation	1
December 31, 2018	**–73**

The Group utilized a recognized impairment loss of € 299 million in 2018 in connection with loss allowances established on trade accounts receivable from 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.

The maturity structure of the carrying amounts of trade accounts receivable as of December 31, 2017, was as follows:

€ million	Dec. 31, 2017
Neither past due nor impaired	2,391
Past due, but not impaired	
up to 3 months	392
up to 6 months	50
up to 12 months	32
up to 24 months	7
over 2 years	1
Impaired	51
Trade accounts receivable	**2,923**

The corresponding impairment in the previous year developed as follows:

€ million	2017
January 1	**–464**
Additions	–39
Reversals/utilizations	99
Currency translation and other changes	37
December 31	**–367**

In fiscal 2017, previously recognized impairments were reversed as a result of the improved solvency of customers, particularly in the Middle East.

SIGNIFICANT MANAGEMENT JUDGEMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – 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.

If the impairment of trade accounts receivable and contract assets had been 10% higher in 2018, profit before income tax would have been € 8 million lower.

Credit risks from other financial assets

As investments in debt instruments either subsequently measured at amortized cost or at fair value through other comprehensive income were largely classified as low-risk investments, the expected credit loss in the next 12 months was used as the sole basis for calculating the impairment loss on these debt instruments. 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. It was therefore not assessed whether there had been a significant increase in the credit risk for such assets. The Group 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 impairments established for expected credit losses were increased. In all other cases, no new risk assessment was undertaken as of the balance sheet date and the initially assumed risk profile was maintained.

Wherever the Group presumes a considerable increase in the default risk, the expected credit loss over the full term of the financial asset is taken into account.

The Group 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.

In the previous year, impairment losses were recognized for investments in companies and other non-current financial assets held for sale in a total amount of € 14 million. Positive and negative fair value adjustments recognized in equity offset each other in the previous year.

(39) Information on fair value measurement

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:

	Carrying amount			Fair value[1]			
€ million Dec. 31, 2018	Current	Non-current	**Total**	Fair value determined by official prices and quoted market values (Level 1)	Fair value determined using inputs observable in the market (Level 2)	Fair value determined using inputs unobservable in the market (Level 3)	**Total**
Financial assets							
Subsequent measurement at amortized cost							
Cash and cash equivalents	2,170	–	2,170				
Trade accounts receivable (excluding leasing receivables)	2,909	–	2,909				
Other debt instruments	296	26	322				
Subsequent measurement at fair value through other comprehensive income							
Equity instruments	–	274	274	17	118	140	274
Trade accounts receivable	21	–	21	–	–	21	21
Other debt instruments	8	4	12	12	–	–	12
Subsequent measurement at fair value through profit or loss							
Equity instruments	–	–	–	–	–	–	–
Contingent considerations	–	259	259	–	–	259	259
Other debt instruments	–	50	50	2	22	27	50
Derivatives without a hedging relationship	16	59	76	–	30	45	76
Derivatives with a hedging relationship	4	1	4	–	4	–	4
Finance lease receivables (measured in accordance with IAS 17)[2]	1	–	1				
Total	**5,425**	**673**	**6,098**	**30**	**174**	**492**	**696**
Financial liabilities							
Subsequent measurement at amortized cost							
Trade accounts payable	1,766	–	1,766				
Other financial liabilities	3,215	6,615	9,830	7,258	2,677	–	9,935
Subsequent measurement at fair value through profit or loss							
Contingent considerations	1	4	5	–	–	5	5
Derivatives without a hedging relationship	16	73	90	–	90	–	90
Derivatives with a hedging relationship	58	20	78	–	78	–	78
Refund liabilities	472	–	472				
Finance lease liabilities (measured in accordance with IAS 17)[2]	2	2	4				
Total	**5,530**	**6,714**	**12,244**	**7,258**	**2,845**	**5**	**10,108**

[1] The simplification option under IFRS 7.29(a) was used for disclosures of certain fair values.
[2] Measurements within the scope of IAS 17 are exempted from the requirements of IFRS 13 (IFRS 13.6(b)).

The following table presents the carrying amounts and the fair values for each individual class of financial instrument as of December 31, 2017, pursuant to IAS 39:

		Subsequent measurement according to IAS 39					
€ million Dec. 31, 2017	**Carrying amount**	Amortized cost	At cost	Fair value	Carrying amount according to IAS 17[2]	Non-financial items	**Fair value, Dec. 31, 2017[1]**
Assets							
Cash and cash equivalents	589	589	–	–	–	–	
Current financial assets	90	47	–	44	–	–	
Held for trading (non-derivatives)	–	–	–	–	–	–	–
Derivatives without a hedging relationship	9	–	–	9	–	–	9
Held to maturity	–	–	–	–	–	–	
Loans and receivables	47	47	–	–	–	–	
Available for sale	35	–	–	35	–	–	35
Derivatives with a hedging relationship	–	–	–	–	–	–	–
Trade accounts receivable	2,923	2,923	–	–	–	–	
Loans and receivables	2,923	2,923	–	–	–	–	
Other current and non-current assets	936	276	–	92	–	568	
Derivatives without a hedging relationship	46	–	–	46	–	–	46
Loans and receivables	276	276	–	–	–	–	
Derivatives with a hedging relationship	45	–	–	45	–	–	45
Non-financial items	568	–	–	–	–	568	
Non-current financial assets	444	12	4	429	–	–	
Derivatives without a hedging relationship	13	–	–	13	–	–	13
Held to maturity	–	–	–	–	–	–	
Loans and receivables	12	12	–	–	–	–	
Available for sale	420	–	4	416	–	–	416
Derivatives with a hedging relationship	–	–	–	–	–	–	–
Liabilities							
Current and non-current financial liabilities	10,823	10,707	–	113	4	–	
Derivatives without a hedging relationship	113	–	–	113	–	–	113
Other financial liabilities	10,707	10,707	–	–	–	–	11,074
Derivatives with a hedging relationship	–	–	–	–	–	–	–
Liabilities from finance leases	4	–	–	–	4	–	
Trade accounts payable	2,195	2,195	–	–	–	–	
Other financial liabilities	2,195	2,195	–	–	–	–	
Current and non-current other liabilities	2,529	1,059	–	43	–	1,427	
Derivatives without a hedging relationship	–	–	–	–	–	–	–
Other financial liabilities	1,059	1,059	–	–	–	–	
Derivatives with a hedging relationship	43	–	–	43	–	–	43
Non-financial items	1,427	–	–	–	–	1,427	

[1] The simplification option under IFRS 7.29(a) was used for disclosures of certain fair values.
[2] Measurement within the scope of IAS 17 are exempted from the requirements of IFRS 13 (IFRS 13.6(b)).

The determination of the fair values of financial assets and liabilities is presented in the following table:

DEC. 31, 2018

€ million

		Fair Value			
Fair value determined by official prices and quoted market values (Level 1)	**Financial instruments concerned**	Financial assets	Financial liabilities	**Description of the measurement technique**	**Main input factors used to determine fair values**
Equity instruments	Shares (equity investments in listed companies)	17			
Debt instruments (subsequent measurement through other comprehensive income)	Bonds	12		Derivation from active market	Quoted prices in an active market
Debt instruments (subsequent measurement through profit or loss)	Publicly-traded funds	2			
Other financial liabilities (subsequent measurement at amortized cost)	Bonds		7,258		
Total		**30**	**7,258**		
Fair value determined using input factors observable in the market (Level 2)					
Equity instruments	Shares (equity investments in listed companies)	118		Derivation from active market considering liquidity discount	Quoted prices in an active market and volatilities observable on the market
Debt instruments (subsequent measurement through profit or loss)	Convertible note with conversion right to shares in companies	22		Nominal value considering liquidity discount	Volatilities observable on the market
Derivatives (with or without a hedging relationship)	Forward exchange contracts and currency options	21	95	Use of recognized actuarial methods	Spot and forward rates observable on the market as well as exchange rate volatilities
	Interest rate swaps	14	73		Interest rate curves available on the market
Other financial liabilities (subsequent measurement at amortized cost)	Liabilities to banks and other loan liabilities		2,677	Discounting of future cash flows	Interest rates obervable on the market
Total		**174**	**2,845**		

DEC. 31, 2018

€ million

Fair value determined using input factors unobservable in the market (Level 3)	Financial instruments concerned	Fair Value: Financial assets	Fair Value: Financial liabilities	Description of the measurement technique	Main input factors used to determine fair values
Equity instruments	Equity interests in unlisted companies	10		Discounting of expected future cash flows	Expected cash flows from recent business planning, average cost of capital, expected long-term growth rate
		129		Derived from observable prices within the scope of equity refinancing sufficiently close to the balance sheet date	Observable prices derived from equity refinancing
		1		Cost-based determination	Acquisition cost
Trade accounts receivable	Trade accounts receivable that are intended for sale due to a factoring agreement	21		Nominal value less factoring fees	Nominal value of potentially sold trade accounts receivable, average fees for sales of trade accounts receivable
Derivatives (without hedging relationship)	Option on equity instruments in an unlisted company	45	–	Option pricing models	Sales planning, milestone payments, probabilities of regulatory and commercial events, discount rates
Contingent considerations	Contingent considerations from the sale and purchase of businesses or shares in corporations	259	5	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	19		Taking into account the fair value of the companies in which the funds are invested	Net asset values of the fund interests
	Bond with embedded settlement option for equity in a unlisted company	7		Used of standard market valuation models	Market observable interest rates
Total		**492**	**5**		

DEC. 31, 2017

€ million

		Fair Value			
Fair value determined by official prices and quoted market values (Level 1)	**Financial instruments concerned**	Financial assets	Financial liabilities	**Description of the measurement technique**	**Main input factors used to determine fair values**
Classified as available for sale	Shares (equity investments in listed companies)	16		Derived from active market	Quoted prices in an active market
	Bonds, investment funds	35			
	Publicly-traded funds	2			
Classified as other liabilities	Bonds		7,719		
Total		**53**	**7,719**		
Fair value determined using input factors observable in the market (Level 2)					
Derivatives with and without a hedging relationship	Forward exchange contracts and currency options	54	70	Use of recognized actuarial methods	Spot and forward rates observable on the market and exchange rate volatilities
	Interest rate swaps	13	86		Interest rate curves available on the market
Classified as other Liabilities	Liabilities to banks and other loan liabilities		3,355	Discounting of future cash flows	Market observable interest rates
Total		**67**	**3,511**		

DEC. 31, 2017

€ million

Fair Value determined using input factors unobservable on the market (Level 3)	Financial instruments concerned	Fair Value: Financial assets	Fair Value: Financial liabilities	Description of the measurement technique	Main input factors used to determine fair values
Classified as available for sale/ classified as other liabilities	Equity investements in unlisted companies	6		Discounting of expected future cash flows	Expected cash flows from recent business planning, average cost of capital, expected long-term growth rate
		96		Derived from observable prices within the scope of equity refinancing sufficiently close to the balance sheet date	Observable prices derived from equity refinancing
	Contingent considerations from the sale and purchase of businesses or shares in corporations	277	3	Discounting of probability-weighted future milestone payments and license fees	Sales planning, milestone payments, probabilities of regulatory and commercial events, discount rates
	Interests in unlisted funds	18		Taking into account the fair value of the companies in which the funds are invested	Net asset values of the fund interests
Derivatives without a hedging relationship	Option on equity instruments in an unlisted company	46	–	Option pricing models	Sales planning, milestone payments, probabilities of regulatory and commercial events, discount rates
Total		**443**	**3**		

Counterparty credit risk was taken into consideration for all valuations of financial instruments. 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.

The planning periods used to determine the fair value of equity investments in unlisted companies ranged from two to eight years. Cash flows for periods in excess of this are included in the terminal value calculation using long-term growth rates of between 0.5% and 2.0% (December 31, 2017: 0.5%). The applied average cost of capital (after tax) was 7.0% on December 31, 2018 (December 31, 2017: 7.0%)

SIGNIFICANT MANAGEMENT JUDGMENTS AND SOURCES OF ESTIMATION UNCERTAINTY – CONTINGENT CONSIDERATIONS

The fair values of contingent considerations were calculated by weighting the expected future milestone payments and royalties using their probability of occurrence and discounting them. This calculation is subject to judgment to a high degree. The main parameters when determining contingent considerations represent

- the estimated probability of occurrence of the individual milestone events,
- the sales planning assumed to derive royalties and
- the discount rate used.

When determining the probability of occurrence of the individual milestone events in connection with the development of drug candidates, the focus was 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 were used. The discount rate (after tax) of between 6.3% and 7.3% (December 31, 2017: 6.5% to 7.6%) was calculated using the weighted average cost of capital.

The most significant contingent consideration was the future purchase price claim from the disposal of the Biosimilars business. It was calculated by an external valuation expert on conclusion of the transaction in 2017. As of December 31, 2018, the carrying amount was € 196 million (December 31, 2017: € 228 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 to the extent presented below, this would have led to the following changes in the measurement and the corresponding effects on the profit before income tax as of December 31, 2018:

		Change in probability of regulatory approval		
€ million		–10%	unchanged	10%
Change of discount rate	5.8%	–34	5	45
	unchanged (6.3%)	–38	0	38
	6.8%	–42	–5	32

A change in the main input parameters used for the measurement of the other contingent compensations would not have had a material impact on profit before income tax.

