Notes to the consolidated financial statements

General Disclosures

(1) Company information

These consolidated financial statements for the year ended December 31, 2023, were prepared for Merck Kommanditgesellschaft auf Aktien, Darmstadt, Germany (Merck KGaA, Darmstadt, Germany), Frankfurter Strasse 250, 64293 Darmstadt, Germany, entered in the commercial register of the Darmstadt Local Court under HRB 6164. The ultimate parent company of the Group is the parent company of Merck KGaA, Darmstadt, Germany, E. Merck Kommanditgesellschaft, Darmstadt, Germany (E. Merck KG, Darmstadt, Germany). The consolidated financial statements of E. Merck KG, Darmstadt, Germany, can be accessed at **https://www.unternehmensregister.de**. Shares in Merck KGaA, Darmstadt, Germany, are traded on the regulated market of the Frankfurt Stock Exchange and on other exchanges.

The German Corporate Governance Code declaration (declaration of conformity) in accordance with section 161 of the German Stock Corporation Act (AktG) was issued and can be viewed at **https://www.emdgroup.com/en/investors/corporate-governance/reports.html**.

(2) Reporting principles

These consolidated financial statements have been prepared in accordance with the International Financial Reporting Standards (IFRSs) effective at the end of the reporting period and adopted by the European Union and the additional provisions of section 315e (1) of the German Commercial Code (HGB). The fiscal year is the calendar year. These consolidated financial statements have been prepared in euros, the reporting currency. The values presented in the consolidated financial statements have been rounded. This may lead to individual values not adding up to the totals presented.

The Executive Board of Merck KGaA, Darmstadt, Germany, prepared these consolidated financial statements on February 14, 2024, and approved them to be forwarded to the Supervisory Board. The Supervisory Board is responsible for examining the consolidated financial statements and declaring whether it approves them.

The accounting and measurement policies used in the consolidated financial statements are presented in the respective Notes and are indicated there.

Standards and amendments to standards effective for the first time in fiscal 2023

Standard/Interpretation	Title	Date of publication	Date of endorsement by EU law	Impact on the consolidated financial statements
Amendments to IAS 1	Disclosure of Accounting Policies	February 12, 2021	March 2, 2022	No material impact
Amendments to IAS 8	Definition of Accounting Estimates	February 12, 2021	March 2, 2022	No material impact
Amendments to IAS 12	Deferred Tax related to Assets and Liabilities arising from a Single Transaction	May 7, 2021	August 11, 2022	No material impact
Amendments to IAS 12	International Tax Reform - Pillar Two Model Rules	May 23, 2023	November 8, 2023	See below
IFRS 17; Amendments to IFRS 17	IFRS 17 Insurance Contracts; Amendments to IFRS 17; Initial Application of IFRS 17 and IFRS 9 - Comparative Information	May 18, 2017 June 25, 2020 December 9, 2021	November 19, 2021 November 19, 2021 September 8, 2022	No material impact

Amendments to standards effective for the first time from fiscal 2024

Standard/ Interpretation	Title	Date of publication	Date of endorsement by EU law	Required date of first-time application[1]	Expected impact on the consolidated financial statements
Amendments to IFRS 16	Lease Liability in a Sale and Leaseback	September 22, 2022	November 20, 2023	January 1, 2024	No material impact
Amendments to IAS 1	Classification of Liabilities as Current or Non-current; Classification of Liabilities as Current or Non-Current — Deferral of Effective Date	January 23, 2020 July 15, 2020	December 19, 2023	January 1, 2024	No material impact
Amendments to IAS 1	Non-current Liabilities with Covenants	October 31, 2022	December 19, 2023	January 1, 2024	No material impact

[1] None of the regulations was applied early.

Regulations published but not yet endorsed by the European Union

Standard/Interpretation	Title	Date of publication	Expected to be effective for the first time for financial years beginning on or after	Expected impact on the consolidated financial statements
Amendments to IAS 7	Supplier Finance Arrangements	May 25, 2023	January 1, 2024	No material impact
Amendments to IAS 21	Lack of Exchangeability	August 15, 2023	January 1, 2025	Currently under review
Amendments to IFRS 7	Supplier Finance Arrangements	May 25, 2023	January 1, 2024	No material impact

Impact of efforts to achieve international convergence on taxation

Based on the information currently available, the Group expects the efforts to achieve international convergence on tax rules as part of the OECD’s Inclusive Framework to have an impact on the Group’s taxation. Although the tax rules apply to the ultimate parent company of the Group, E. Merck Kommanditgesellschaft, Darmstadt, Germany, top-up taxes could be payable in a number of jurisdictions, and this could have an impact on the Group.

Allocation of taxing rights (Pillar I)

The planned allocation of taxing rights between jurisdictions as part of the OECD rules is currently still being negotiated. An analysis of the available drafts found that the rules are likely to apply to the Group. Due to the status of the negotiations and the lack of clarity concerning the participation of key nations, it is not currently possible to make a reliable statement about the expected impact.

Ensuring global minimum taxation within the OECD (Pillar II)

The legislation on global minimum taxation was published in the German Federal Law Gazette on December 27, 2023, and came into force on January 1, 2024. The exception provided by IAS 12 for the recognition and disclosure of information about deferred tax assets and liabilities in connection with income taxes relating to global minimum taxation was applied for fiscal 2023.

Under the regulations on global minimum taxation, the Group is obliged to determine the effective tax rate for each country in which its business units operate within the meaning of the legislation and, where the effective tax rate is lower than the minimum tax rate of 15%, to pay a top-up tax in the amount of the difference. Jurisdictions where the Group has material operating activities and where the nominal tax rate is below 15% are Ireland and Switzerland. The Group is currently taking action to ensure that it satisfies the reporting obligations and tax compliance requirements arising from the legislation. When it comes to determining the effective tax rate, the legislation provides for numerous specific adjustments that can lead to effective tax rates that differ from those calculated in accordance with IAS 12.86. The complexity of applying the legislation, the extensive additional data requirements as a result and changes to the tax rules of individual nations meant that it was not yet possible to quantify the impact precisely and fully at the reporting date. For example, it is possible that the specific adjustments provided for the calculation of minimum taxation will not result in a tax burden for the Group even though the effective tax rate calculated in accordance with IAS 12.86 is lower than 15%. Conversely, minimum taxation may apply even if the effective tax rate is higher than 15%.

Based on a preliminary calculation and taking account of the data available as of the reporting date, the Group anticipates an additional annual tax expense in a mid-double-digit million-euro amount.

Change in the recognition of liabilities and provisions

In order to increase transparency, the tranche of the Long-Term Incentive Plan of Merck KGaA, Darmstadt, Germany, that is payable in the months following the reporting date has been reported in other current non-financial liabilities rather than current provisions for employee benefits since January 1, 2023. This resulted in a reclassification in the amount of € 158 million. The changes in provisions and other assets and liabilities in the operating cash flow were adjusted by € 166 million accordingly.

For the same reason, liabilities in connection with wages and salaries have been reported in other non-financial liabilities rather than other financial liabilities since January 1, 2023. With regard to the comparative period (December 31, 2022), this resulted in the reclassification of € 127 million to other non-financial liabilities (of which € 121 million to other current non-financial liabilities).

Accounting and measurement policies

Currency translation

Functional currency

The subsidiaries of Merck KGaA, Darmstadt, Germany, conduct their business largely in the respective local currency, which they use as their functional currency.

However, some subsidiaries, particularly in the Electronics business sector, use the U.S. dollar as their functional currency rather than the local currency.

Transactions in non-functional currency

When the financial statements of consolidated companies are prepared, business transactions that are conducted in currencies other than the functional currency are translated using the exchange rate on the date of the transaction.