The changes in financial assets and liabilities for each of the individual categories of financial instruments allocated to Level 3 and measured at fair value were as follows:

		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		Equity instruments	Other debt instruments	Contingent considerations	Derivatives without a hedging relationship	Equity instruments	Trade accounts receivable	Contingent considerations
Net carrying amounts, December 31, 2017 (IAS 39)	**440**	**18**	**–**	**277**	**46**	**102**	**–**	**–3**
Adjustment on initial application of IFRS 9	7	–18	21	–	–	4	–	–
Net carrying amounts, January 1, 2018 (IFRS 9)	**447**	**–**	**21**	**277**	**46**	**106**	**–**	**–3**
Additions due to acquisitions/divestments/ conclusion of factoring agreements	105	–	15	8	–	33	49	–
Transfers into Level 3 out of Level 1/Level 2	–	–	–	–	–	–	–	–
Fair value changes								
Gains (+)/losses (–) recognized in profit or loss	–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	1	–	1	–	–	–	–	–
Disposals due to divestments/ payments received	–80	–	–4	–20	–	–29	–28	–
Transfers out of Level 3 into Level 1/Level 2	–9	–	–	–	–	–9	–	–
Other	–	–	–8	–	–	8	–	–
Net carrying amounts, December 31, 2018 (IFRS 9)	**487**	**–**	**27**	**259**	**45**	**140**	**21**	**–5**

Additions during the reporting period comprised particularly acquisitions of equity investments by Merck Ventures B.V., Amsterdam, Netherlands, a subsidiary of Merck KGaA, Darmstadt, Germany, 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 divestments of equity investments by Merck Ventures B.V., Amsterdam, Netherlands, a subsidiary of Merck KGaA, Darmstadt, Germany, as well as payments received in connection with the contingent consideration from the sale of the Biosimilars business. Transfers from Level 3 to Level 1 comprised the now listed equity investment Translate Bio Inc., United States. 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".

		Financial assets			Financial liabilities	
€ million	**Total**	Available-for-sale financial assets	thereof: contingent considerations	Derivatives without a hedging relationship	Other liabilities	thereof: contingent considerations
Net carrying amounts, January 1, 2017 (IAS 39)	**74**	**75**	**50**	**–**	**–1**	**–1**
Additions as result of acquisitions/divestments	302	258	228	46	– 2	– 2
Transfers to Level 3 from previous measurement at cost/Level 1/Level 2	68	68	–	–	–	–
Fair value changes						
Gains (+)/losses (–) recognized in profit or loss	– 6	– 6	–	–	–	–
thereof: other operating result	– 9	– 9	– 4	–	–	–
thereof: attributable to assets/liabilities held as of the balance sheet date	– 9	– 9	– 4	–	–	–
thereof: financial result	3	3	3	–	–	–
thereof: attributable to assets/liabilities held as of the balance sheet date	3	3	3	–	–	–
Gains (+)/losses (–) recognized in other comprehensive income	5	5	–1	–	–	–
Currency translation	– 2	– 2	–	–	–	–
Disposals due to divestments	–1	–1	–	–	–	–
Transfers out of Level 3 into Level 1/Level 2	–	–	–	–	–	–
Net carrying amounts, December 31, 2017 (IAS 39)	**440**	**397**	**277**	**46**	**–3**	**–3**

The following equity instruments measured at fair value through other comprehensive income were disposed of in fiscal year 2018:

2018 € million Equity instrument[1]	Reasons for the disposal	Fair value at the date of disposal	The cumulative gain (+) or loss (–) on disposal included in other comprehensive income	Transfers of the cumulative gain (+) or loss (–) within group equity in retained earnings
M Ventures portfolio companies	Portfolio adjustments and acquisitions	40	32	32
Cascadian Therapeutics, Inc., United States	Acquired by Seattle Genetics, Inc., United States	–	–17	–17
Nature's Best Health Products Ltd., United Kingdom	Sale of Consumer Health business to Procter & Gamble Company, United States	–	–	–

[1] Disposals due to liquidations are not included.

The M Ventures portfolio companies that were disposed of are Prexton Therapeutics SA, Switzerland, ObsEva SA, Switzerland, and F-Star Gamma Limited, United Kingdom.

(40) Other financial obligations

Other financial obligations comprised the following:

€ million	Dec. 31, 2018	Dec. 31, 2017
Acquisition of intangible assets and due to collaboration agreements	2,763	3,328
Acquisition of property, plant and equipment	144	151
Operating lease	577	530
Long-term purchase commitments	150	236
Remaining other financial obligations	52	63
Other financial obligations	**3,686**	**4,308**

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 the Group 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 milestones, the Group would be obligated to pay up to € 1,548 million (December 31, 2017: € 1,968 million) for the acquisition of intangible assets. The table above does not contain other financial obligations from possible future sales-based license fees and milestone payments.

Moreover, within the scope of collaboration agreements, individual research and development or commercialization budgets were contractually set, upon the basis of which collaboration partners can commit the Group to make payments in the amount of up to € 1,215 million (2017: € 1,360 million)

The expected maturities of these obligations were as follows:

€ million	Dec. 31, 2018	Dec. 31, 2017
Obligations to acquire intangible assets and from collaboration agreements		
within one year	266	247
in 1–5 years	1,255	1,572
more than 5 years	1,242	1,509
	2,763	**3,328**

Other financial obligations were recognized at nominal value.

The maturities of liabilities from lease agreements were as follows:

€ million Dec. 31, 2018	Within 1 year	1–5 years	More than 5 years	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	**131**	**308**	**138**	**577**

€ million Dec. 31, 2017	Within 1 year	1–5 years	More than 5 years	Total
Present value of future payments from finance leases	1	2	–	4
Interest component of finance leases	–	–	–	–
Future finance lease payments	**1**	**3**	**–**	**4**
Future operating lease payments	**137**	**287**	**106**	**530**

Operating leasing agreements related mainly to leasing arrangements to lease real estate, vehicles as well as operating and office equipment. The payments resulting from operating leasing agreements amounted to € 153 million (2017: € 146 million) and were recorded as an expense in the reporting period.

(41) Net cash flows from financing activities

The change in financial debt was as follows:

€ million	Jan. 1, 2018	Cash inflows	Repayments	Changes in scope of consolidation	Currency translation	Fair value changes	Other	Dec. 31, 2018
Bonds	7,375	–	–323	–	121	–	–	7,173
thereof: current	335	–	–323	–	–12	–	869	869
thereof: non-current	7,040	–	–	–	133	–	–869	6,304
Liabilities to related parties	765	375	–319	–	–	–	–	821
Other current and non-current financial liabilities[1]	2,687	32	–1,821	–	–2	5	–	902
Financial liabilities[1]	**10,827**	**407**	**–2,463**	**–**	**119**	**5**	**–**	**8,896**

[1] Values effective January 1, 2018, have been adjusted, see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

€ million	Jan. 1, 2017	Cash inflows	Repayments	Changes in scope of consolidation	Currency translation	Fair value changes	Other	Dec. 31, 2017
Bonds	8,731	–	–932	–	–425	–	–	7,375
thereof: current	937	–	–932	–	–25	–	354	335
thereof: non-current	7,794	–	–	–	–400	–	–354	7,040
Liabilities to related parties	729	349	–314	–	–	–	–	765
Other current and non-current financial liabilities	3,136	147	–546	–	–38	–16	–	2,683
Financial liabilities	**12,597**	**497**	**–1,792**	**–**	**–463**	**–16**	**–**	**10,823**

"Other changes" relate to the reclassification of bonds owing to a change from long-term to short-term.

In 2017, the repayment of other current and non-current financial debt mainly related to the repayment of liabilities to finance the acquisition of the Sigma-Aldrich Corporation, United States. The repayment of the remaining current and non-current financial debt in the consolidated cash flow statement includes cash changes in assets from derivatives that are not contained in the changes noted above.

The amount of undrawn borrowing facilities that could be tapped for future operating activities and to meet obligations is disclosed in Note (35) "Financial liabilities/capital management".

Other Disclosures

(42) Related-party disclosures

Related parties in respect of the Group are E. Merck KG, Darmstadt, Germany, Emanuel-Merck-Vermögens-KG, Darmstadt, Germany, and E. Merck Beteiligungen KG, Darmstadt, Germany. Furthermore, direct or indirect subsidiaries of Merck KGaA, Darmstadt, Germany, associates of the Group, jointly controlled companies where the 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, Darmstadt, Germany, the Executive Board and the Board of Partners of E. Merck KG, Darmstadt, Germany, 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, 2018, there were liabilities by Merck Financial Services GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany, Merck KGaA, Darmstadt, Germany, and Merck & Cie, Altdorf, Switzerland, to E. Merck KG, Darmstadt, Germany, in the amount of € 1,331.6 million (December 31, 2017: € 1,349.2 million). The balances result mainly from mutual profit transfers between Merck KGaA, Darmstadt, Germany, and E. Merck KG, Darmstadt, Germany, as well as the profit transfer by Merck & Cie, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany, to E. Merck KG, Darmstadt, Germany. These included financial liabilities of € 820.8 million (December 31, 2017: € 764.8 million), which were subject to standard market interest rates. As of December 31, 2017, Merck KGaA, Darmstadt, Germany, had receivables from E. Merck Beteiligungen KG, Darmstadt, Germany, in the amount of € 140.9 million and Merck Financial Services GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany, had receivables from Merck Pensionstreuhandverein e.V., Darmstadt, Germany, a related party of Merck KGaA, Darmstadt, Germany, in the amount of € 0.1 million. They included receivables of € 0.1 million that were subject to standard market interest rates. Neither collateral nor guarantees existed for any of the balances either in favor or to the disadvantage of the Group.

From January to December 2018, Merck KGaA, Darmstadt, Germany, performed services for E. Merck KG, Darmstadt, Germany, with a value of € 1.0 million (2017: € 0.9 million) and for E. Merck Beteiligungen KG, Darmstadt, Germany, with a value of € 0.3 million (2017: € 0.1 million); in the previous year, Merck KGaA, Darmstadt, Germany, performed services for Emanuel-Merck-Vermögens-KG, Darmstadt, Germany, with a value of € 0.2 million. During the same period, E. Merck KG, Darmstadt, Germany, performed services for Merck KGaA, Darmstadt, Germany, with a value of € 0.5 million (2017: € 0.5 million).

As of December 31, 2018, there were no receivables or liabilities from the Venezuelan entities deconsolidated as of February 29, 2016 (December 31, 2017: receivables with a carrying amount of € 22.7 million after impairment losses and liabilities with a carrying amount of € 21.5 million).

As of December 31, 2018, there were receivables of € 12.0 million (December 31, 2017: € 8.3 million) and liabilities of € 10.1 million (December 31, 2017: € 9.1 million) vis-à-vis non-consolidated subsidiaries. From January to December 2018, the Group generated revenues of € 0.1 million (December 31, 2017: € 0.1 million) with these companies. During the same period, expenses amounting to € 0.3 million (December 31, 2017: € 0.8 million) were incurred as a result of transactions with these companies.

Between January and December 2018, sales of € 0.7 million (2017: € 0.6 million) from supplies of goods resulted from transactions with Altmann-Analytik GmbH & Co. KG, Munich, which is controlled by a member of the Supervisory Board of Merck KGaA, Darmstadt, Germany, who also served as a member of the Board of Partners of E. Merck KG, Darmstadt, Germany, until January 27, 2019. As of December 31, 2018, there were receivables of € 0.1 million vis-à-vis this company (December 31, 2017: € 0.1 million).

Information on pension funds that are classified as defined benefit plans in accordance with IAS 19 can be found in Note (25) "Provisions for pensions and other post-employment benefits".

Information on Executive Board and Supervisory Board compensation can be found in Note (43) "Executive Board and Supervisory Board compensation". Activities above and beyond those set forth in Note (43) such as, for example, the provision of services or the granting of loans, between companies of the Group and members of the Executive Board or the Supervisory Board of Merck KGaA, Darmstadt, Germany, the Executive Board or the Board of Partners of E. Merck KG, Darmstadt, Germany, or members of their immediate families took place neither in 2018 nor 2017.

(43) Executive Board and Supervisory Board compensation

The compensation of the Executive Board of Merck KGaA, Darmstadt, Germany, is basically paid by the general partner, E. Merck KG, Darmstadt, Germany. Furthermore, companies included in these consolidated financial statements recorded expenses for the period from January to December 2018 in the amount of € 3.2 million (2017: € 3.5 million) for services provided by members of the Executive Board of Merck KGaA, Darmstadt, Germany, at those companies.

For the period from January to December 2018, fixed salaries of € 5.9 million (2017: € 6.0 million), variable compensation of € 17.2 million (2017: € 16.3 million), and additional benefits of € 0.4 million (2017: € 0.3 million) were recorded for members of the Executive Board of Merck KGaA, Darmstadt, Germany, by E. Merck KG, Darmstadt, Germany, and by companies included in these consolidated financial statements. Furthermore, additions to provisions for the Long-Term Incentive Plan for members of the Executive Board of Merck KGaA, Darmstadt, Germany, resulted in expense of € 15.9 million from (2017: gains of € 1.8 million from the release of provisions), and additions to the pension provisions for members

of the Executive Board of Merck KGaA, Darmstadt, Germany, included current service costs of € 3.1 million (2017: € 3.2 million) and, in 2017, past service costs of € 0.9 million.

The compensation of the Supervisory Board amounting to € 869.0 thousand (2017: € 868.3 thousand) consisted of a fixed portion of € 822.5 thousand (2017: € 822.5 thousand) and meeting attendance compensation of € 46.5 thousand (2017: € 45.8 thousand).

Further individualized information and details can be found in the Compensation Report on pages 168 et seq.

(44) Auditor's fees

The costs of the auditors (KPMG) of the financial statements of the Group consisted of the following:

	2018		2017	
€ million	Group	thereof: KPMG AG Wirtschaftsprüfungsgesellschaft, Germany	Group	thereof: KPMG AG Wirtschaftsprüfungsgesellschaft, Germany
Audits of financial statements	10.0	3.5	8.5	2.4
Other audit-related services	0.4	0.2	0.3	0.2
Tax consultancy services	0.9	0.4	0.6	0.4
Other services	–	–	1.0	0.9
	11.3	**4.1**	**10.4**	**3.9**

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.

(45) 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.emdgroup.com/investors → Corporate governance in March 2018 and thus made permanently available.

(46) Companies opting for exemption under section 264 (3) HGB or section 264b HGB

The following companies, which have been consolidated in these financial statements, opted for exemption:

- Allergopharma GmbH & Co. KG, Reinbek
- Allergopharma Verwaltungs GmbH, Darmstadt
- Biochrom GmbH, Berlin
- Chemitra GmbH, Darmstadt
- Litec-LLL GmbH, Greifswald
- Merck 12. Allgemeine Beteiligungs-GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck 16. Allgemeine Beteiligungs-GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck 20. Allgemeine Beteiligungs-GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Accounting Solutions & Services Europe GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Chemicals GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Export GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Healthcare KGaA, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Life Science Germany GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Life Science GmbH, Eppelheim, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Patent GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Performance Materials Germany GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Real Estate GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany
- Merck Serono GmbH, Darmstadt, Germany, a subsidiary of Merck KGaA, Darmstadt, Germany

(47) Information on preparation and approval

The Executive Board of Merck KGaA, Darmstadt, Germany, prepared the consolidated financial statements on February 14, 2019, and approved them for forwarding to the Supervisory Board. The Supervisory Board has the responsibility to examine the consolidated financial statements and to declare whether it approves them.

(48) Subsequent events

On February 5, 2019, the Group signed an agreement with a subsidiary of GlaxoSmithKline plc, United Kingdom, (GSK) to co-develop and co-commercialize the immuno-oncology drug candidate M7824. A bifunctional fusion protein, M7824 is currently an investigational candidate for several types of cancer. Of particular note is a Phase II study to investigate M7824 as a first-line treatment in patients with PD-L1-expressing advanced non-small cell lung cancer (NSCLC).

After receipt of the required anti-trust approvals, the Group will receive an upfront payment of € 300 million from GSK and, depending on data from the lung cancer trial program, is eligible to receive potential payments totaling as much as € 500 million for development milestones. In addition, the Group can receive future payments as high as € 2.9 billion for the achievement of certain milestones related to approval and commercialization. The Group expects that part of the upfront payment in 2019 will be recognized as other operating income.

The two companies will jointly develop and commercialize M7824. In case of regulatory approval, the Group will realize the net sales in the United States and GSK in all other countries. The collaboration partners will evenly split the net result from net sales less defined expense components.

Subsequent to the balance sheet date, no further events of special importance occurred that could have a material impact on the net assets, financial position and results of operations.

Accounting and Measurement Policies

(49) Effects from new accounting standards and other presentation and measurement changes

FIRST-TIME APPLICATION OF IAS 29 "FINANCIAL REPORTING IN HYPERINFLATIONARY ECONOMIES" IN ARGENTINA

During the financial year under review, Argentina was classified as a hyperinflationary economy in accordance with IAS 29. Therefore, the respective non-monetary items disclosed in the consolidated balance sheet as of January 1, 2018, were no longer carried at historical cost, but on the basis of current costs, adjusted for the inflationary effects in previous periods. In accordance with IAS 21 "Effects of Changes in Foreign Exchange Rates", financial statement figures from previous years reported in non-hyperinflationary reporting currencies have not been adjusted. Further information can be found in Note (52) "Currency translation".

CHANGES TO ACCOUNTING AND MEASUREMENT PRINCIPLES APPLICABLE TO INTEREST AND PENALTIES RELATED TO INCOME TAXES

IAS 12 "Income Taxes" shall be applied to interest and penalties related to income taxes only if these items are based on profit before tax. In all other cases, such items are within the scope of application of IAS 37 "Provisions, Contingent Liabilities and Contingent Assets". Therefore, all obligations in connection with interest and penalties related to income taxes that are within the scope of application of IAS 37 are disclosed separately under the "other provisions" item in the consolidated balance sheet. This applies in particular to interest payables which are related to income tax obligations. Adjustments of figures pertaining to previous years are disclosed in the column "Reclassification of interest and penalties related to income taxes", in the section "Effects of changed accounting and measurement policies on the consolidated balance sheet as of December 31, 2017, and January 1, 2018". Further information can be found in Note (26) "Other provisions". There were no changes in the disclosure of income and expenses from interest and penalties in connection with income taxes, given that these items were previously not disclosed within income taxes.

CHANGES TO ACCOUNTING AND MEASUREMENT PRINCIPLES RESULTING FROM IFRS 9 "FINANCIAL INSTRUMENTS"

IFRS 9 sets forth new rules for classification and measurement of financial instruments and the impairment of financial assets as well as for hedge accounting. The modified retrospective method was used for the adoption of IFRS 9 at the Group, with the exception of the provisions for hedge accounting. In the case of hedging relationships where the Group used options as hedging instruments, the first-time application of IFRS 9 was made retrospectively, as required, by disclosing comparative information for prior periods (see "Adjustments of prior periods" in this Note). In the case of hedging relationships where the Group used forward contracts as hedging instruments, the new IFRS 9 rules were applied for the first time using the prospective method.

Classification and measurement

According to IFRS 9, the classification and measurement of financial assets are determined by the business model of the company and the characteristics of the cash flows of the respective financial asset. Upon initial recognition, a financial asset is designated either as "at amortized cost", "at fair value through other comprehensive income" or "at fair value through profit or loss".

For equity instruments held as of January 1, 2018, that are not held for trading, the Group has uniformly exercised the option of recognizing future changes in fair value in other comprehensive income in the consolidated statement of comprehensive income, and thus retaining them in consolidated equity upon disposal of the financial instrument.

The first-time application of IFRS 9 did not lead to any material changes in the disclosure of financial liabilities.

Impairments

The first-time application of IFRS 9 resulted in the application of a new impairment model which takes into account expected credit losses already at initial recognition of a financial asset. This accounting change leads to an earlier recognition of impairment losses for financial assets. The following financial assets are affected by the new impairment model:

- Trade accounts receivable
- Contract assets
- Other debt instruments measured at amortized cost
- Debt instruments measured at fair value through other comprehensive income

The Group uses the simplified impairment model for trade accounts receivable and contract assets pursuant to which any credit losses expected to occur over the entire lifetime of the relevant financial assets are taken into account. Further information can be found in Note (60) "Financial assets".

Hedge accounting

The Group applied the hedge accounting provisions of IFRS 9 effective January 1, 2018, and did not opt for the option to continue to apply IAS 39. The existing hedging relationships were continued, even after the first-time application of IFRS 9.

The adjustments relevant to the Group arising from the first-time application of the IFRS 9 provisions regarding hedge accounting are presented below:

- In the case of hedging relationships where the Group uses options as hedging instruments, only the intrinsic value of options has been designated as the hedging instrument since the first-time application of IFRS 9. Changes in the fair value of the time value component of options that are used for hedge accounting have to be recognized in other comprehensive income and in a new reserve for hedging costs within equity. The subsequent accounting of these amounts depends on the type of the hedged transaction. The table presented under "Adjustments of prior periods" shows the effects on the affected financial statement components arising from the retrospective application of the hedging approach in accordance with IFRS 9.
- In the case of hedging relationships where the Group uses forward contracts as hedging instruments, only the spot element is designated as a hedging instrument. Changes in the fair value of the forward element in forward contracts are initially recognized in a new reserve for hedging costs within equity. The subsequent accounting of these amounts depends on the type of the hedged transaction. These amendments did not have any impact on the consolidated balance sheet as of January 1, 2018.

The following reclassifications and measurement effects upon first-time application of IFRS 9 resulted from the change in the classification and measurement of financial assets as well as the amended impairment requirements:

RECONCILIATION OF FINANCIAL ASSETS FROM IAS 39 TO IFRS 9 AS OF JANUARY 1, 2018

€ million

	Measurement category		
Consolidated balance sheet item	IAS 39	IFRS 9	Explanation
Cash and cash equivalents	Cash and cash equivalents	Subsequent measurement at amortized cost	
Trade accounts receivable	Loans and receivables	Subsequent measurement at amortized cost	→ a
Current financial assets	Loans and receivables	Subsequent measurement at amortized cost	
	Available-for-sale financial assets	Subsequent measurement at fair value through other comprehensive income (debt instruments)	→ b
	Derivatives without a hedging relationship	Derivatives without a hedging relationship	
Other current financial assets	Loans and receivables	Subsequent measurement at amortized cost	→ a
	Derivatives with a hedging relationship	Derivatives with a hedging relationship	
Non-current financial assets	Loans and receivables	Subsequent measurement at amortized cost	
	Derivatives without a hedging relationship	Derivatives without a hedging relationship	
	Available-for-sale financial assets	Subsequent measurement at fair value through profit or loss (debt instruments)	→ c+d
		Subsequent measurement at fair value through other comprehensive income (debt instruments)	→ e
Other non-current financial assets	Loans and receivables	Subsequent measurement at amortized cost	
	Derivatives without a hedging relationship	Derivatives without a hedging relationship	
	Derivatives with a hedging relationship	Derivatives with a hedging relationship	
Financial assets			
Adjustments from the first-time application of IFRS 9			

			Retained earnings		Gains/losses recognized in equity	
Carrying amount in accordance with IAS 39 Dec. 31, 2017	Remeasurement due to the application of the impairment model	**Carrying amount in accordance with IFRS 9 Jan. 1, 2018**	Retained earnings/ net retained profit effect Jan. 1, 2018	Fair value reserve for equity instrustuments Jan. 1, 2018	Available-for-sale financial assets Jan 1, 2018	Fair value reserve for debt instruments Jan. 1, 2018
589		**589**	–	–	–	–
2,923	–15	**2,908**	–13	–	–	–
47		**47**	–	–	–	–
35		**35**	–	–	1	–1
9		**9**	–	–	–	–
247	–1	**246**	–1	–	–	–
30		**30**	–	–	–	–
12		**12**	–	–	–	–
13		**13**	–	–	–	–
420		**297**	8	–	–8	–
		123	29	–6	–23	–
29		**29**	–	–	–	–
46		**46**	–	–	–	–
15		**15**	–	–	–	–
4,415	**–16**	**4,399**				
			23	**–6**	**–31**	**–1**

The first-time application of IFRS 9 led to the following transition effects:

a) As of January 1, 2018, the first-time application of IFRS 9 led to an increase in impairment losses from expected credit risks of financial assets in the amount of € 16 million (before taking deferred taxes into account). This increase related mainly to trade accounts receivable.
b) Debt instruments in the amount of € 35 million, which represented available-for-sale debt instruments under IAS 39, were designated as measured at "fair value through other comprehensive income" in accordance with IFRS 9. As of January 1, 2018, this reclassification led to a transfer within gains/losses recognized in equity from available-for-sale financial assets to the fair value reserve for debt instruments in the amount of € –1 million.
c) Pursuant to IFRS 9, financial assets from contingent considerations with a carrying amount of € 277 million were designated as debt instruments "measured at fair value through profit or loss". As of January 1, 2018, this reclassification led to a transfer within gains/losses recognized in equity (due to market value fluctuations) from available-for-sale financial assets to retained earnings in the amount of € –1 million.
d) Financial assets from closed investment funds in the amount of € 18 million were designated as "measured at fair value through profit or loss" in accordance with IFRS 9, given their cash flows were not solely payments of principal and interest. As of January 1, 2018, this reclassification led to a transfer within gains/losses recognized in equity (due to market value fluctuations) from available-for-sale financial assets to retained earnings in the amount of € 9 million.
e) Equity instruments with a carrying amount of € 123 million have been recognized at fair value through other comprehensive income in the consolidated statement of comprehensive income. As of January 1, 2018, the first-time application of IFRS 9 resulted in a reclassification, in the amount of € 23 million, from gains/losses recognized in equity (due to available-for-sale financial assets) to equity instruments measured through other comprehensive income. Within retained earnings, an additional amount of € 29 million was reclassified from retained earnings/net retained profit to equity instruments measured through other comprehensive income due to impairment losses recognized through profit or loss in the past.

CHANGES TO ACCOUNTING AND MEASUREMENT PRINCIPLES RESULTING FROM IFRS 15 "REVENUE FROM CONTRACTS WITH CUSTOMERS"

IFRS 15 defines comprehensive principles for revenue recognition as well as for the provision of information about the nature, amount, timing and uncertainty of revenue from contracts with customers. Since the Group generates approximately 95% of its revenues from contracts on the sale of goods that usually have a simple structure and normally do not constitute long-term contracts, the first-time application of IFRS 15 only had minor effects on the Group's assets, liabilities, financial position, and financial performance.

Within the context of the introduction of IFRS 15, the Group made use of the option to apply the modified first-time application method and thus recognized the cumulative adjustments in retained earnings as of January 1, 2018. Comparative information for prior periods was not disclosed under IFRS 15. The changes to the accounting and measurement principles as well as the resulting adjustment effects from the first-time application of IFRS 15 and the impact on equity as of January 1, 2018, or the consolidated income statement, were as follows:

- Timing of transfer of control: In the case of specific supplies of goods, the transfer of control and thus the timing of revenue recognition in accordance with IFRS 15 occurred later than the transfer of risks and rewards within the meaning of IAS 18. As of January 1, 2018, inventories and contract liabilities for the supply of goods were recognized for which the related revenues were already recognized in 2017 in accordance with IAS 18. However, these revenues did not meet the criteria for revenue recognition under IFRS 15 as of the date of first-time application. As of January 1, 2018, this led to a reduction in retained earnings in the amount of € 20 million (before tax). The new rules did not have a material impact on the consolidated income statement for fiscal 2018.
- Out-licensing of intellectual property: With the application of IFRS 15, out-licensing intellectual property led, in some cases, to earlier revenue recognition as compared with IAS 18 if the out-licensed intellectual property meets the right-to-use criteria (recognition of revenue at a point in time), rather than right-to-access criteria (recognition over a period of time) and the consideration is not paid in the form of sales- or usage-based royalties. As of January 1, 2018, contract liabilities for licenses were derecognized which would have led to a recognition of revenue at a point in time (at the inception of the license) on the basis of an assessment pursuant to IFRS 15. Accordingly, this led to an increase in retained earnings in the amount of € 17 million (before tax) as of the date of transition. In fiscal 2018, these new rules resulted in a decrease in net sales and in other operating income in the low single-digit million euro range.