Translation of financial statements into the reporting currency (Euro)

The financial statements of consolidated companies not using the euro as their functional currency are translated into the reporting currency, the euro. Assets and liabilities are measured at the closing rate while income and expenses are translated at average monthly rates. Any currency translation differences arising during consolidation of Group companies are recognized in equity.

Hyperinflation

Argentina (since 2018) and Türkiye (since April 2022) are classified as hyperinflationary economies in accordance with IAS 29 “Financial Reporting in Hyperinflationary Economies.” Accordingly, business activities in these countries are no longer reported at historical cost but are presented adjusted for inflation. In Argentina, the Group uses a combination of the wholesale index IPIM (Índice de precios internos al por mayor) and the consumer price index IPC (Índice de precios al consumidor). The index applied stood at 37,078.3 as of the balance sheet date (December 31, 2022: 14,227.31/January 1, 2022: 7,396.8). In Türkiye, the Consumer Price

Index (CPI) published by the Turkish Statistical Institute is applied retrospectively with effect from January 1, 2022. The index applied stood at 1,859.4 as of the balance sheet date (December 31, 2022: 1,128.5/January 1, 2022: 686.9). In accordance with the requirements of IAS 21 “The Effects of Changes in Foreign Exchange Rates” for financial statements in non-hyperinflationary reporting currencies, the prior-year amounts have not been restated.

The respective loss from the net position of the monetary items is recognized within other operating expenses and reported separately as a loss from hyperinflation accounting (see Note (14) “**Other operating expenses**”).

After adjusting the amounts for inflation, the balance sheet items and income and expenses are translated into the reporting currency, the euro, at the closing rate in accordance with IAS 21.42.

Exchange rates of most significant currencies

The exchange rates of the most significant currencies in these consolidated financial statements were as follows:

	Average rate		Closing rate	
€ 1 =	**2023**	2022	**Dec. 31, 2023**	Dec. 31, 2022
Chinese renminbi (CNY)	7.667	7.088	7.854	7.420
Japanese yen (JPY)	151.913	137.989	156.462	140.716
Swiss franc (CHF)	0.972	1.005	0.931	0.985
South Korean won (KRW)	1,412.674	1,357.642	1,428.798	1,342.189
Taiwan dollar (TWD)	33.695	31.336	33.845	32.728
U.S. dollar (USD)	1.082	1.054	1.107	1.065

(3) Discretionary decisions and sources of estimation uncertainty

Dealing with discretionary decisions and sources of estimation uncertainty

The preparation of the consolidated financial statements requires the Group to make discretionary decisions on the applicable accounting and measurement policies as well as estimates to a certain extent. The discretionary scope and estimation uncertainty are assessed on a company-specific basis. Discretion describes the need to make assumptions concerning recognition or measurement when applying accounting policies. Sources of estimation uncertainty affecting the selection of the valuation techniques to be applied relate in particular to the parameters used therein. The degree of estimation uncertainty may vary considerably depending on the availability and reliability of the input factors.

Increased uncertainty due to the macroeconomic situation

The continued dynamic development of the macroeconomic environment means that the degree of uncertainty in the preparation of the consolidated financial statements remains high. In particular, uncertainties included the sustained high level of inflation, the development of interest rates, geopolitical challenges, and efforts on the part of various nations to reduce international dependencies along with the related trade restrictions and sanctions. This applies in particular to the recoverability of non-financial assets. Based on the information currently available, there is no evidence of significant impairment losses to date. Furthermore, as in previous years, there are no grounds to suggest that the going concern assumption should not have been applied in preparing the consolidated financial statements.

Impact of inflation

The high rate of inflation slowed in fiscal 2023. Procurement costs for materials and energy in particular, which were mainly reflected in the increased cost of sales, remained above the level seen in previous years. As in the previous year, the cost of purchasing natural gas and electricity came to a low triple-digit million-euro amount for the Group in fiscal 2023. As in the previous year, the Group was able to offset these increased procurement costs by passing on price rises to the market. The assumptions concerning the long-term salary and pension trends applied in calculating pension obligations were reviewed again in fiscal 2023 to reflect the development of inflation, as they had been in the previous year. Compared with the previous year, however, this resulted in an adjustment and an increase in defined benefit obligations in connection with the measurement of defined benefit pension plans only in certain countries (see Note (33) "**Provisions for employee benefits**").

Impact of higher interest rates

The sustained high level of interest rates in fiscal 2023 affected our customers' refinancing costs, especially in the Life Science business sector, resulting in lower customer demand.

The higher interest rates also resulted in a rise in the discount rates applied in performing impairment testing and determining the fair values of financial and non-financial assets compared with the previous year (see Note (18) "**Goodwill**" and Note (43) "**Information on fair value measurement**" in particular).

Direct impact of armed conflicts

The war in Ukraine has not had any material effects on the Group's net assets, financial position, or results of operations owing to its limited business volume in Russia, Ukraine, Belarus, and the Republic of Moldova. In fiscal 2023 and 2022 alike, the total share of Group net sales generated in the aforementioned countries amounted to less than 1.5%. Furthermore, the conflict in the Middle East did not have a material impact on the Group's net assets, financial position, and results of operations in the reporting period. In fiscal 2023 and 2022 alike, the share of Group net sales generated with customers in Israel was less than 1%.

Impact of trade restrictions, sanctions, and supply chain bottlenecks

In the past, inventories were increased in order to limit the risks in connection with supply chain disruption. Accordingly, there is a heightened risk of subsequent write-downs if it is not possible to process or sell these inventories. Furthermore, the impact of the trade restrictions concerning semiconductor materials that were imposed between the United States of America and China in the fourth quarter of 2022 has been examined since fiscal 2022. No impairment losses have been recognized to date. However, there is considerable uncertainty with regard to future developments.

Increased uncertainty due to climate risks

As a globally active science and technology group, the Group is subject to transition-related and physical climate risks that could have a potentially negative impact on its net assets, financial position, and results of operations and lead to increased estimation uncertainty in accounting. To determine the potential impact of climate risks, a structured climate risk analysis is currently being conducted as part of a project aimed at implementing the recommendations of the "Task Force on Climate-Related Financial Disclosures" (TCFD) with the support of an external consulting firm and an insurance company.

Reduction targets for greenhouse gas emissions

The Group has set itself the goal of reducing its direct (Scope 1) and indirect (Scope 2) greenhouse gas emissions by 50% in comparison with the 2020 base year in the period from 2020 to 2030. By 2030, 80% of its purchased electricity will come from renewable sources. The Group also plans to reduce the indirect emissions along the entire value chain (Scope 3) in terms of metric kilotons of CO_2 equivalents per euro of gross profit by 52% by 2030 and to achieve climate-neutral business operations along the entire value chain (Scope 1-3) by 2040. In 2022, the Science Based Targets Initiative confirmed that the targets for 2030 and the necessary measures support its ambition and that of the Paris Agreement to limit global warming to 1.5°C.

The goals described above are to be achieved through the following measures in particular:

- reduction in process-related emissions,
- increased purchase of electricity from renewable sources,
- energy efficiency measures,
- reduced emissions in the supply chain (e.g. switching to sea transportation), and
- recognition of a shadow price for the CO_2 emissions of major projects.

Transition-related climate risks

Transition-related climate risks describe the consequences for companies as a result of the transition to a more sustainable economic system.