- Long-term supply contracts with minimum purchase quantities (take-or-pay contracts): Occasionally, contracts with customers provide for minimum purchase quantities. In such cases, in accordance with IFRS 15, the expected transaction price attributable to the minimum purchase quantity had to be allocated to the individual supplies. However, under IAS 18, revenue was recognized in the amount of the invoiced selling price for the individual supplies. A contract asset was recognized as of January 1, 2018. This led to a corresponding increase in retained earnings by € 4 million (before tax). The impact of these new rules on the consolidated income statement for fiscal 2018 was negligible.
- Multiple-element contracts: Revenues from multiple-element contracts are recognized when the respective contract component is delivered or rendered. In the Life Science business sector, there were multiple-element contracts with service components to a minor extent. In future, the transaction price will have to be allocated in some cases in a different manner than under IAS 18. This led to a slight increase in retained earnings as of January 1, 2018. The impact on the consolidated income statement for fiscal 2018 was negligible.

Besides the adjustment effects described above, the first-time application of IFRS 15 had the following presentation effects on the consolidated balance sheet as of January 1, 2018:

- Sales deductions from refunds related to contracts with customers were reclassified from trade accounts payable into the separate item “Refund liabilities” in the consolidated balance sheet, effective January 1, 2018. Therefore, trade accounts payable declined by € 431 million.
- As of January 1, 2018, discounts that customers were expected to apply when making payments were recognized in the consolidated balance sheet as reductions of trade accounts receivable. This led to a slight reduction in trade accounts payable and trade accounts receivable.
- The presentation of customer refund claims was adjusted according to IFRS 15; since January 1, 2018, assets resulting from expected product returns were presented within other current assets, provided that resale of the returned products was deemed possible. Effective January 1, 2018, this led to a slight increase in trade accounts payable and other current assets.

Moreover, the new rules of IFRS 15 in the following areas were of no relevance – or only very minor relevance – for the Group:

- variable consideration
- revenue recognition over time for long-term service contracts and customer-specific construction contracts
- consignment arrangements
- collaboration agreements
- costs of obtaining or fulfilling a contract
- principal-agent relationships
- bill-and-hold arrangements
- financing components
- barter transactions
- repurchase agreements
- separate performance obligations from transportation or other logistic services

The following table shows the consolidated income statement in the reporting period had IAS 18 been applied on an ongoing basis:

	2018		
€ million	**IFRS 15 (as reported)**	Reconciliation to IAS 18	IAS 18
Net sales	**14,836**	**–6**	**14,830**
Cost of sales	–5,382	3	–5,379
Gross profit	**9,454**	**–3**	**9,451**
Other operating income	627	1	628
Other income and expenses/financial result	–8,621	–	–8,621
Profit before income tax	**1,461**	**–2**	**1,459**
Income tax	–368	–1	–369
Profit after tax from continuing operations	**1,093**	**–3**	**1,090**
Profit after tax from discontinued operation	**2,303**	**2**	**2,305**
Profit after tax	**3,396**	**–1**	**3,395**

EFFECTS OF CHANGED ACCOUNTING AND MEASUREMENT POLICIES ON RESERVES AS OF DECEMBER 31, 2017, AND JANUARY 1, 2018

The following table shows the effects of the first-time application of IAS 29, IFRS 9 and IFRS 15 on reserves as of December 31, 2017, and January 1, 2018, respectively.

€ million	
December 31, 2017 (as reported)	**12,357**
IFRS 9 (after income tax)	**1**
Hedge accounting (mandatory retrospective adoption)	1
December 31, 2017 (restated)/January 1, 2018 (before adjustments)	**12,358**
IFRS 9 (before income tax)	**16**
Reclassification of financial assets	32
Expected credit loss on trade accounts receivable and other debt instruments	–16
Income tax effect IFRS 9	**2**
IFRS 15 (before income tax)	**2**
Timing of transfer of control from the sale of goods	– 20
Out-licensing of intellectual property	17
Take-or-pay contracts	4
Multiple-element arrangements	1
Income tax effect IFRS 15	**–2**
IAS 29 (after income tax)	**4**
Hyperinflation in Argentina	4
January 1, 2018 (restated)	**12,379**

EFFECTS OF CHANGED ACCOUNTING AND MEASUREMENT POLICIES ON THE CONSOLIDATED BALANCE SHEET AS OF DECEMBER 31, 2017, AND JANUARY 1, 2018

The following table shows the effects of the aforementioned changes to the accounting and measurement principles on the consolidated balance sheet.

		IFRS 9	IAS 12/IAS 37	
€ million	**Dec. 31, 2017 (as reported)**	Reclassification (mandatory retrospective adoption)	Reclassification of interest and penalties related to income taxes	**Dec. 31, 2017 (restated)/ January 1, 2018 (before adjustments)**
Non-current assets				
Goodwill	13,582	–	–	13,582
Other intangible assets	8,317	–	–	8,317
Property, plant and equipment	4,512	–	–	4,512
Non-current financial assets	444	–	–	444
Other non-current assets	205	–	–	205
Deferred tax assets	1,106	–	–	1,106
	28,166	–	–	**28,166**
Current assets				
Inventories	2,632	–	–	2,632
Trade accounts receivable	2,923	–	–	2,923
Current financial assets	90	–	–	90
Other current assets	731	–	–	731
Income tax receivables	490	–	–	490
Cash and cash equivalents	589	–	–	589
Assets held for sale	–	–	–	–
	7,455	**–**	**–**	**7,455**
Total assets	**35,621**	**–**	**–**	**35,621**
Total equity				
Equity capital	565	–	–	565
Reserves	12,357	1	–	12,358
Gains/losses recognized in equity	1,082	–1	–	1,081
Equity attributable to shareholders of Merck KGaA, Darmstadt, Germany	**14,003**	**–**	**–**	**14,003**
Non-controlling interests	63	–	–	63
	14,066	**–**	**–**	**14,066**
Non-current liabilities				
Provisions for pensions and other post-employment benefits	2,257	–	–	2,257
Other non-current provisions	788	–	–	788
Non-current financial liabilities	8,033	–	–	8,033
Other non-current liabilities	354	–	–	354
Deferred tax liabilities	1,489	–	–	1,489
	12,919	**–**	**–**	**12,919**
Current liabilities				
Current provisions	414	–	43	457
Current financial liabilities	2,790	–	–	2,790
Trade accounts payable	2,195	–	–	2,195
Refund liabilities		–	–	
Income tax liabilities	1,059	–	–43	1,016
Other current liabilities	2,175	–	–	2,175
Liabilities directly related to assets held for sale	–	–	–	–
	8,635	**–**	**–**	**8,635**
Total equity and liabilities	**35,621**	**–**	**–**	**35,621**

IFRS 9		IFRS 15		IAS 29	
Reclassification	Remeasurement	Reclassification	Remeasurement	Remeasurement	**Jan. 1, 2018 (after adjustments)**
–	–	–	–	1	13,582
–	–	–	–	–	8,317
–	–	–	–	2	4,514
–	–	–	–	–	444
–	–	–	–	–	205
–	1	–	–2	–	1,105
–	**1**	**–**	**–2**	**2**	**28,167**
–	–	–	5	2	2,639
–	–15	–4	–	–	2,904
–	–	–	–	–	90
	–1	1	4	–	735
–	–	–	–	–	490
–	–	–	–	–	589
–	–	–	–	–	–
–	**–16**	**–3**	**9**	**2**	**7,447**
–	**–15**	**–3**	**7**	**5**	**35,614**
–	–	–	–	–	565
32	–15	–	–	4	12,379
–32		–	–	–	1,049
–	**–15**	**–**	**–**	**4**	**13,992**
–	–	–	–	–	63
–	**–15**	**–**	**–**	**4**	**14,055**
–	–	–	–	–	2,257
–	–	–	–	–	788
3	–	–	–	–	8,036
–3	–	–	–17	–	334
–	–	–	–	1	1,489
–	**–**	**–**	**–17**	**1**	**12,903**
–	–	–		–	457
–	–	–		–	2,790
–	–	–434		–	1,761
–	–	431		–	431
–	–	–		–	1,016
–	–	–	25	–	2,200
–	–	–	–	–	–
–	**–**	**–3**	**25**	**–**	**8,657**
–	**–15**	**–3**	**7**	**5**	**35,614**

ADJUSTMENTS OF PREVIOUS PERIODS

	2017			
€ million	as reported	IFRS 9 adjustment	IFRS 5 adjustment	adjusted
Consolidated Income Statement				
Net sales	**15,327**	**–**	**–809**	**14,517**
Cost of sales	–5,320	–	249	–5,071
Gross profit	**10,007**	**–**	**–560**	**9,446**
Marketing and selling expenses	–4,702	–	353	–4,349
Administration expenses	–930	–	31	–899
Research and development costs	–2,140	–	32	–2,108
Other operating income	1,227	–	–14	1,212
Other operating expenses	–937	–	56	–880
Operating result (EBIT)[1]	**2,525**	**–**	**–102**	**2,423**
Financial result	–300	5	1	–294
Profit before income tax	**2,224**	**5**	**–101**	**2,129**
Income tax	386	–1	43	428
Profit after tax from continuing operations	**2,610**	**4**	**–57**	**2,557**
Profit after tax from discontinued operation	**–**	**–**	**57**	**57**
Profit after tax	**2,610**	**4**	**–**	**2,615**
thereof: attributable to shareholders of Merck KGaA, Darmstadt, Germany (net income)	2,600	4	–	2,605
thereof: attributable to non-controlling interests	10	–	–	10
Earnings per share in € (basic/diluted)				
– attributable to continuing operations	5.98	0.01	–0.12	5.87
– attributable to discontinued operation	–	–	0.12	0.12
Consolidated Statement of Comprehensive Income				
Profit after tax	**2,610**	**4**	**–**	**2,615**
Items of other comprehensive income that may be reclassified to profit or loss in subsequent periods:				
Cost of cash flow hedge reserve				
Fair value adjustments	–	–5	–	–5
Tax effect	–	1	–	1
Other comprehensive income	**–1,843**	**–4**	**–**	**–1,847**
Comprehensive income	**767**	**–**	**–**	**767**
Consolidated Cash Flow Statement				
Profit after tax	**2,610**	**4**	**–**	**2,615**
Other non-cash income and expenses	–3	–4	–	–7
Net cash flows from operating activities	**2,696**	**–**	**–**	**2,696**

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

Group € million	2017 as reported	IFRS 5 adjustment	 adjusted
Reconciliation of EBIT[1] to EBITDA pre[1]			
Operating result (EBIT)[1]	**2,525**	**–102**	**2,423**
Depreciation/amortization/impairment losses/reversals of impairments	1,758	–17	1,741
EBITDA[1]	**4,282**	**–118**	**4,164**
Restructuring expenses	84	–23	61
Integration expenses/IT expenses	189	–1	188
Gains (+)/losses (–) on the divestment of businesses	–310	–	–310
Acquisition-related adjustments	63	–	63
Other adjustments	106	–26	81
EBITDA pre[1]	**4,414**	**–168**	**4,246**
Business free cash flow[1]			
EBITDA pre[1]	4,414	–168	4,246
Investments in property, plant and equipment, software as well as advance payments for intangible assets	–1,047	35	–1,012
Changes in inventories	–23	5	–18
Changes in trade accounts receivable as well as receivables from royalties and licenses	–24	2	–22
Elimination first-time consolidation of BioControl Systems	–2	–	–2
Business free cash flow[1]	**3,318**	**–125**	**3,193**

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

Healthcare € million	2017 as reported	IFRS 5 adjustment	 adjusted
Financial performance			
Net sales	**6,999**	**–809**	**6,190**
Cost of sales	–1,587	248	–1,340
Gross profit	**5,412**	**–562**	**4,850**
Marketing and selling expenses	–2,722	349	–2,373
Administration expenses	–299	28	–271
Research and development costs	–1,632	32	–1,600
Other operating income and expenses	688	43	731
Operating result (EBIT)[1]	**1,447**	**–111**	**1,337**
Depreciation/amortization/impairment losses/reversals of impairments	708	–17	691
EBITDA[1]	**2,155**	**–127**	**2,028**
Restructuring expenses	40	–23	17
Integration expenses/IT expenses	28	–	27
Gains (+)/losses (–) on the divestment of businesses	–316	–	–316
Acquisition-related adjustments	–	–	–
Other adjustments	42	–26	16
EBITDA pre[1]	**1,949**	**–177**	**1,773**
Business free cash flow[1]			
EBITDA pre[1]	1,949	–177	1,773
Investments in property, plant and equipment, software as well as advance payments for intangible assets	–411	35	–375
Changes in inventories	–39	5	–34
Changes in trade accounts receivable as well as receivables from royalties and licenses	–51	2	–49
Business Free Cash Flow[1]	**1,448**	**–134**	**1,314**

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

(50) Measurement policies

The main assets and liabilities disclosed in the consolidated balance sheet are measured as follows:

Balance sheet item	Measurement principle
Assets	
Goodwill	Amortized cost (subsequent measurement: impairment-only approach)
Other intangible assets	
With finite useful life	Amortized cost
With indefinite useful life or not yet available for use	Amortized cost (subsequent measurement: impairment-only approach)
Property, plant and equipment	Amortized cost
Financial assets (current/non-current)[1]	
Equity instruments	Fair value
Debt instruments	Amortized cost or fair value, depending on the business model (see Note (60) "Financial assets").
Derivative assets (financial transactions)	Fair value
Other assets (current/non-current)	
Other receivables (financial instruments)[1]	Amortized cost
Derivative assets (operative)[1]	Fair value
Non-financial items	Amortized cost
Deferred tax assets	Undiscounted measurement based on tax rates that are expected to apply to the period when the asset is realized or the liability is settled
Inventories	Lower of cost and net realizable value
Trade accounts receivable (without lease receivables)[1]	Amortized cost
Lease receivables	According to IAS 17 (see Note (59) "Leasing")
Income tax receivables	Expected tax refunds based on tax rates that have been enacted or substantively enacted by the end of the reporting period
Cash and cash equivalents[1]	Amortized cost
Assets held for sale	Lower of carrying amount and fair value less costs to sell

[1] As from January 1, 2018, in accordance with IFRS 9; see Note (49) “Effects from new accounting standards and other presentation and measurement changes”.