The most significant transition-related climate risks to the net assets, financial position, and results of operations are in the Electronics business sector, which is responsible for well in excess of half of the Group's direct (Scope 1) and indirect (Scope 2) greenhouse gas emissions. The majority of these greenhouse gas emissions take the form of process-related emissions resulting from the production of specialty gases for the semiconductor and electronics industries. In order to achieve the climate goals it has adopted, the Group intends to reduce the emissions in its business with these specialty gases by making technological improvements to the production process in particular. The recoverability of the assets recognized in connection with these products depends on the successful implementation of the technological improvements in production, as they could largely prevent the risk of long-term price rises due to the increased pricing of greenhouse gas emissions. Furthermore, based on the information currently available, the implementation of the Group's sustainability strategy is not expected to result in a significant decline in net sales in this business. There have been no indications of impairment of the assets concerned to date, nor has it been necessary to adjust their remaining useful lives. There is significant estimation uncertainty due to the long-term nature of the underlying analyses and the high degree of uncertainty concerning future development.

The Group has concluded several virtual purchase agreements for the purchase of electricity from renewable energy sources as an additional measure to mitigate climate risks, and it also intends to increasingly purchase such electricity physically. After signing two virtual power purchase agreements in 2022, renewable energy sources will account for 90% of the electricity consumed by the Group in the United States and 55% of its global electricity consumption in the future. A further three virtual power purchase agreements were concluded in Spain in 2023 (see the disclosures in Note (42) "**Management of financial risks**" in addition to the existing virtual power purchase agreements that are in place with wind and solar farm project developers in the United States and Spain). This will further increase the proportion of energy consumption covered by renewable energy sources.

The Group participates in EU emissions trading and purchases emission certificates where the certificates allocated by the public authorities are not sufficient to cover the Group's greenhouse gas emissions. The impact of this EU emissions trading is currently immaterial to the Group's net assets, financial position, and results of operations.

Physical climate risks

Physical climate risks describe the risks that could result from longer-term changes in the general climatic conditions. For example, physical climate risks can have an accounting impact in the form of the necessary shortening of the economic life of items of property, plant, and equipment ("stranded assets"); the risk of operational disruption; or increased future expenses due to necessary adaptations to safeguard sites. In determining physical climate risks as part of the current TCFD project, the long-term impact of climate change was simulated for 100 site clusters of the Group using two global warming scenarios for 2030 and 2050 that took account of risks due to flood, fire, wind, extreme heat, precipitation, drought, extreme cold, thunderstorms, and hail. All in all, the identified physical climate risks have not led to any material direct accounting impact. However, there is significant estimation uncertainty due to the long-term nature of the underlying analyses and the high degree of uncertainty concerning future development.

Overview of significant discretionary decisions and sources of estimation uncertainty

The accounting matters with the most significant discretionary decisions as well as the most comprehensive assumptions relating to the future and sources of estimation uncertainty are described below:

Accounting matter	Carrying amount as of Dec. 31, 2023 in € million	IFRS	Discretionary scope/ estimation uncertainty	Sensitivity analysis	Note
Goodwill	17,845			yes	18
Determination of recoverable amount		IAS 36	high		
Other intangible assets	6,551			yes	6, 19
Identification and measurement of intangible assets within the scope of business combinations		IFRS 3	high		
In-licensing of intangible assets		IAS 38	medium		
Determination of amortization		IAS 38	medium		
Identification of impairments or reversal of impairments		IAS 36	high		
Property, plant, and equipment	9,056			no	20
Determination of depreciation		IAS 16	medium		
Identification of impairments or reversal of impairments		IAS 36	medium		
Leases	500			yes	21
Recognition and measurement of lease arrangements		IFRS 16	medium		
Inventories	4,637			no	24
Identification of impairments or reversal of impairments		IAS 2	medium		
Trade and other receivables	4,031			no	25, 42
Determination of loss allowance		IFRS 9	medium		
Other financial assets				yes	36, 43
Determination of fair values of contingent consideration	125	IFRS 13	high		
Determination of fair values of equity instruments	643	IFRS 9, IFRS 13	medium		
Provisions for employee benefits				yes	33
Determination of present value of defined-benefit obligations	4,787	IAS 19	medium		
Other provisions and contingent liabilities	852			no	27, 28
Recognition and measurement of other provisions and contingent liabilities		IAS 37	high		
Revenue recognition				yes	9
Measurement of sales deductions and refund liabilities	877	IFRS 15	high		
Income tax				no	15
Recognition and measurement of income tax liabilities	1,473	IAS 12	high		
Recognition and measurement of deferred taxes from temporary differences		IAS 12	medium		
Recognition of deferred tax assets from tax loss carryforwards	67	IAS 12	high		

(4) Subsequent events

In January 2024, the Group announced measures for Life Science to streamline processes to become more efficient, customer focused, and agile. The implementation of these measures will adversely impact profit before tax in a mid-double-digit million-euro amount in 2024.

No other events of particular importance that could have a material impact on the net assets, financial position, or results of operations occurred subsequent to the balance sheet date.

Group Structure

(5) Scope of Consolidation

Accounting and measurement policies

Scope of Consolidation

Subsidiaries that are immaterial to the assessment of the net assets, financial position, and results of operations of the Group are not included in consolidation but are instead reported in non-current financial assets (see Note (36) "**Other financial assets**").

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

Fully consolidated companies as of Dec. 31, 2022[1]		**313**
Additions	Companies established	–
	Acquisitions	–
	Materiality	2
Retirements	Liquidations/mergers	-9
	Divestments	–
	Immateriality	–
	Loss of control	–
Fully consolidated companies as of Dec. 31, 2023		**306**
Companies rated at-equity as of Dec. 31, 2022		2
Companies rated at-equity as of Dec. 31, 2023		2
Non-consolidated subsidiaries as of Dec. 31, 2022		31
Non-consolidated subsidiaries as of Dec. 31, 2023		34

[1] Previous year has been adjusted for better comparability with note (48) "List of shareholdings".

The list of non-consolidated subsidiaries mainly comprises non-operating shelf companies as well as entities subject to liquidation procedures, which were subsequently measured at fair value through other comprehensive income.

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. The two companies accounted for using the equity method are Syntropy Technologies LLC, United States, and MM Domain Holdco Limited, United Kingdom. There is also one (2022: two) joint operation within the meaning of IFRS 11 (Resonac Versum Materials Co. LTD, Japan, formerly: Showa Denko Versum Materials 2 Co., Ltd., Japan). This joint operation is immaterial to the presentation of the net assets, financial position, and results of operations. The effects of the existing contractual arrangements also have no potentially significant effect in these contexts.

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 (48) "**List of shareholdings**").

(6) Acquisitions and divestments

Accounting and measurement policies

Business combinations

The balance sheet items goodwill, other intangible assets, and deferred taxes are significantly influenced by purchase price allocations conducted within the scope of business combinations. As observable market prices are mostly not available for the acquired other intangible assets, the Group regularly relies on the expertise of external professionals when it comes to business combinations. The following overview shows the methods typically used to measure intangible assets within the scope of purchase price allocations:

	Measurement method for determining fair value
Customer relationships	Multi-period excess earnings method
Technology	Relief from royalty method
Trademark	Relief from royalty method

Results from foreign currency hedging of expected business combinations, if they meet the requirements for hedge accounting, are offset against the carrying value of the net assets acquired.

Where management considers it to be appropriate, the optional concentration test set out in IFRS 3.B7B is applied in individual transactions in order to determine the presentation of the transaction in the consolidated financial statements.

Significant discretionary decisions and sources of estimation uncertainty

Business combinations

In particular, estimation uncertainty and discretionary decisions in conjunction with purchase price allocation relate to:

- planning of future cash flows;
- the customer churn rate, which indicates how existing customer relationships will change in the future;
- the license rate for technologies, which estimates royalty savings on the basis of comparable transactions of similar technologies;
- the discount factor, which is applied for maturity- and risk-based discounting of expected cash inflows; and
- the useful life and the degree of technical obsolescence which depend, among other things, on assumptions about technological developments.