Balance sheet item	Measurement principle
Equity and liabilities	
Provisions for pensions and other post-employment benefits	Projected unit credit method
Other provisions (current/non-current)	Present value of the expenditures expected to be required to settle the obligation
Financial liabilities (current/non-current)	
Bonds and commercial paper	Amortized cost
Bank loans	Amortized cost
Liabilities to related parties	Amortized cost
Loans from third parties and other financial liabilities	Amortized cost
Liabilities from derivatives (financial transactions)[1]	Fair value
Finance lease liabilities	Amortized cost
Other liabilities (current/non-current)	
Liabilities from derivatives (operative)[1]	Fair value
Liabilities from non-income related taxes	Settlement amount
Other liabilities	Settlement amount
Deferred tax liabilities	Undiscounted measurement based on tax rates that are expected to apply to the period when the asset is realized or the liability is settled
Trade accounts payable	Amortized cost
Refund liabilities	Expected reimbursement amount
Income tax liabilities	Expected tax payments based on tax rates that have been enacted or substantively enacted by the end of the reporting period
Liabilities directy related to assets held for sale	Fair value

[1] As from January 1, 2018, in accordance with IFRS 9; see Note (49) "Effects from new accounting standards and other presentation and measurement changes".

(51) Consolidation methods

The consolidated financial statements are based on the single-entity financial statements of the consolidated companies as of the balance sheet date, which were prepared applying consistent accounting policies in accordance with IFRSs.

Acquisitions were accounted for using the purchase method in accordance with IFRS 3. In cases where a company was not acquired in full, non-controlling interests were measured using the fair value of the proportionate share of net assets. The option to measure non-controlling interests at fair value on the date of their acquisition (full goodwill method) was not utilized.

When additional shares in non-controlling interests are acquired, the purchase price amount that exceeds the carrying amount of this interest was offset directly in equity.

IFRS 11 was applied for joint arrangements. A joint arrangement exists when, on the basis of a contractual arrangement, the Group and third parties jointly control business activities. Joint control means that decisions about the relevant activities require unanimous consent. Joint arrangements are either joint operations or joint ventures. Revenues and expenses as well as assets and liabilities from joint operations were included in the consolidated financial statements in accordance with the Group's rights and obligations. By contrast, interests in joint ventures as well as in material associates over which the Group has significant influence were recognized in accordance with IAS 28 using the equity method of accounting.

Intragroup sales, expenses and income, as well as all receivables and payables between the consolidated companies, are eliminated. The effects of intragroup deliveries reported under non-current assets and inventories are adjusted by eliminating any intragroup profits. In accordance with IAS 12, deferred taxes are applied to these consolidation measures.

(52) Currency translation

The functional currency concept applies to the translation of financial statements of consolidated companies prepared in foreign currencies. The subsidiaries of the Group generally conduct their operations independently. The functional currency of these companies is normally the respective local currency. Assets and liabilities are measured at the closing rate, and income and expenses are measured at weighted average annual rates in euros, the reporting currency. Any currency translation differences arising during consolidation of Group companies are recognized in equity. If Group companies are deconsolidated, existing currency differences are reversed and reclassified to profit or loss.

When the financial statements of consolidated companies are prepared, business transactions that are conducted in currencies other than the functional currency are disclosed using the current exchange rate on the date of the transaction. Foreign currency monetary items (cash and cash equivalents, receivables and payables) in the year-end financial statements of the consolidated companies prepared in the functional currency are translated at the respective closing rates. Exchange differences from the translation of monetary items are recognized in the income statement with the exception of net investments in a foreign operation.

Currency translation was based on the following key exchange rates:

	Average annual rate		Closing rate	
€ 1 =	**2018**	2017	**Dec. 31, 2018**	Dec. 31, 2017
Chinese renminbi (CNY)	7.815	7.621	7.869	7.791
Japanese yen (JPY)	130.372	126.921	126.131	134.669
Swiss franc (CHF)	1.153	1.112	1.128	1.168
South Korean won (KRW)	1,294.331	1,275.143	1,271.164	1,275.923
Taiwan dollar (TWD)	35.544	34.398	34.958	35.538
U.S. dollar (USD)	1.181	1.130	1.144	1.195

Since July 2018, Argentina's economy has been classified as hyperinflationary in accordance with IAS 29 "Financial Reporting in Hyperinflationary Economies". Accordingly, the Group's business activities in Argentina were no longer disclosed at historical cost, but were restated retrospectively for the entire reporting year, adjusted for inflation. For this purpose, the Group used a dedicated index combining the wholesale index IPIM (Índice de precios internos al por mayor) and the consumer price index IPC (Índice de precios al consumidor). As of the balance sheet date, the Group's dedicated index stood at 2,462.1 (January 1, 2018: 1,656.6).

(53) Recognition of net sales and other income

Depending on the business sector, the Group uses various distribution channels to provide its products. In the Healthcare business sector, pharmaceutical prescription products are often sold to specialized wholesalers and distributors, and to a lesser extent directly to pharmacies, physicians or hospitals. In the Life Science and Performance Materials business sectors, products are largely sold to business customers, and to a lesser extent to distributors.

Net sales and other income are recognized when (or as) the customer obtains control of the asset. In the case of product sales, 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, the Group 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, i.e. as soon as the Group has invoiced the respective products and the additional criteria laid out in IFRS 15. B81 are fulfilled. In the case of sales of hardware and equipment in the Life Science business sector, the revenue recognition criteria 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.

In addition to revenue from the sale of goods, net sales also include commission income, profit-sharing participations, revenue from services, and – in the Life Science business sector – license income, but the volume involved is insignificant.

For service contracts, and customer-specific equipment construction contracts, revenue is recognized over time, based on the progress towards complete satisfaction of the performance obligation, provided that the Group has an enforceable right to payment for performance completed to date. The progress is mostly determined according to the cost-to-cost method, and the milestones achieved as at 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 not presented within net sales, but within other operating income. If the license represents a separate performance obligation, it must be determined whether a right-to-use asset (recognition of revenue at a point in time), or an access right (recognition over a period of time), is transferred to the customer. Irrespective of the classification of licenses, sales- or usage-based royalties are recognized only after the customer makes the corresponding disposals, or uses the corresponding intellectual property.

Net sales from contracts comprising several separate performance obligations (particularly sales of goods in combination with services) are recognized when the respective obligation has been fulfilled. 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.

Dividend income is recognized when the right of dividend payment is established, when it is considered probable that the economic benefit attributable to the dividend payment will flow to the Group, and when the dividend payment can be measured reliably.

Net sales are recognized net of sales-related taxes and sales deductions. When net sales are recognized, estimated amounts are taken into account for sales deductions, for example rebates, discounts and returns. Payments to customers are generally recognized as sales deductions, unless the payments are made for distinct goods or services provided by the customer, provided that their value does not exceed the fair value of the goods or services received by the Group.

Sales deductions, such as discounts provided on the invoice as price-reducing items, which will likely be applied by customers when making the respective payments, are recognized in the consolidated balance sheet as reductions of trade accounts receivable. Expected refunds, such as bonus payments, reimbursements for returns, or rebates from health plans and programs, are recognized in the separate item "refund liabilities" in the consolidated balance sheet (see Note (30) "refund liabilities").

Given that the Group generates the large majority of its revenue via sales 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 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 in the consolidated balance sheet until revenue is recognized. A contract asset is recognized for an over-time realization of sales of services and customer-specific equipment/hardware if the Group does not have an unconditional right to payment until complete fulfillment of the contractual services.

The Group uses the following practical expedients of IFRS 15:

- 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 to up to one year.
- Expected revenue from contracts with customers is not disclosed for contracts with a term of up to one year.

Please refer to the Annual Report 2017 for further information on the accounting and measurement principles applied in the previous year with regard to the recognition of net sales and other income.

(54) Collaboration agreements, in-licensing and out-licensing in the Healthcare business sector

In the Healthcare business sector, the Group regularly enters into collaboration agreements, as well as in-licensing and out-licensing contracts, in particular with research institutions, pharmaceutical and biotechnology companies. In the majority of cases, the Group acquires rights to the intellectual property of the respective contract parties against the provision of upfront payments, regulatory or commercial milestone payments, or license fees. The portion of the consideration paid by the Group to acquire intellectual property is recognized as an intangible asset. If additional service is acquired from the contract party – besides intellectual property – an appropriate portion of the consideration is allocated to research and development costs in line with the service performance of the contract party.

In individual cases, the Group enters into collaboration agreements with other pharmaceutical and biotechnology companies whereby both contract parties develop drug candidates on a collaborative basis; in case of regulatory approval, such drugs will be commercialized by both contract parties. As a general rule, such collaboration agreements comprise the granting of rights to intellectual property as well as additional goods or services promised by the Group, such as the provision of development activities or production services. For these activities and services, the Group usually receives consideration from its contract parties, such as upfront payments, or regulatory and commercial milestone payments and license fees (see Note (63) "Contingent consideration"). Furthermore, specific income and expense items are commonly carried collectively amongst the contract parties. When entering into this kind of collaboration agreements, the Group must determine whether the individual promised goods or services are separate performance obligations, or whether they instead must be combined with other performance obligations. Given that the collaboration partner is usually not able to obtain any benefit from the license alone, or from the license in combination with other readily available resources, and considering, moreover, that the individual promised goods or services are invar-

iably not distinct in the context of the contract, the performance obligations are often integrated into bundles, income from which is recognized in this case in other operating income during the period where the material development activities are provided.

Furthermore, collaboration agreements in the pharmaceutical area typically allocate the revenue generated in specific markets, or with specific products, to individual collaboration partners; simultaneously, specific income and expense items are carried by the collaboration partners according to predefined allocation ratios. The Group recognizes the revenue from the sale of products to third-party customers, if it is the principal within the meaning of IFRS 15. Expenses resulting from payments made to collaboration partners in connection with profit-sharing agreements are recognized in other operating expenses. Reimbursements of research and developments costs made between the collaboration partners are recognized in research and development costs. The Group's most important collaboration agreement is the strategic alliance with Pfizer Inc., United States, in the immuno-oncology area (see Note (6) "Collaboration agreements of material significance").

(55) Research and development costs

Research and development costs comprise the costs of 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).

The costs of research cannot be capitalized and are expensed in full in the period in which they are incurred. As internally generated intangible assets, it is necessary to capitalize development expenses if the cost of the internally generated intangible asset can be reliably determined and the asset can be expected to lead to future economic benefits. The condition for this is that the necessary resources are available for the development of the asset, technical feasibility of the asset is given, its completion and use are intended, and marketability is given. Owing to the high risks up to the time that pharmaceutical products are approved, these criteria are not met in the Healthcare business sector regarding the development of drug candidates. Costs incurred after regulatory approval were insignificant and were therefore not recognized as intangible assets. In the Life Science and Performance Materials business sectors, development expenses are capitalized as soon as the aforementioned criteria have been met. Provided the relevant criteria set forth in IAS 38 are fulfilled, software development costs are capitalized.

Reimbursements for R&D are offset against research and development costs.

(56) Goodwill

Goodwill is recognized on the acquisition date in the course of business combinations. Goodwill is measured at cost, and is defined as the excess amount of the purchase price paid for the company shares over the value of the acquired portion of net assets. Net assets are defined as the net balance of the fair values of the acquired identifiable assets, and the assumed liabilities and contingent liabilities.

Goodwill is allocated to cash-generating units or groups of cash-generating units and tested for impairment either annually or if there are indications of impairment. The carrying amounts of the cash-generating units or groups of cash-generating units are compared with their recoverable amounts and impairment losses are recognized where the recoverable amount is lower than the carrying amount.

(57) Other intangible assets

Acquired intangible assets are capitalized at cost. Self-developed intangible assets are only capitalized if the requirements specified by IAS 38 have been met. Intangible assets acquired in the course of business combinations are recognized at fair value on the acquisition date. If the development of intangible assets takes a substantial period of time, the directly attributable borrowing costs incurred up until completion are capitalized as part of the costs.

INTANGIBLE ASSETS WITH INDEFINITE USEFUL LIVES AND INTANGIBLE ASSETS NOT YET AVAILABLE FOR USE

Intangible assets with indefinite useful lives and intangible assets not yet available for use are not amortized; however they are tested for impairment when a triggering event arises or at least once a year. Here, the respective carrying amounts are compared with the recoverable amount and impairments are recognized as required. Impairment losses recognized on indefinite-life intangible assets and intangible assets not yet available for use are reversed if the original reasons for impairment no longer apply.

The marketing authorizations, patents, licenses and similar rights, and other items not yet available for use primarily relate to rights that the Group acquired for active ingredients, products or technologies that are still in development stages. Amortization begins when the product reaches market approval, and is charged on a straight-line basis over the shorter of the patent or contract term and the estimated useful life.

INTANGIBLE ASSETS WITH FINITE USEFUL LIVES

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. Amortization of intangible assets and software is allocated to the functional costs in the consolidated income statement. An impairment test is performed if there are indications of impairment. Impairment losses are determined using the same methodology as for indefinite-life intangible assets. Impairment losses are reversed if the original reasons for impairment no longer apply.

(58) Property, plant and equipment

Property, plant and equipment is measured at cost less depreciation and impairments plus reversals of impairments. The component approach is applied here in accordance with IAS 16. Subsequent costs are only capitalized if it is probable that future economic benefits will arise for the Group and the cost of the asset can be measured reliably. The cost of self-constructed property, plant and equipment is calculated on the basis of the directly attributable unit costs and an appropriate share of overheads. If the construction of property, plant and equipment takes a substantial period of time, the attributable borrowing costs incurred up until completion are capitalized as part of the costs. In accordance with IAS 20, costs are reduced by the amount of government grants in those cases where government grants or subsidies have been paid for the acquisition or manufacture of assets (grants related to assets). Grants related to expenses which no longer offset future expenses are recognized in profit or loss. Property, plant and equipment is depreciated using the straight-line method over the useful life of the asset concerned. Depreciation of property, plant and equipment is based on the following useful lives:

USEFUL LIFE OF PROPERTY, PLANT AND EQUIPMENT

	Useful life
Production buildings	maximum of 33 years
Administration buildings	maximum of 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. If indications of a decline in value exist, an impairment test is performed. If the reasons for an impairment loss no longer exist, a reversal of the impairment loss recognized in prior periods is recognized.