Divestments

The assessment as to when a non-current asset, disposal group, or discontinued operation meets the prerequisites of IFRS 5 for classification as “held for sale” is subject to discretionary judgment.

Acquisitions in the previous year

Acquisition of Exelead Inc., United States

On December 30, 2021, the Group signed a definitive agreement to acquire Exelead Inc., United States (Exelead), a biopharmaceutical contract development and manufacturing organization (CDMO). The transaction closed on February 22, 2022, after regulatory clearances and the satisfaction of other customary closing conditions. The purchase price amounted to US$ 793 million (€ 702 million) in cash. The determination of the fair values for Exelead was completed by December 31, 2022.

Exelead specializes in complex injectable formulations, including the lipid nanoparticles that are key components of mRNA (messenger ribonucleic acid) therapeutics for treating Covid-19 and other indications. The aim of the acquisition is to use Exelead's capacities and expertise to expand the service range for mRNA contract development and manufacturing and to provide a fully integrated offering across the entire mRNA manufacturing process. The business was integrated into the Life Science Services business unit, which is part of the Life Science business sector.

Acquisition of the chemicals business of Mecaro Co. Ltd., Korea

On December 30, 2022, the Group successfully completed the acquisition of the chemicals business of Mecaro Co. Ltd., Korea (Mecaro), trading as M Chemicals Inc., Korea (M Chemicals), after obtaining the necessary regulatory clearances; the acquisition had been announced on August 17, 2022. Mecaro is a Korea-based, publicly listed manufacturer of heater blocks and chemical precursors for semiconductors.

The acquisition forms part of the Level Up growth program of the Electronics business sector. M Chemicals primarily develops and produces precursors used in thin film deposition. The total purchase price involved payments totaling € 90 million, of which € 80 million and € 9 million were due and were paid in 2022 and 2023 respectively.

No preliminary purchase price allocation had taken place by the time the 2022 consolidated financial statements were prepared. The total difference between the purchase price and the net assets acquired, amounting to € 46 million, was therefore recognized as goodwill on a preliminary basis at this date. The purchase price allocation was completed in 2023 and served to reduce goodwill by € 5 million, which mainly resulted in a reclassification to other intangible assets.

Acquisition of Erbi Biosystems Inc., United States

The Group acquired all the shares in Erbi Biosystems Inc., United States (Erbi), on December 1, 2022. The purchase price amounted to € 78 million in cash.

Erbi is the developer of Breez™, one of the few micro-scale, fully automated, functionally closed and continuous perfusion cell culture platform technologies on the market. By integrating Breez™ into its existing Mobius® portfolio, the Group can offer a full range of bioreactors, cell retention systems, and devices as well as cell culture media. The business is allocated to the Process Solutions business unit in the Life Science business sector.

No preliminary purchase price allocation had taken place by the time the 2022 consolidated financial statements were prepared. The total difference between the purchase price and the net assets acquired, amounting to € 72 million, was therefore recognized as goodwill on a preliminary basis at this date. The purchase price allocation was completed in 2023 and served to reduce goodwill by € 21 million, which mainly resulted in a reclassification to other intangible assets.

Adjustments to the prior-year consolidated balance sheet to reflect the purchase price allocations completed in fiscal 2023

In the case of the Erbi and M Chemicals acquisitions, the carrying amounts of the assets and liabilities as of the acquisition date were recognized as preliminary fair values in the previous year because the completion date was shortly before the reporting date. The completion of the purchase price allocations for both companies in 2023 resulted in the following adjustments:

€ million	Dec. 31, 2022 as reported	Adjustments for Erbi and M Chemicals	Dec. 31, 2022 adjusted
Non-current assets			
Goodwill	18,415	-26	18,389
Intangible assets (excluding goodwill)	7,302	34	7,335
Property, plant and equipment	8,203	1	8,204
Other non-current assets	2,406	–	2,406
	36,325	**9**	**36,334**
Current assets			
Current assets	12,201	–	12,201
	12,201	**–**	**12,201**
Total assets	**48,526**	**9**	**48,535**
Equity			
Equity	26,005	–	26,005
	26,005	**–**	**26,005**
Non-current liabilities			
Other non-current provisions and liabilities	11,729	–	11,729
Deferred tax liabilities	1,279	8	1,287
	13,007	**8**	**13,015**
Current liabilities			
Trade payables and other liabilities	2,498	1	2,499
Other current liabilities	7,016	–	7,016
	9,513	**1**	**9,514**
Total equity and liabilities	**48,526**	**9**	**48,535**

Divestments

Sale of shares in Calypso Biotech B.V., Netherlands

Assets held for sale as of December 31, 2023, included equity and debt components in connection with the M Ventures portfolio company Calypso Biotech B.V., Netherlands (Calypso). Calypso is a biotech company that develops drug candidates for the treatment of autoimmune diseases. It was allocated to "Corporate and other". The company was acquired in full by Novartis AG, Switzerland, on January 8, 2024. The disposal group included non-current equity instruments in a mid-double-digit million-euro amount that were measured at fair value through other comprehensive income subsequent to initial recognition, and a convertible bond issued by Calypso in a mid-single-digit million-euro amount that was measured at fair value through profit or loss subsequent to initial recognition. The cumulative income recognized in other comprehensive income amounted to € 48 million.

(7) Collaboration and licensing agreements

Accounting and measurement policies

Out-licensing agreements

The Group primarily enters into material out-licensing agreements for intellectual property in the Healthcare business sector. The granting of a license typically constitutes a distinct performance obligation that must usually be recognized at a point in time. Due to the uncertainty of development results and regulatory events, contingent consideration is typically recognized when the event in question has occurred. Sales-based and usage-based royalties are recognized when the contract partner makes the corresponding sales or uses the intellectual property. As out-licensing transactions in the Healthcare business sector do not form part of ordinary activities and the licensees do not constitute customers within the meaning of IFRS 15, the corresponding income from upfront payments, milestone payments, and royalties is reported in other operating income (see Note (13) "**Other operating income**").

In-licensing agreements

The accounting and measurement policies for the in-licensing of intellectual property are presented in Note (19) "**Other intangible assets**".

Collaboration agreements

In addition to out-licensing agreements for selling intellectual property, the Group enters into collaboration agreements in the Healthcare business sector in which the Group works with partners to develop pharmaceutical drug candidates and, if regulatory approval is granted, to commercialize them.

As the partner companies do not have customer characteristics, these collaboration agreements do not fall directly within the scope of IFRS 15, and any income from upfront payments, milestone payments, and royalties is reported under other operating income. Reimbursements of research and development costs made between the collaboration partners are recognized on a net basis in research and development costs. The Group recognizes the consideration received in the course of collaboration agreements for bundled obligations arising from granting rights to intellectual property as well as other goods and services promised as income over the performance period in line with industry practice. Income is caught up cumulatively upon receipt of uncertain future milestone payments attributable to contractual obligations that have already been fulfilled. This refers in particular to milestone payments subsequent to regulatory approval. Furthermore, collaboration agreements in the Healthcare business sector typically allocate the net sales generated in specific markets, or with specific products, to the respective collaboration partners in the event of a successful approval; in turn, defined income and expense items are carried by the collaboration partners according to fixed allocation ratios. Under these circumstances, the Group recognizes the net sales from the commercialization of products to third-party customers, if the Group takes on the role of a principal within the meaning of IFRS 15. Expenses resulting from payments made to collaboration partners in connection with profit share agreements are reported under Note (14) "**Other operating expenses**".

Significant discretionary decisions and sources of estimation uncertainty

Collaboration and licensing agreements

As part of the accounting treatment of collaboration and licensing agreements, significant discretionary decisions have to be made in the following areas:

- Identification of an appropriate income recognition method and
- Determination of the appropriate timing of income recognition.

Estimates are to be made, especially when it comes to determining the transaction price and progress on the performance obligation.

Strategic alliance with Pfizer Inc., United States, to jointly co-develop and co-commercialize active ingredients in immuno-oncology and its termination effective June 30, 2023

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. From 2017, avelumab was approved for the treatment of several cancer indications under the trade name Bavencio®. The overriding objective of the strategic alliance was to share the development risks and to expand the two companies' presence in immuno-oncology. The execution of the collaboration agreement was not 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, which was recognized in the income statement until the end of 2019.

According to the collaboration agreement, each company bore one half of the development expenses during the development period. In the commercialization phase, the Group recognized the majority of net sales from the commercialization of Bavencio® while the Group and Pfizer evenly split the net amount of sales less defined expense components up until the termination of the agreement. The net sales recognized by the Group in connection with Bavencio® amounted to € 713 million in fiscal 2023 (fiscal 2022: € 611 million). The Group recognized a high double-digit million-euro amount in research and development expenses in fiscal 2023, as in the previous year, in addition to profit transfer expenses of € 143 million up until the termination of the agreement (2022: € 255 million).

On March 27, 2023, the Group announced the termination of the alliance agreement with Pfizer on the co-development and co-commercialization of Bavencio® with effect from June 30, 2023.

Since the termination agreement came into force on June 30, 2023, the Group has held the exclusive global rights for development, manufacturing, and commercialization and has full control over Bavencio®. Pfizer's previous even split of the net amount of sales less defined expense components was replaced by a 15% royalty on defined net sales of Bavencio® that is reported in the cost of sales (see Note (10) "**Cost of sales**"). While the Group and Pfizer will continue to run their respective clinical studies on Bavencio®, the Group will control all future research and development activities. The Group will also have sole responsibility for manufacturing the product and serving the supply chain.

In-licensing agreement with Debiopharm International SA, Switzerland, on drug candidates for the treatment of head and neck cancer

On March 1, 2021, the Group announced its entry into an in-licensing agreement with Debiopharm International SA, Switzerland (Debiopharm), for the exclusive rights for the development and global commercialization of the drug candidate xevinapant (Debio 1143) and for the development of preclinical follow-on compounds. Xevinapant is currently being investigated in a Phase III study for patients with untreated high-risk locally advanced squamous cell carcinoma of the head and neck in combination with platinum-based chemotherapy and standard fractionation intensity-modulated radiotherapy.

The Group made upfront payments of € 188 million in conjunction with the agreement. Moreover, Debiopharm received a right to future milestone payments of up to € 710 million in total, dependent on the achievement of certain development and sales milestones, plus royalties on future net sales. The transaction became effective in April 2021. The upfront cash payment resulted in the recognition of an intangible asset not yet available for use in the amount of € 118 million, an asset under other financial assets for claims for reimbursement in respect of Debiopharm, and a prepayment for future development activities.

In-licensing agreement with Jiangsu Hengrui Pharmaceuticals Co. Ltd., China, on drug candidates for the treatment of metastatic colorectal cancer

On October 30, 2023, the Group announced the conclusion of an in-licensing agreement with Jiangsu Hengrui Pharmaceuticals Co. Ltd., China (Hengrui), including an exclusive worldwide license (excluding China) to develop, manufacture and commercialize the PARP1 inhibitor HRS-1167 and a corresponding option for SHR-A1904, an antibody-drug conjugate.

The Group agreed to make an upfront cash payment of € 160 million for acquired rights and future development activities to be performed by the seller. Additional milestone payments will be due on the achievement of certain development, approval, and commercialization milestones. The agreement also includes tiered royalties on potential net sales. The acquisition of the rights resulted in the recognition of an intangible asset not yet available for use in the amount of € 147 million.

In-licensing agreement with Abbisko Therapeutics Co. Ltd., China, on drug candidates for the treatment of tenosynovial giant cell tumor

On December 4, 2023, the Group announced the conclusion of an in-licensing agreement with Abbisko Therapeutics Co. Ltd., China (Abbisko), including an exclusive license to commercialize pimicotinib in China, Hong Kong, Macau, and Taiwan as well as an exclusive commercialization option in the rest of the world. Pimicotinib is an orally administered, highly selective and potent small-molecule antagonist of colony stimulating factor-1 receptor (CSF-1R).

The Group agreed to make an upfront cash payment of US$ 70 million (€ 64 million) for acquired rights and future development activities to be performed by the seller. An option fee will also be payable to Abbisko if the option is exercised. Abbisko will receive additional payments for the achievement of certain regulatory and commercial milestones as well as tiered royalties on net sales by the Group. The acquisition of the rights resulted in the recognition of an intangible asset not yet available for use in the amount of € 45 million.

Operating Activities

(8) Segment Reporting

Accounting and measurement policies

Segment reporting

The Group’s business activities are broken down into the three operational business sectors of Life Science, Healthcare, and Electronics, as well as the central Group functions. This segment structure reflects the internal organizational and reporting structure. The Life Science business sector encompasses business with tools, chemicals, and equipment for academic labs, biotech, and pharmaceutical manufacturers, as well as the industrial sector. The Healthcare business sector discovers, develops, manufactures, and markets prescription drugs and biopharmaceuticals. The Electronics business sector supplies materials for the semiconductor and display industries and surface design. The three business sectors differ in terms of their products and services, their customers, their sales structures and processes, and the regulatory environment in which they operate. However, the activities that are bundled in each individual business sector are extremely similar in terms of these criteria. The central Group functions also encompass service activities that are the same for all business sectors, such as procurement and human resources, as well as other central Group functions that are not allocated to any of the business sectors. Resource allocation and the assessment of business development are performed at the level of the business sectors by the Executive Board of Merck KGaA, Darmstadt, Germany, as the chief operating decision-maker.

In addition to the direct activities of the central Group functions, Corporate and Other includes income and expenses, assets, and liabilities, as well as cash flows that cannot be allocated to the reportable segments as they are managed at Group level in central Group functions. This relates in particular to expenses and income for the foreign currency hedging of transactions in operating business, financial expenses, and financial income, which include interest expenses and interest income, and income tax expenses and income. Financial liabilities, pension provisions and income tax assets and liabilities are also allocated to Corporate and Other. Moreover, the column serves as the reconciliation to the Group figures.

Apart from net sales, the success of a segment is mainly determined by EBITDA pre (segment result). EBITDA pre is a key figure that is not defined by International Financial Reporting Standards (IFRS). However, it represents the most important variable 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 in addition to specific adjustments presented below.

The segment information is derived from the financial figures, which are based on the IFRSs applied in the Consolidated Financial Statements. Transfer prices for intragroup net sales were determined on an arm’s-length basis for all of the business sectors. Fixed assets are allocated to the segments on the basis of the degree of utilization. Depreciation expenses are allocated on the same basis. Fixed assets are always recognized by the buyer at the amortized Group cost following intragroup transactions. Services performed by the Group functions are allocated on the basis of planning data. Any deviations in the actual costs incurred are not allocated to the reportable operating segments but continue to be recognized in the Corporate and Other column.