(59) Leasing

Where non-current assets are leased and economic ownership lies with the Group (finance lease), the asset is recognized at the present value of the minimum lease payments or the lower fair value in accordance with IAS 17 and depreciated over its useful life. The corresponding payment obligations from future lease payments are recognized as liabilities. If an operating lease is concerned, the associated expenses are recognized in the period in which they are incurred.

(60) Financial assets

CLASSIFICATION

Since January 1, 2018, the classification and measurement of financial assets are determined by the business model of the company and the characteristics of the cash flows of the respective financial asset in accordance with IFRS 9. Upon initial recognition, a financial asset is designated either as “at amortized cost”, as “at fair value through other comprehensive income” or as “at fair value through profit or loss”.

Financial assets are recognized as at the settlement date. Debt instruments are reclassified only if the business model used to manage such assets has changed. Financial assets with embedded derivatives are considered as one item, provided that the respective cash flows are solely payments of principal and interest.

MEASUREMENT

At initial recognition, the Group recognizes financial assets at fair value, plus any transaction costs directly attributable to the acquisition of such assets – provided the financial assets are subsequently not measured at fair value through profit or loss. However, trade accounts receivable without significant financing components are exempted from this general rule and measured at their transaction price. Transaction costs of assets measured at fair value through profit or loss are recognized as expenses in the consolidated income statement. 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. Provided that the trade accounts receivable are sold, the factoring fees previously recognized directly in equity are recycled through the operating result upon derecognition of the trade accounts receivable sold.

Debt instruments

The following table provides details on the measurement effects of debt instruments on 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 at amortized cost	Operative	Impairment losses, and reversals of impairment losses on financial assets (net)	Other operating income or other operating expenses	Other operating income or other operating expenses	Financial result (applying the effective interest method)
	Financial	Financial result	Financial result	Financial result	
Subsequent measurement at fair value through other comprehensive income	Operative	Impairment losses, and reversals of impairment losses on financial assets (net)	• Results recognized directly in equity (value adjustments) • Recycling of the cumulative results previously recognized directly in equity through the operating result (derecognition) when asset is disposed	Other operating income or other operating expenses	Financial result (applying the effective interest method)
	Financial	Financial result	• Results recognized directly in equity (value adjustments) • Recycling of the cumulative results previously recognized directly in equity through the operating result (derecognition) when asset is disposed	Financial result	
Subsequent measurement at fair value through profit or loss	Operative		Other operating income or other operating expenses	Other operating income or other operating expenses	Financial result (applying the effective interest method)
	Financial		Financial result	Financial result	

Depending on the category of debt instrument, at initial recognition the Group recognizes either the credit losses expected to occur over the entire lifetime or the 12-month expected credit losses. Except debt instruments with subsequent measurement through profit or loss, the impairment model of IFRS 9 is applied to all debt instruments.

The Group uses the simplified impairment model for trade accounts receivable 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 on the basis of the existing credit risk structure and the respective maturity structure. The customer groups with comparable default risks to be taken into account are determined at the Group in accordance with the business sectors and location of the respective customers. The default rates used in the simplified impairment model are derived on the basis of historical experience and current macroeconomic expectations by taking into account country-specific ratings. These country ratings are aggregated to three separate rating groups. In this context, historical default rates generally also represent the best approximation for future expected defaults to the extent that a country's rating remains unchanged. 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. Further information on the impairment of financial assets can be found in Note (38) "Management of financial risks".

Provided that the Group expects default risk to be low, the impairments of all other debt instruments are limited to the 12-month expected credit losses. If the default risk has increased significantly since initial recognition, impairments are increased to the amount of credit losses expected to occur over the entire lifetime of the respective asset. The Group considers default risk to be low if the risk of non-performance is remote and the contract party is able to fulfill its payment obligations at short notice at any time. The probabilities used to establish 12-month expected credit losses, or lifetime expected credit losses, are based on historical default rates, taking current credit ratings into consideration.

Equity instruments

Equity instruments are subsequently measured at fair value.

For equity instruments not held for trading, the Group has uniformly exercised the option of recognizing future changes in fair value in other comprehensive income in the consolidated statement of comprehensive income and thus to retain them in consolidated equity upon disposal of the financial instrument.

Changes in the fair value of equity instruments held for trading are recognized through profit or loss (other operating income/expenses).

Dividend income from equity instruments of both categories is recognized in the consolidated income statement in other operating income. Impairments and impairment reversals of equity instruments are disclosed together with other fair value changes.

DERECOGNITION

The Group derecognizes financial assets if there is no reasonable expectation that the contract party will fulfill its contractual obligations. In this context, the Group takes individual discretionary decisions in order to evaluate whether contract fulfillment can be reasonably expected.

ACCOUNTING AND MEASUREMENT PRINCIPLES APPLIED IN THE PREVIOUS YEAR (IAS 39)

For further information on the accounting and measurement principles applied in the previous year (IAS 39 "Financial instruments: recognition and measurement"), please refer to the Annual Report 2017.

(61) Financial liabilities

OTHER FINANCIAL LIABILITIES

Except for contingent consideration, which only occurs in the context of business combinations in accordance with IFRS 3, and derivatives with negative market values, all financial liabilities are subsequently measured at amortized cost using the effective rate method. The Group primarily assigns financial liabilities such as issued bonds and bank loans, trade payables, and non-derivative current and non-current liabilities to this category.

LIABILITIES SUBSEQUENTLY MEASURED AT FAIR VALUE THROUGH PROFIT OR LOSS

Contingent consideration, as well as derivatives with negative market values, are subsequently measured at fair value. Value changes are recognized through profit or loss.

(62) Derivatives and hedge accounting

The Group applied the hedge accounting provisions of IFRS 9 effective January 1, 2018, and did not opt for the option to continue to apply IAS 39. The existing hedging relationships were continued, even after the first-time application of IFRS 9.

The Group uses derivatives solely to economically hedge recognized assets or liabilities and forecast transactions. The Group applied the hedge accounting rules exclusively to forecast cash flow hedges. Hedging transactions were entered into for highly probable forecast transactions in foreign currencies. 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.

Depending on the nature of the hedged item, changes in the fair values of derivatives used for hedging purposes are recognized in the consolidated income statement either in the operating result or in the financial result.

The Group currently only uses derivatives as hedging instruments. The hedging relationship must be effective at all times, i.e. the change in fair value of the hedging instrument almost fully offsets changes in the fair value of the hedged item. The Group uses the dollar offset method as well as regression analyses to measure hedge effectiveness. Hedging ineffectiveness may occur when the forecast cash flows are made/received, 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 as "financial assets and liabilities at fair value through profit or loss".

In the case of hedging relationships where the Group uses options as hedging instruments, only the intrinsic value of options has been designated as the hedging instrument since the first-time application of IFRS 9. Changes in the fair value of the time value component of options that are used for hedge accounting have to be recognized in other comprehensive income and in a new reserve for cost of hedging within equity. The subsequent accounting of these amounts depends on the type of the hedged transaction.

In the case of hedging relationships where the Group 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 a new reserve for hedging costs within equity. The subsequent accounting of these amounts depends on the type of the hedged transaction.

Reclassifications of 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.

(63) Contingent consideration

For contingent consideration that was contractually agreed with the acquirer or seller within the context of the disposal or the acquisition of businesses within the meaning of IFRS 3, the fair value of the claims or obligations as at the transaction date is recognized as a financial asset or financial liability. The subsequent measurement is at fair value through profit or loss. Contingent consideration in connection with the purchase of individual assets outside of business combinations is recognized as a financial liability only when the consideration is contingent upon future events that are beyond the Group's control. In cases where the payment of contingent consideration is within the Group's control, the liability is recognized only as from the date when a non-contingent obligation arises. Contingent consideration linked to the purchase of individual assets primarily relates to future milestone payments in connection with in-licensed intellectual property in the Healthcare business sector.

Changes in the fair value of financial assets and financial liabilities from contingent consideration are recognized as other operating income or other operating expenses, except for changes due to interest rate fluctuations and the effect from unwinding discounts. Interest rate effects from unwinding of discounts as well as changes due to interest rate fluctuations are recognized in financial income or financial expenses.

(64) Other non-financial assets and liabilities

Other non-financial assets are carried at amortized cost. Impairments are recognized for any credit risks. Long-term non-interest bearing and low-interest receivables and liabilities are carried at their present value. Other non-financial liabilities are carried at their repayment amount

(65) Deferred taxes

Deferred tax assets and liabilities result from temporary differences between the carrying amount of an asset or liability in the IFRSs and tax balance sheets of consolidated companies as well as from consolidation activities, insofar as the reversal of these differences will occur in the future.

Deferred taxes are recognized through profit or loss, except when they relate to items recognized in equity; in the latter case, deferred taxes are recognized either in gains/losses recognized in equity, or in consolidated equity.

Deferred tax assets resulting from deductible temporary differences, tax credits as well as tax loss (and interest) carryforwards, are recognized if it is considered probable that taxable profit will be available in the future to apply such tax assets. Deferred tax liabilities are recognized for temporary differences subject to tax in the future. Our calculations are based on the expected prevailing tax rates in the respective countries as at the date the tax will be due. As a rule, our tax projections are based on the statutory regulations applicable, or endorsed, at the balance sheet date. Deferred tax assets and liabilities are offset, provided they relate to the same tax authority, and provided that the Group has an enforceable right to offset tax. Material effects on deferred tax assets and liabilities resulting from changes of tax rates, or amendments of tax laws, are usually recognized in the period in which the legislative procedure is completed. As a rule, these effects are recognized through profit or loss. In case of deferred tax items recognized in equity, such effects are recognized either in the consolidated statement of comprehensive income (gains/losses recognized in equity), or in consolidated equity.

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 in line with IFRSs and the investment value determined for tax purposes.

(66) Inventories

Inventories are carried at the lower of cost or net realizable value. When determining cost, the "first-in, first-out" (FIFO) and weighted average cost formulas are used. 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.

Inventories are written down if the net realizable value is lower than the acquisition or manufacturing cost carried in the balance sheet.

Since inventories are for the most part not manufactured within the scope of long-term production processes, the manufacturing costs do not include any borrowing costs.

Inventory prepayments are recognized under other current assets.

(67) Provisions for pensions and other post-employment benefits

Provisions for pensions and other post-employment benefits are recognized in accordance with IAS 19. The obligations under defined benefit plans are measured using the projected unit credit method. Under the projected unit credit method, dynamic parameters are taken into account in calculating the expected benefit payments after an insured event occurs; these payments are spread over the entire period of service of the participating employees. Annual actuarial opinions are prepared for this purpose. Actuarial gains and losses resulting from changes in actuarial assumptions and/or experience adjustments (the effects of differences between the previous actuarial assumptions and what has actually occurred) are recognized immediately in equity as soon as they are incurred, taking deferred taxes into account. Consequently, the consolidated balance sheet provides – after deduction of the plan assets – the full scope of the obligations while avoiding the fluctuations in expenses that can result especially when the calculation parameters change. The actuarial gains and losses recognized in the respective reporting period are disclosed separately in the consolidated statement of comprehensive income.

(68) Other provisions and contingent liabilities

Provisions are recognized if it is more likely than not that an outflow of resources will be required to settle the obligation and the amount of the obligation can be measured reliably. The carrying amount of other provisions takes into account the amounts required to cover future payment obligations, recognizable risks and uncertain obligations of the Group to third parties.

Measurement of other provisions is based on the settlement amount with the highest probability or, if a large number of similar cases exist with respect to the provision being measured, it is based on the expected value of the settlement amounts. Long-term provisions are discounted and carried at their present value as of the balance sheet date if the discount rate effect is material. To the extent that reimbursement claims exist as defined in IAS 37, they are recognized as an asset – separately from provisions – if their realization is virtually certain and the asset recognition criteria have been met. Restructuring provisions are recognized after detailed restructuring plans have been established and disclosed.

Contingent liabilities comprise not only possible obligations arising from past events and whose existence is subject to the occurrence of uncertain future events, but also present obligations arising from past events where an outflow of resources embodying economic benefits is not probable or where the amount of the obligation cannot be measured reliably. Contingent liabilities that were not assumed within the context of a business combination are not recognized in the consolidated balance sheet. Unless the possibility of an outflow of resources embodying economic benefits is remote, information on the relevant contingent liabilities is disclosed in the notes. In this context, the present value of the future settlement amount is used as the basis for measurement. The settlement amount is determined in accordance with the rules set out in IAS 37 and is based on the best estimate.

(69) Share-based compensation programs

Provisions have been set up for obligations from long-term variable compensation programs (Long-Term Incentive Plan of the Group). These share-based compensation programs with cash settlement are aligned not only with target achievement based on key performance indicators, but above all with the long-term performance of shares of Merck KGaA, Darmstadt, Germany. Certain executives and employees could be eligible to receive a certain number of virtual shares – Share Units of Merck KGaA, Darmstadt, Germany (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 shares of Merck KGaA, Darmstadt, Germany, in Xetra® trading during the last 60 trading days prior to January 1 of the respective performance cycle (reference price). In order for members of top management to receive payment for the 2016 tranche, they must personally own an investment in shares of Merck KGaA, Darmstadt, Germany, dependent on their respective fixed annual compensation. For the 2017 and 2018 tranches, an obligatory personal investment is not a precondition to receive payments. Since 2017, the personal investment for top management is defined in a separate Share Ownership Guideline (SOG). 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).