Information by business sector – 2023

€ million	Life Science	Healthcare	Electronics	Total of reportable operating segments	Corporate and Other	Group
Net sales[1]	**9,281**	**8,053**	**3,659**	**20,993**	**–**	**20,993**
Intersegment sales	77	–	–	77	-77	–
Operating result (EBIT)[2]	**1,850**	**2,225**	**248**	**4,322**	**-713**	**3,609**
Depreciation	848	299	526	1,673	109	1,782
Impairment losses[3]	34	27	42	103	1	104
Reversals of impairment losses	–	-6	–	-6	–	-6
EBITDA[4]	**2,731**	**2,545**	**816**	**6,092**	**-603**	**5,489**
Adjustments[2]	88	-1	97	184	206	390
EBITDA pre (segment result)[2]	**2,820**	**2,543**	**913**	**6,276**	**-397**	**5,879**
EBITDA pre margin (in % of net sales)[2]	30.4%	31.6%	25.0%	–	–	28.0%
Assets by business sector	23,476	8,522	10,275	42,273	6,222	48,495
Liabilities by business sector	-1,843	-3,146	-636	-5,626	-16,115	-21,741
Investments in property, plant and equipment[5]	953	316	394	1,663	145	1,807
Investments in intangible assets[5]	54	69	58	181	35	216
Non-cash changes in provisions(according to consolidated cash flow statement)[6]	33	94	100	227	154	381

[1] Excluding intersegment sales.
[2] Not defined by International Financial Reporting Standard (IFRS).
[3] Without impairments on financial assets and inventories.
[4] Not defined by International Financial Reporting Standards (IFRS); EBITDA corresponds to operating result (EBIT) adjusted by depreciation, amortization, impairment losses, and reversals of impairment losses.
[5] According to the consolidated cash flow statement.
[6] Excluding provisions for pensions and other post-employment benefits.

Information by business sector – 2022

€ million	Life Science	Healthcare	Electronics	Total of reportable operating segments	Corporate and Other	Group
Net sales[1]	**10,380**	**7,839**	**4,013**	**22,232**	**–**	**22,232**
Intersegment sales	61	–	–	61	-61	–
Operating result (EBIT)[2]	**2,808**	**1,895**	**572**	**5,275**	**-801**	**4,474**
Depreciation	845	303	545	1,693	105	1,798
Impairment losses[3]	24	187	20	232	–	232
Reversals of impairment losses	–	–	–	–	–	–
EBITDA[4]	**3,678**	**2,385**	**1,138**	**7,200**	**-696**	**6,504**
Adjustments[2]	82	92	55	228	117	345
EBITDA pre (segment result)[2]	**3,760**	**2,477**	**1,192**	**7,428**	**-579**	**6,849**
EBITDA pre margin (in % of net sales)[2]	36.2%	31.6%	29.7%	–	–	30.8%
Assets by business sector[5]	24,203	8,135	10,857	43,195	5,341	48,535
Liabilities by business sector[5]	-2,094	-3,111	-744	-5,949	-16,571	-22,521
Investments in property, plant and equipment[6]	694	344	397	1,435	97	1,531
Investments in intangible assets[6]	107	136	13	256	20	275
Non-cash changes in provisions (according to consolidated cash flow statement)[7]	72	174	28	274	3	277

[1] Excluding intersegment sales.
[2] Not defined by International Financial Reporting Standard (IFRS).
[3] Without impairments on financial assets and inventories.
[4] Not defined by International Financial Reporting Standards (IFRS); EBITDA corresponds to operating result (EBIT) adjusted by depreciation, amortization, impairment losses, and reversals of impairment losses.
[5] Previous-year figures have been adjusted, see note (6) "**Acquisitions and divestments**".
[6] According to the consolidated cash flow statement.
[7] Excluding provisions for pensions and other post-employment benefits.

Information by country and region – 2023

€ million	Europe	thereof: Germany	thereof: Switzerland	North America	thereof: USA	Asia-Pacific	thereof: China	Latin America	Middle East and Africa	Group
Net sales by customer location[1]	6,037	1,000	369	5,952	5,632	6,936	2,708	1,331	737	20,993
Net sales by company location[1]	6,334	1,420	512	6,198	5,911	6,658	2,477	1,267	535	20,993
Goodwill and other intangible assets[2]	5,121	1,783	1,780	18,794	18,783	480	47	2	–	24,396
Property, plant and equipment	4,878	2,215	1,097	2,576	2,571	1,315	444	225	62	9,056
Research and development costs	-2,004	-1,042	-827	-349	-348	-63	-25	-18	-11	-2,445
Number of employees	28,304	13,531	2,648	14,718	14,496	15,259	4,433	3,458	1,169	62,908

[1] Excluding intersegment sales.

[2] Goodwill and other intangible assets are allocated by currency area.

Information by country and region – 2022

€ million	Europe	thereof: Germany	thereof: Switzerland	North America	thereof: USA	Asia-Pacific	thereof: China	Latin America	Middle East and Africa	Group
Net sales by customer location[1]	6,248	1,108	469	6,361	6,025	7,697	3,157	1,231	695	22,232
Net sales by company location[1]	6,648	1,532	592	6,596	6,302	7,297	2,818	1,175	516	22,232
Goodwill and other intangible assets[2, 3]	4,930	1,568	1,768	20,163	20,152	629	57	2	–	25,724
Property, plant and equipment[3]	4,302	1,911	1,059	2,368	2,363	1,266	423	211	57	8,204
Research and development costs	-2,051	-1,081	-835	-372	-371	-69	-26	-17	-12	-2,521
Number of employees	28,243	13,620	2,574	15,847	15,634	15,412	4,904	3,487	1,243	64,232

[1] Excluding intersegment sales.

[2] Goodwill and other intangible assets are allocated by currency area.

[3] Previous-year figures have been adjusted, see note (6) "**Acquisitions and divestments**".

No single customer accounted for more than 10% of the Group’s total net sales in fiscal 2023 or 2022.

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

€ million	2023	2022
EBITDA pre of the operating businesses[1]	**6,276**	**7,428**
Corporate and Other	-397	-579
EBITDA pre of the Group[1]	**5,879**	**6,849**
Depreciation/amortization/impairment losses/reversals of impairment losses	-1,880	-2,030
Adjustments[1]	-390	-345
Operating result (EBIT)[1]	**3,609**	**4,474**
Financial result	-125	-187
Profit before income tax	**3,484**	**4,287**

[1] Not defined by International Financial Reporting Standard (IFRS). Please refer to the following table for the components of the adjustments.

The adjustments comprised the following:

€ million	2023	2022
Restructuring expenses	-249	-198
Integration expenses/IT expenses	-118	-88
Gains (+)/losses (-) on the divestment of businesses	51	38
Acquisition-related adjustments	-18	-29
Other adjustments	-56	-68
Adjustments before impairment losses/reversals of impairment losses[1]	**-390**	**-345**
Impairment losses[2]	-88	-232
Reversals of impairment losses	1	–
Adjustments (total)[1]	**-477**	**-577**

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

[2] Without impairments on financial assets and inventories.

Restructuring expenses in the year under review primarily related to a program to further improve processes and align the Group functions more closely with the businesses (€ 126 million; 2022: € 20 million; see Note (27) "**Other provisions**").

As in the previous year, integration and IT expenses in fiscal 2023 related to expenses for the enhancement of ERP systems.

Other adjustments include the losses on the net position of monetary assets and liabilities resulting from hyperinflationary accounting in Argentina and Turkey, which are reported in other operating expenses (see Note (2) "**Reporting principles**" and Note (14) "**Other operating expenses**").

Impairment losses were attributable in particular to intangible assets in the Electronics and Life Science business sectors (see Note (14) "**Other operating expenses**" and Note (19) "**Other intangible assets**").

The adjustments are reported in the consolidated income statement as part of the respective functional costs and allocated to them as follows:

2023

€ million	thereof: cost of sales	thereof: marketing and selling expenses	thereof: administration expenses	thereof: research and development expenses	thereof: other operating income and expenses	**Total**
Restructuring expenses	-42	-44	-135	-6	-21	-249
Integration expenses/IT expenses	-1	–	-110	-1	-6	-118
Gains (+)/losses (-) on the divestment of businesses	–	–	–	–	51	51
Acquisition-related adjustments	–	–	–	–	-18	-18
Other adjustments	–	–	–	–	-56	-56
Adjustments before impairment losses/reversals of impairment losses[1]	**-43**	**-44**	**-246**	**-7**	**-50**	**-390**
Impairment losses[2]	–	–	–	–	-88	-88
Reversals of impairment losses	–	–	–	–	1	1
Adjustments in the operating result (total)[1]	**-43**	**-44**	**-246**	**-7**	**-138**	**-477**

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

[2] Without impairments on financial assets and inventories.

2022

€ million	thereof: cost of sales	thereof: marketing and selling expenses	thereof: administration expenses	thereof: research and development expenses	thereof: other operating income and expenses	Total
Restructuring expenses	-27	-32	-38	-74	-28	-198
Integration expenses/IT expenses	2	–	-77	-1	-12	-88
Gains (+)/losses (-) on the divestment of businesses	–	–	–	–	38	38
Acquisition-related adjustments	-7	–	–	–	-22	-29
Other adjustments	–	–	–	–	-68	-68
Adjustments before impairment losses/reversals of impairment losses[1]	**-32**	**-32**	**-115**	**-75**	**-91**	**-345**
Impairment losses[2]	–	–	–	–	-232	-232
Reversals of impairment losses	–	–	–	–	–	–
Adjustments in the operating result (total)[1]	**-32**	**-32**	**-115**	**-75**	**-323**	**-577**

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

[2] Without impairments on financial assets.

(9) Net sales

Accounting and measurement policies

Nature and timing of revenue recognition

Net sales are recognized when (or as) the customer obtains control of the asset. For sales of goods, the customer typically 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. In the case of equipment sales, the criteria for revenue recognition are only met after installation has been successfully completed – to the extent that the installation requires specialized knowledge, does not represent a clear ancillary service and the relevant equipment can only be used by the customer once successfully set up.

For service contracts and customer-specific contract manufacturing of goods and equipment, the Group recognizes revenue over time based on the progress toward complete satisfaction of the performance obligation, if there is a contractual claim for payment against the customer for the services already performed and there is no alternative use. Input- and output-oriented methods are used to appropriately determine progress on a contract-specific basis. Although progress is ideally measured using input-oriented methods, output-oriented methods are always applied when the input cannot be reliably determined, for example. Specifically, the appropriate degree of progress is mainly calculated on the basis of milestones reached, time elapsed, units delivered, or costs incurred in proportion to the anticipated total costs.

Licenses for intellectual property are granted to a limited extent in the Life Science and Healthcare business sectors. Unlike in the Life Science business sector, these transactions do not usually form part of ordinary activities in the Healthcare business sector, meaning that the corresponding income is reported in other operating income (see Note (7) “**Collaboration and licensing agreements**” and Note (13) “**Other operating income**”).

Net sales from contracts comprising several separate performance obligations are recognized on a pro rata basis when the respective performance obligation has been fulfilled. Multiple-element arrangements of this nature only exist to a very limited extent in the Life Science business sector.

Determining the transaction price

The Group grants customers various kinds of rebates and discounts. These, as well as anticipated customer refund claims, state compulsory charges, and rebates from health plans and programs, are deducted from sales. The most significant portion of these deductions from sales is attributable to the Healthcare business sector and, in particular, sales in the United States.

Sales deductions provided on the invoice as price-reducing items, which will likely be applied by customers when making the respective payments, are recognized as reduction of trade accounts receivable. Expected refunds, such as bonus payments, reimbursements for rights of return or rebates from health plans and programs, are reported in the consolidated balance sheet under refund liabilities.

The measurement of sales deductions and refund liabilities arising from expected rebates and discounts takes account of past experience, specific knowledge of expected sales volume growth rates, contractual conditions, pricing information, and external information from distributors and industry services.

The measurement of sales deductions and refund liabilities resulting from rights of return takes into account historical rates of return for individual product groups, information from distributors on inventory levels, and publicly available information on product sales from sector-specific service providers (in the Healthcare business sector).

Contractual payment terms

Given that the Group generates the large majority of its net sales through transactions with simple structures, the company usually has an enforceable right to payment after the performance obligation has been fulfilled. The payment targets contractually agreed between the Group and its customers usually range between 30 and 60 days.

Practical expedients

The Group uses the practical expedient of IFRS 15 in which the promised amount of consideration is not adjusted for the effects of a significant financing component if the period between the fulfillment of a performance obligation and the payment by the customer only amounts to up to one year.

Significant discretionary decisions and sources of estimation uncertainty

Sales deductions

The measurement of sales deductions and the corresponding refund liabilities requires extensive estimates. Uncertainties exist in particular concerning the extent to which past experience serves as a reliable basis for estimating the future development of expected refunds, such as bonus payments, reimbursements for rights of return, or rebates from health plans and programs. External information from distributors and industry services outside of the Group's control, which are also subject to uncertainty, are used to determine sales deductions.

Due to a lack of past experience, the estimation uncertainty referenced above is particularly relevant for product launches in the Healthcare business sector.

Any changes in estimates of the parameters listed above have a cumulative impact on the net sales for the respective adjustment period.

If the carrying amount of refund liabilities had been 10% higher as of the reporting date, this would have resulted in a € 88 million (2022: € 91 million) reduction in profit before tax.

The following tables present a breakdown of net sales by key product lines/products:

Life Science[1]

€ million	2023		2022	
Science & Lab Solutions	4,706	51%	4,898	47%
Process Solutions	3,782	41%	4,540	44%
Life Science Services	792	8%	943	9%
Total	**9,281**	**100%**	**10,380**	**100%**

[1] Prior-year figures have been adjusted owing to realignment in the Life Science business sector.

Healthcare

€ million	2023		2022	
Oncology	**1,819**	**22%**	**1,683**	**22%**
thereof: Erbitux®	1,025	13%	1,023	13%
thereof: Bavencio®	713	9%	611	8%
Neurology & Immunology	**1,665**	**21%**	**1,743**	**22%**
thereof: Mavenclad®	956	12%	856	11%
thereof: Rebif®	709	9%	887	11%
Fertility	**1,547**	**19%**	**1,446**	**18%**
thereof: Gonal-f®	847	11%	825	11%
Cardiovascular, Metabolism & Endocrinology	**2,786**	**35%**	**2,805**	**36%**
thereof: Glucophage®	882	11%	930	12%
thereof: Concor®	571	7%	590	8%
thereof: Euthyrox®	565	7%	553	7%
thereof: Saizen®	332	4%	266	3%
Other	**235**	**3%**	**161**	**2%**
Total	**8,053**	**100%**	**7,839**	**100%**

Electronics

€ million	2023		2022	
Semiconductor Solutions	2,479	68%	2,674	67%
Display Solutions	770	21%	900	22%
Surface Solutions	411	11%	439	11%
Total	**3,659**	**100%**	**4,013**	**100%**

The following tables present a more detailed breakdown of net sales from contracts with customers in the individual business sectors by product type and region.