For the 2016 tranche, these are on the one hand the performance of the share price of Merck KGaA, Darmstadt, Germany, compared to the performance of the DAX® with a weighting of 70%, and on the other hand the development of the EBITDA pre margin during the performance cycle as a proportion of a defined target value with a weighting of 30%.

As of fiscal 2017, the program conditions were modified. For the 2017 and 2018 tranches, the performance of the share price of Merck KGaA, Darmstadt, Germany, relative to the performance of the DAX® is considered with a weighting of 50%, and the development of the EBITDA pre margin during the performance cycle as a proportion of a defined target value with a weighting of 25%. The development of organic sales growth as a proportion of a defined target value with a weighting of 25% is a new key performance indicator now taken into account.

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 shares of Merck KGaA, Darmstadt, Germany, in Xetra® trading during the last 60 trading days prior to January 1 after the performance cycle. Whereas the payout for the 2016 tranche is limited to two times the reference price, the payout for the 2017 and 2018 tranches is limited to two and a half times the individual grant.

The fair value of the obligations is recalculated by an external expert using a Monte Carlo simulation based on the previously described KPIs on each balance sheet date. The expected volatilities are based on the implicit volatility of shares of Merck KGaA, Darmstadt, Germany, 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 of 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 financial expenses.

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.

On the occasion of the 350th anniversary of the company in 2018, every employee in Germany was granted shares of Merck KGaA, Darmstadt, Germany, worth € 350. For the granted shares of Merck KGaA, Darmstadt, Germany, the required shares were purchased on the stock market by a third party on behalf of the Group and then transferred to the eligible employees.

List of Shareholdings

(70) List of Shareholdings

The shareholdings of Merck KGaA, Darmstadt, Germany, as of December 31, 2018, are presented below, and 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, Darmstadt, Germany (%)
I. Fully consolidated companies				
Germany				
Germany	Merck KGaA, Darmstadt, Germany	Darmstadt	Parent Company	
Germany	AB Allgemeine Pensions GmbH & Co. KG	Zossen	100.00	100.00
Germany	Allergopharma GmbH & Co. KG	Reinbek	100.00	
Germany	Allergopharma Verwaltungs GmbH	Darmstadt	100.00	100.00
Germany	Biochrom GmbH	Berlin	100.00	
Germany	Chemitra GmbH	Darmstadt	100.00	100.00
Germany	Emedia Export Company mbH	Gernsheim	100.00	
Germany	Litec-LLL GmbH	Greifswald	100.00	100.00
Germany	Merck 12. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 13. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck 15. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck 16. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck 20. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck 21. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck Accounting Solutions & Services Europe GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Chemicals GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck China Chemicals Holding GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck Consumer Health Holding Germany GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Export GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)
Germany	Merck Financial Services GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Financial Trading GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Gernsheim	100.00	100.00
Germany	Merck Healthcare Holding GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Healthcare KGaA, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck Holding GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Gernsheim	100.00	100.00
Germany	Merck International GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Internationale Beteiligungen GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck Life Science Germany GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck Life Science GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Eppelheim	100.00	100.00
Germany	Merck Life Science Holding GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Patent GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck Performance Materials Germany GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck Performance Materials GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Wiesbaden	100.00	
Germany	Merck Performance Materials Holding GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Real Estate GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Schuchardt OHG, a subsidiary of Merck KGaA, Darmstadt, Germany	Hohenbrunn	100.00	100.00
Germany	Merck Serono GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Vierte Allgemeine Beteiligungsgesellschaft mbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Gernsheim	100.00	
Germany	Merck Wohnungs- und Grundstücksverwaltungsgesellschaft mbH, a subsidiary of Merck KGaA, Darmstadt, Germany	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

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)
Other European countries				
Austria	Allergopharma Vertriebsgesellschaft m.b.H.	Vienna	100.00	
Austria	Merck Chemicals and Life Science GesmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Vienna	100.00	
Austria	Merck Gesellschaft mbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Vienna	100.00	
Austria	Sigma-Aldrich Handels GmbH	Vienna	100.00	
Belgium	Merck Chemicals N.V./S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Overijse	100.00	
Belgium	Merck N.V.-S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Overijse	100.00	
Belgium	Sigma-Aldrich BVBA/SPRL	Overijse	100.00	
Bulgaria	Merck Bulgaria EAD, a subsidiary of Merck KGaA, Darmstadt, Germany	Sofia	100.00	
Croatia	Merck d.o.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Zagreb	100.00	
Czech Republic	Merck spol. s r.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Prague	100.00	
Czech Republic	Sigma-Aldrich spol. s r.o.	Prague	100.00	
Denmark	Merck A/S, a subsidiary of Merck KGaA, Darmstadt, Germany	Soborg	100.00	
Denmark	Merck Life Science A/S, a subsidiary of Merck KGaA, Darmstadt, Germany	Soborg	100.00	
Denmark	Sigma-Aldrich Denmark ApS	Soborg	100.00	
Denmark	Survac ApS	Frederiksberg	100.00	100.00
Estonia	Merck Serono OÜ, a subsidiary of Merck KGaA, Darmstadt, Germany	Tallinn	100.00	
Finland	Merck Life Science OY, a subsidiary of Merck KGaA, Darmstadt, Germany	Espoo	100.00	
Finland	Merck OY, a subsidiary of Merck KGaA, Darmstadt, Germany	Espoo	100.00	
Finland	Sigma-Aldrich Finland OY	Espoo	100.00	
France	Gonnon S.A.S.	Lyon	100.00	
France	Merck Biodevelopment S.A.S., a subsidiary of Merck KGaA, Darmstadt, Germany	Lyon	100.00	
France	Merck Chimie S.A.S., a subsidiary of Merck KGaA, Darmstadt, Germany	Fontenay s/Bois	100.00	
France	Merck Performance Materials S.A.S., a subsidiary of Merck KGaA, Darmstadt, Germany	Trosly-Breuil	100.00	
France	Merck S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Lyon	99.84	
France	Merck Santé S.A.S., a subsidiary of Merck KGaA, Darmstadt, Germany	Lyon	100.00	
France	Merck Serono S.A.S., a subsidiary of Merck KGaA, Darmstadt, Germany	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., a subsidiary of Merck KGaA, Darmstadt, Germany	Maroussi, Athens	100.00	

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)
Hungary	Merck Kft., a subsidiary of Merck KGaA, Darmstadt, Germany	Budapest	100.00	
Hungary	Sigma-Aldrich Kft.	Budapest	100.00	
Ireland	Merck Finance Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Carrigtwohill	100.00	
Ireland	Merck Millipore Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Carrigtwohill	100.00	
Ireland	Merck Serono (Ireland) Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	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	
Ireland	Silverberry Limited	Arklow	100.00	
Italy	Allergopharma S.p.A.	Rome	100.00	
Italy	Istituto di Ricerche Biomediche Antoine Marxer RBM S.p.A.	Colleretto Giacosa	100.00	
Italy	Merck S.p.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Milan	100.00	
Italy	Merck Serono S.p.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Rome	99.74	
Italy	Sigma-Aldrich S.r.l.	Milan	100.00	
Latvia	Merck Serono SIA, a subsidiary of Merck KGaA, Darmstadt, Germany	Riga	100.00	
Lithuania	Merck Serono, UAB, a subsidiary of Merck KGaA, Darmstadt, Germany	Vilnius	100.00	
Luxembourg	AZ Electronic Materials S.a.r.l.	Luxembourg	100.00	
Luxembourg	Mats Finance S.a.r.l.	Luxembourg	100.00	
Luxembourg	Merck Chemicals Holding S.a.r.l., a subsidiary of Merck KGaA, Darmstadt, Germany	Luxembourg	100.00	
Luxembourg	Merck Finance S.a.r.l., a subsidiary of Merck KGaA, Darmstadt, Germany	Luxembourg	100.00	
Luxembourg	Merck Finanz S.a.r.l., a subsidiary of Merck KGaA, Darmstadt, Germany	Luxembourg	100.00	
Luxembourg	Merck Holding S.a.r.l., a subsidiary of Merck KGaA, Darmstadt, Germany	Luxembourg	100.00	
Luxembourg	Merck Invest SCS, a subsidiary of Merck KGaA, Darmstadt, Germany	Luxembourg	100.00	
Luxembourg	Merck Re S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Luxembourg	100.00	100.00
Luxembourg	Millilux S.a.r.l.	Luxembourg	100.00	
Luxembourg	Millipore International Holdings, S.a.r.l.	Luxembourg	100.00	
Luxembourg	Ridgefield Acquisition 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., a subsidiary of Merck KGaA, Darmstadt, Germany	Pietà	100.00	
Malta	Merck Capital Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Pietà	100.00	
Netherlands	BioControl Systems B.V.	Nieuwerkerk Ad Ijssel	100.00	
Netherlands	Merck B.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Schiphol-Rijk	100.00	
Netherlands	Merck Chemicals B.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Amsterdam Zuidoost	100.00	

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)
Netherlands	Merck Holding Netherlands B.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Schiphol-Rijk	100.00	
Netherlands	Merck Ventures B.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Amsterdam	100.00	
Netherlands	Merck Window Technologies B.V., a subsidiary of Merck KGaA, Darmstadt, Germany	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	
Norway	Merck Life Science AS, a subsidiary of Merck KGaA, Darmstadt, Germany	Oslo	100.00	
Norway	Sigma-Aldrich Norway AS	Oslo	100.00	
Poland	Merck Business Solutions Europe Sp.z.o.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Wroclaw	100.00	
Poland	Merck Sp.z.o.o., a subsidiary of Merck KGaA, Darmstadt, Germany	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., a subsidiary of Merck KGaA, Darmstadt, Germany	Algés	100.00	
Romania	Merck Romania S.R.L., a subsidiary of Merck KGaA, Darmstadt, Germany	Bucharest	100.00	
Russia	Merck LLC, a subsidiary of Merck KGaA, Darmstadt, Germany	Moscow	100.00	
Russia	Sigma-Aldrich Rus LLC	Moscow	100.00	
Serbia	Merck d.o.o. Beograd., a subsidiary of Merck KGaA, Darmstadt, Germany	Belgrade	100.00	
Slovakia	Merck spol. s r.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Bratislava	100.00	
Slovakia	Sigma-Aldrich, spol. s r.o.	Bratislava	100.00	
Slovenia	Merck d.o.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Ljubljana	100.00	
Spain	Merck Chemicals and Life Science S.A.U., a subsidiary of Merck KGaA, Darmstadt, Germany	Madrid	100.00	
Spain	Merck, S. L. U., a subsidiary of Merck KGaA, Darmstadt, Germany	Madrid	100.00	
Spain	Sigma-Aldrich Quimica S.L.	Madrid	100.00	
Sweden	Merck AB, a subsidiary of Merck KGaA, Darmstadt, Germany	Solna	100.00	
Sweden	Merck Chemicals and Life Science AB, a subsidiary of Merck KGaA, Darmstadt, Germany	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., a subsidiary of Merck KGaA, Darmstadt, Germany	Altdorf	51.63	51.63
Switzerland	Merck (Schweiz) AG, a subsidiary of Merck KGaA, Darmstadt, Germany	Zug	100.00	
Switzerland	Merck Performance Materials (Suisse) SA, a subsidiary of Merck KGaA, Darmstadt, Germany	Coinsins	100.00	
Switzerland	Merck Serono SA, a subsidiary of Merck KGaA, Darmstadt, Germany	Coinsins	100.00	
Switzerland	SeroMer Holding SA	Coinsins	100.00	
Switzerland	Sigma-Aldrich (Switzerland) Holding AG	Buchs	100.00	

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)
Switzerland	Sigma-Aldrich Chemie GmbH	Buchs	100.00	
Switzerland	Sigma-Aldrich International GmbH	St. Gallen	100.00	
Switzerland	Sigma-Aldrich Production GmbH	Buchs	100.00	
Turkey	Merck Ilac Ecza ve Kimya Ticaret AS., a subsidiary of Merck KGaA, Darmstadt, Germany	Istanbul	100.00	
United Kingdom	Aldrich Chemical Co. Ltd.	Gillingham	100.00	
United Kingdom	AZ Electronic Materials (UK) Ltd.	Feltham	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., a subsidiary of Merck KGaA, Darmstadt, Germany	Gillingham	100.00	
United Kingdom	Merck Holding Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Merck Investments Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Merck Performance Materials Services UK Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Merck Serono Europe Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	London	100.00	
United Kingdom	Merck Serono Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Millipore (U.K.) Ltd.	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	Sigma-Aldrich Holdings Ltd.	Gillingham	100.00	
United Kingdom	Sigma-Genosys Limited	Gillingham	100.00	
North America				
Canada	EMD Chemicals Canada Inc.	Toronto	100.00	
Canada	EMD Crop BioScience Canada Inc.	Toronto	100.00	
Canada	EMD Inc.	Mississauga	100.00	
Canada	Millipore (Canada) Ltd.	Toronto	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	EMD Accounting Solutions & Services America, Inc.	Rockland	100.00	

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)
United States	EMD Digital Inc.	Burlington	100.00	
United States	EMD Finance LLC	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	
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	Grzybowski Scientific Inventions Ltd.	Evanston	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	
Asia-Pacific (APAC)				
Australia	Merck Pty. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Bayswater	100.00	
Australia	Merck Serono Australia Pty. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Sydney	100.00	
Australia	Proligo Australia Pty. Ltd.	Castle Hill	100.00	
Australia	SAFC Biosciences Pty. Ltd.	Castle Hill	100.00	
Australia	Sigma-Aldrich Oceania Pty. Ltd.	Castle Hill	100.00	
Australia	Sigma-Aldrich Pty. Ltd.	Castle Hill	100.00	
China	Beijing Skywing Technology Co., Ltd.	Beijing	100.00	
China	Merck Chemicals (Shanghai) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Shanghai	100.00	
China	Merck Display Materials (Shanghai) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Shanghai	100.00	
China	Merck Electronic Materials (Suzhou) Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Suzhou	100.00	

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)
China	Merck Holding (China) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Shanghai	100.00	
China	Merck Life Science Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Hong Kong	100.00	
China	Merck Life Science Technologies (Nantong) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Nantong	100.00	
China	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Hong Kong	100.00	
China	Merck Management Consulting (Shanghai) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Shanghai	100.00	
China	Merck Performance Materials Hong Kong Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Hong Kong	100.00	
China	Merck Pharmaceutical (HK) Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Hong Kong	100.00	
China	Merck Pharmaceutical Distribution (Jiangsu) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Nantong	100.00	
China	Merck Pharmaceutical Manufacturing (Jiangsu) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Nantong	100.00	
China	Merck Serono (Beijing) Pharmaceutical Distribution Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Beijing	100.00	
China	Merck Serono (Beijing) Pharmaceutical R&D Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Beijing	100.00	
China	Merck Serono Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	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	
India	Merck Life Science Pvt. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Mumbai	100.00	
India	Merck Performance Materials Pvt. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Mumbai	100.00	
India	Merck Specialities Pvt. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Mumbai	100.00	
India	Sigma-Aldrich Chemicals Private Limited	Bangalore	100.00	
Indonesia	P.T. Merck Chemicals and Life Sciences, a subsidiary of Merck KGaA, Darmstadt, Germany	Jakarta	100.00	
Indonesia	P.T. Merck Tbk., a subsidiary of Merck KGaA, Darmstadt, Germany	Jakarta	86.65	
Japan	BioReliance K.K.	Tokyo	100.00	
Japan	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Tokyo	100.00	
Japan	Merck Performance Materials Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Tokyo	100.00	
Japan	Merck Serono Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Tokyo	100.00	
Japan	Sigma-Aldrich Japan G.K.	Tokyo	100.00	
Malaysia	Merck Sdn Bhd, a subsidiary of Merck KGaA, Darmstadt, Germany	Petaling Jaya	100.00	
Malaysia	Sigma-Aldrich (M) Sdn Bhd	Kuala Lumpur	100.00	
New Zealand	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Palmerston North	100.00	
New Zealand	Sigma-Aldrich New Zealand Co.	Christchurch	100.00	

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)
Philippines	Merck Business Solutions Asia Inc., a subsidiary of Merck KGaA, Darmstadt, Germany	Bonifacio Global City	99.99	
Philippines	Merck Inc., a subsidiary of Merck KGaA, Darmstadt, Germany	Bonifacio Global City	100.00	
Singapore	Merck Performance Materials Pte. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Singapore	100.00	
Singapore	Merck Pte. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Singapore	100.00	
Singapore	Sigma-Aldrich Pte. Ltd.	Singapore	100.00	
South Korea	Merck Electronic Materials Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Seoul	100.00	
South Korea	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Seoul	100.00	
South Korea	Merck Performance Materials Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Pyeongtaek-shi	100.00	
South Korea	Sigma-Aldrich Korea Ltd.	Yongin City	100.00	
Taiwan	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Taipei	100.00	
Taiwan	Merck Performance Materials Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Taipei	100.00	
Taiwan	SAFC Hitech Taiwan Co. Ltd.	Kaohsiung	100.00	
Thailand	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Bangkok	45.11	
Vietnam	Merck Vietnam Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Ho Chi Minh City	100.00	
Latin America				
Argentina	Merck S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Buenos Aires	100.00	
Argentina	Sigma-Aldrich de Argentina S.r.l.	Buenos Aires	100.00	
Brazil	Merck S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Rio de Janeiro	100.00	
Brazil	Sigma-Aldrich Brasil Ltda.	São Paulo	100.00	
Chile	Merck S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Santiago de Chile	100.00	
Chile	Sigma-Aldrich Quimica Ltda.	Santiago de Chile	100.00	
Colombia	Merck S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Bogota	100.00	
Ecuador	Merck C.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Quito	100.00	
Guatemala	Merck, S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Guatemala City	100.00	
Mexico	Merck Biopharma Distribution S.A. de C.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Mexico City	100.00	
Mexico	Merck, S.A. de C.V., a subsidiary of Merck KGaA, Darmstadt, Germany	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., a subsidiary of Merck KGaA, Darmstadt, Germany	Lima	100.00	
Uruguay	ARES Trading Uruguay S.A.	Montevideo	100.00	
Middle East and Africa (MEA)				
Egypt	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Cairo	100.00	
Israel	Inter-Lab Ltd.	Yavne	100.00	
Israel	InterPharm Laboratories Ltd.	Yavne	100.00	

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)
Israel	Merck Serono Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	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	
Kenya	Merck Healthcare and Life Science Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Nairobi	100.00	
South Africa	Merck (Pty) Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Halfway House	100.00	
South Africa	Sigma-Aldrich (Pty) Ltd.	Kempton Park	100.00	
Tunisia	Merck Promotion SARL, a subsidiary of Merck KGaA, Darmstadt, Germany	Tunis	100.00	
Tunisia	Merck SARL, a subsidiary of Merck KGaA, Darmstadt, Germany	Tunis	100.00	
United Arab Emirates	Merck Serono Middle East FZ-Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Dubai	100.00	

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)	Fair value (€ million)
II. Companies not consolidated due to secondary importance					
Germany					
Germany	AB Pensionsverwaltung GmbH	Zossen	100.00	100.00	< 0.5
Germany	Merck 24. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 25. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 26. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 27. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 28. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 29. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 30. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 31. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 36. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 37. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 38. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)	Fair value (€ million)
Germany	Merck 39. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 40. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck 41. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Germany	Merck Foundation gGmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00	< 0.5
Other European countries					
Greece	Sigma-Aldrich (OM) Ltd.	Athens	100.00		< 0.5
Ireland	SAFC Arklow Ltd.	Arklow	100.00		< 0.5
Netherlands	Merck Europe B.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Amsterdam	100.00		< 0.5
Russia	Chemical Trade Limited LLC	Moscow	100.00		< 0.5
Russia	MedChem Limited	Moscow	100.00		< 0.5
Russia	SAF-LAB LLC	Moscow	100.00		< 0.5
Switzerland	iOnctura SA	Plan-les-Ouates	73.60		A)
United Kingdom	B-Line Systems Limited	Gillingham	100.00		< 0.5
United Kingdom	Bristol Organics Ltd.	Gillingham	100.00		< 0.5
United Kingdom	Fluka Chemicals Ltd.	Gillingham	100.00		< 0.5
United Kingdom	Merck Cross Border Trustees Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00		< 0.5
United Kingdom	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00		< 0.5
United Kingdom	Merck Pension Trustees Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00		< 0.5
United Kingdom	Sigma Chemical Co. Ltd.	Gillingham	100.00		< 0.5
United Kingdom	Sigma Entity One Limited	Gillingham	100.00		< 0.5
United Kingdom	UFC Ltd.	Gillingham	100.00		< 0.5
United Kingdom	Ultrafine Limited	Gillingham	100.00		< 0.5
United Kingdom	Webnest Ltd.	Gillingham	100.00		< 0.5
United Kingdom	Wessex Biochemicals Ltd.	Gillingham	100.00		A)
North America					
United States	Fluka Chemical Corp.	St. Louis	100.00		< 0.5
United States	TocopheRx, Inc.	Burlington	62.83		A)
Asia-Pacific (APAC)					
Australien	Biochrom Australia Pty. Ltd.	Bayswater	100.00		< 0.5
China	Merck Innovation Hub (Guangdong) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Guangzhou	100.00		< 0.5
Latin America					
Dominican Republic	Merck Dominicana, S.R.L., a subsidiary of Merck KGaA, Darmstadt, Germany	Santo Domingo	100.00		< 0.5

A) These are affiliates in the portfolio of M Ventures. The fair value of the M Ventures portfolio on December 31, 2018, amounted to € 145 million.

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)	Fair value (€ million)
Middle East and Africa (MEA)					
Morocco	Merck Maroc S.A.R.L., a subsidiary of Merck KGaA, Darmstadt, Germany	Casablanca	100.00		< 0.5
Nigeria	Merck Pharmaceutical and Life Sciences Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Lagos	100.00		< 0.5
III. Non-controlled companies majority-owned					
Latin America					
Venezuela	Merck S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Caracas	100.00		< 0.5
Venezuela	Representaciones MEPRO S.A.	Caracas	100.00		< 0.5
IV. Associates not included at equity due to secondary importance					
Other European countries					
Netherlands	Calypso Biotech B.V.	Amsterdam	38.81		A)
Switzerland	Asceneuron SA	Lausanne	25.35		A)
Switzerland	CAMAG Chemie-Erzeugnisse und Adsorptionstechnik AG	Muttenz	39.11		2
Switzerland	Vaximm AG	Basel	22.06		A)
North America					
United States	Prolog Healthy Living Fund, L.P.	St. Louis	38.32		B)
United States	Prolog Healthy Living Fund II, L.P.	St. Louis	50.58		B)
Middle East and Africa (MEA)					
Israel	Neviah Genomics Ltd.	Yavne	69.00	7.75	A)
V. Other equity investments					
Germany					
Germany	Alcan Systems GmbH	Darmstadt	< 20.00		A)
Germany	Azelis Deutschland Kosmetik GmbH	Moers	< 20.00	< 20.00	2
Germany	InfraServ GmbH & Co. Wiesbaden KG	Wiesbaden	< 20.00		2
Germany	Inuru GmbH	Berlin	< 20.00		< 0.5
Germany	IOmx Therapeutics AG	Martinsried	< 20.00		A)
Germany	pharma mall Gesellschaft für Electronic Commerce mbH	Sankt Augustin	< 20.00		1
Germany	PharmLog Pharma Logistik GmbH	Bönen	< 20.00	< 20.00	3
Germany	PrintCity GmbH & Co. KG	Neuried	< 20.00	< 20.00	< 0.5

A) These are affiliates in the portfolio of M Ventures. The fair value of the M Ventures portfolio on December 31, 2018, amounted to € 145 million.
B) These are closed funds that are classified as debt within the meaning of IFRS 9.

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)	Fair value (€ million)
Other European countries					
Austria	f-star Biotechnologische Forschungs- und Entwicklungsgesellschaft mbH	Vienna	< 20.00		A)
Belgium	ReWind Therapeutics N.V.	Leuven-Heverlee	< 20.00		A)
Finland	Abacus Diagnostica OY	Turku	< 20.00		< 0.5
Finland	Forendo Pharma OY	Turku	< 20.00		A)
France	Aveni S.A.S.	Massy	< 20.00		A)
France	DNA Script S.A.S.	Paris	< 20.00		A)
Netherlands	Mosa Meat B.V.	Maastricht	< 20.00		A)
Netherlands	SynAffix B.V.	Nijmegen	< 20.00		A)
Sweden	Galecto Biotech AB	Lund	< 20.00		A)
Switzerland	Inthera Bioscience AG	Schlieren	23.28		A)
Switzerland	ObsEva SA	Cologny	< 20.00		A)
United Kingdom	Artios Pharma Limited	London	< 20.00		A)
United Kingdom	Canbex Therapeutics Ltd.	London	< 20.00		A)
United Kingdom	F-Star Alpha Limited	Cambridge	< 20.00		A)
United Kingdom	F-Star Beta Limited	Cambridge	< 20.00		A)
United Kingdom	F-Star Delta Limited	Cambridge	< 20.00		A)
United Kingdom	Macrophage Pharma Limited	Windsor	< 20.00		A)
United Kingdom	Peratech HoldCo Limited	Brompton-on-Swale	< 20.00		A)
United Kingdom	Storm Therapeutics Limited	London	< 20.00		A)
North America					
United States	Akili Interactive Labs, Inc.	Boston	< 20.00		A)
United States	Allozyne, Inc.	Seattle	< 20.00		< 0.5
United States	ApoGen Biotechnologies, Inc.	Seattle	< 20.00		A)
United States	Biolinq Inc.	San Diego	< 20.00		A)
United States	Bird Rock Bio, Inc.	La Jolla	< 20.00		A)
United States	CLEARink Displays, Inc.	Fremont	< 20.00		A)
United States	Indi Molecular, Inc.	Culver City	< 20.00		A)
United States	Intrexon Corporation	Germantown	< 20.00		118
United States	Kraig Biocraft Laboratories, Inc.	Ann Arbor	< 20.00		< 0.5
United States	Lumiode, Inc.	New York	< 20.00		A)
United States	Progyny, Inc.	Menlo Park	< 20.00		A)
United States	Raze Therapeutics, Inc.	Cambridge	< 20.00		A)
United States	Ribometrix Inc.	Durham	< 20.00		A)
United States	Tioga Pharmaceuticals, Inc.	San Diego	< 20.00	< 20.00	< 0.5
United States	Translate Bio, Inc.	Cambridge	< 20.00		A)

A) These are affiliates in the portfolio of M Ventures. The fair value of the M Ventures portfolio on December 31, 2018, amounted to € 145 million.

Country	Company	Registered office	Equity interest (%)	Thereof: Merck KGaA, Darmstadt, Germany (%)	Fair value (€ million)
Asia-Pacific (APAC)					
Australia	Immutep Limited	Sydney	< 20.00		< 0.5
Middle East and Africa (MEA)					
Algeria	Novapharm Production SARL	Wilaya de Tipiza	20.00		< 0.5
Israel	ARTSaVIT Ltd.	Yavne	< 20.00		A)
Israel	Explore Bio 1 Ltd.	Yavne	20.00		A)
Israel	Explore Bio 3 Ltd.	Yavne	22.50		A)
Israel	MediSafe Project Ltd.	Haifa	< 20.00		A)
Israel	Metabomed Ltd.	Yavne	< 20.00		A)
Israel	Pantheon Biosciences Ltd.	Yavne	< 20.00		A)
Israel	Wiliot Ltd.	Caesarea	< 20.00		A)

A) These are affiliates in the portfolio of M Ventures. The fair value of the M Ventures portfolio on December 31, 2018, amounted to € 145 million.

Darmstadt, February 14, 2019

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Belén Garijo

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