2023

€ million

Net sales by nature of the products	Life Science		Healthcare		Electronics		Group	
Goods	8,074	87%	8,004	99%	2,952	81%	19,030	91%
Equipment	411	5%	–	–	593	16%	1,004	5%
Services	778	8%	33	1%	111	3%	922	4%
License income	17	–	–	–	3	–	19	–
Commission income	1	–	15	–	–	–	17	–
Income from co-commercialization agreements	–	–	–	–	–	–	–	–
Total	**9,281**	**100%**	**8,053**	**100%**	**3,659**	**100%**	**20,993**	**100%**
Net sales by region (customer location)								
Europe	3,178	34%	2,541	31%	318	9%	6,037	29%
North America	3,372	36%	1,793	22%	787	21%	5,952	28%
Asia-Pacific	2,263	25%	2,232	28%	2,440	67%	6,936	33%
Latin America	352	4%	941	12%	39	1%	1,331	6%
Middle East and Africa	116	1%	546	7%	75	2%	737	4%
Total	**9,281**	**100%**	**8,053**	**100%**	**3,659**	**100%**	**20,993**	**100%**

2022

€ million

Net sales by nature of the products	Life Science		Healthcare		Electronics		Group	
Goods	9,097	88%	7,804	100%	3,481	87%	20,382	92%
Equipment	463	4%	1	–	417	10%	881	4%
Services	804	8%	16	–	110	3%	930	4%
License income	16	–	–	–	4	–	20	–
Commission income	1	–	17	–	–	–	18	–
Income from co-commercialization agreements	–	–	1	–	–	–	1	–
Total	**10,380**	**100%**	**7,839**	**100%**	**4,013**	**100%**	**22,232**	**100%**
Net sales by region (customer location)								
Europe	3,445	33%	2,433	31%	371	9%	6,248	28%
North America	3,931	38%	1,781	23%	649	16%	6,361	29%
Asia-Pacific	2,536	25%	2,261	29%	2,901	72%	7,697	35%
Latin America	353	3%	838	10%	40	1%	1,231	5%
Middle East and Africa	116	1%	527	7%	53	2%	695	3%
Total	**10,380**	**100%**	**7,839**	**100%**	**4,013**	**100%**	**22,232**	**100%**

Group net sales amounted to € 20,993 million in fiscal 2023 (2022: € 22,232 million). Around 5% of this figure was recognized over time (2023: € 1,119 million; 2022: € 933 million). This mainly related to net sales from services in the Life Science business sector and net sales from the project business of the Semiconductor Solutions business unit in the Electronics business sector.

Orders already received by the reporting date that will result in net sales in future periods amounted to around € 4 billion as of December 31, 2023 (December 31, 2022: around € 6 billion), of which around € 3 billion related to the Life Science business sector (December 31, 2022: around € 4 billion). Based on past experience, around 13% of orders received are not expected to result in net sales until fiscal 2025 or later (December 31, 2022: around 10% in fiscal 2024 or later).

The following table shows the change in refund liabilities:

2022

	Rebates/Bonus payments		Rights of return		
€ million	Total	thereof: United States	Total	thereof: United States	Total
Jan. 1, 2022	**784**	**445**	**55**	**35**	**839**
Additions due to business combinations	–	–	–	–	**–**
Other additions	2,470	1,902	56	40	**2,526**
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	**–**
Utilizations	-2,270	-1,739	-43	-29	**-2,313**
Cumulative increase (-)/decrease (+) in net sales	-159	-147	-9	-6	**-168**
thereof: attributable to performance obligations satisfied in prior periods	-118	-115	–	0	**-118**
Currency translation	29	31	2	2	**31**
Other	-3	–	–	–	**-3**
Dec. 31, 2022	**850**	**492**	**62**	**43**	**912**

2023

	Rebates/Bonus payments		Rights of return		
€ million	Total	thereof: United States	Total	thereof: United States	**Total**
Jan. 1, 2023	**850**	**492**	**62**	**43**	**912**
Additions due to business combinations	–	–	–	–	**–**
Other additions	2,596	1,945	52	31	**2,648**
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	**–**
Utilizations	-2,485	-1,855	-60	-37	**-2,545**
Cumulative increase (-)/decrease (+) in net sales	-121	-120	8	10	**-113**
thereof: attributable to performance obligations satisfied in prior periods	-118	-116	9	10	**-109**
Currency translation	-26	-18	-2	-2	**-28**
Other	2	–	–	–	**2**
Dec. 31, 2023	**816**	**443**	**60**	**44**	**877**

The development in contract assets and contract liabilities is shown in Note (26) “**Contract assets**” and in Note (29) “**Other non-financial liabilities**”.

(10) Cost of sales

Accounting and measurement policies

Cost of sales

The cost of sales primarily includes the cost of manufactured products sold and the merchandise sold.

Cost comprises the following items: directly attributable costs, such as cost of materials; personnel and energy costs; depreciation and amortization; overheads attributable to the production process; and inventory impairment losses and their reversals.

The cost of sales included amortization of intangible assets (excluding amortization of internally generated or separately acquired software) in the amount of € 173 million (2022: € 207 million). Material costs amounted to € 3,709 million in fiscal 2023 (2022: € 3,996 million) and were largely reported under cost of sales. For the first time, the cost of sales also included royalties of € 55 million for Bavencio® as a result of the agreement terminating the strategic alliance with Pfizer Inc., United States, which came into force on June 30, 2023 (see Note (7) “**Collaboration and licensing agreements**”).

Impairment losses on inventories amounted to € 424 million (2022: € 279 million) in the reporting period, while reversals of impairment losses amounted to € 237 million (2022: € 197 million).

(11) Marketing and selling expenses

Accounting and measurement policies

Marketing and selling expenses

Marketing and selling expenses within logistics costs also include expenses for transportation services performed on behalf of customers. The corresponding income from these services is reported under net sales.

Amortization of the intangible assets under marketing and selling expenses is mainly attributable to customer relationships, licenses and similar rights, brands, and trademarks.

Marketing and selling expenses comprised the following items:

€ million	**2023**	2022
Sales force	-950	-971
Internal sales services	-923	-972
Sales promotion	-515	-476
Logistics	-1,061	-1,193
Amortization of intangible assets[1]	-596	-616
Royalty and license expenses	-126	-137
Other marketing and selling expenses	-339	-348
Marketing and selling expenses	**-4,510**	**-4,714**

[1] Excluding amortization of internally generated or separately acquired software.

The reduction in logistics costs was due to lower freight rates in international goods transportation and the lower sales volume in the Life Science and Electronics business sectors. Savings also resulted in lower expenses for the internal and external sales force.

Of the royalty and license expenses, € 51 million (2022: € 53 million) related to the commercialization of Erbitux®.

(12) Research and development costs

Accounting and measurement policies

Research and development costs

The item comprises the costs of the Group's own research and development departments, the expenses incurred as a result of research and development collaborations as well as the costs of clinical trials in the Healthcare business sector (both before and after approval is granted).

For information on the capitalization of development costs and their separation from research and development services agreed in conjunction with in-licensing, see Note (19) "**Other intangible assets**".

Cost reimbursements for research and development are offset against research and development costs.

The net income from repayments of subsidies received and reimbursements recognized within research and development costs amounted to € 21 million in fiscal 2023 (2022: € 23 million).

Research and development costs include a high double-digit million-euro amount for the expected acceptance and follow-on obligations in connection with the discontinuation of the development program for evobrutinib as a result of not meeting their primary endpoints of the two Phase III clinical trials.

(13) Other operating income

Accounting and measurement policies

Other operating income

Other operating income comprises all income that cannot be allocated to net sales or finance income on account of its character.

Income from upfront payments, milestone payments, and royalties

Income from upfront payments, milestone payments, and royalties comprises consideration received by the Group from contract partners that are not customers. This relates in particular to collaboration and out-licensing agreements in the Healthcare business sector (see Note (7) "**Collaboration and licensing agreements**").

Income from the revaluation of contingent considerations

The accounting treatment of contingent consideration agreed at the sale of a business as defined in IFRS 3 is shown in Note (36) "**Other financial assets.**"

Other operating income was broken down as follows:

€ million	**2023**	2022
Income from the disposal of assets	137	54
Income from the revaluation of contingent considerations	71	6
Income from upfront payments, milestone payments and royalties	53	105
Currency effects from operating activities	37	–
Income from fair value measurement of assets	27	47
Income from the reversal of provisions for litigation	25	24
Realized gains from currency translation	15	71
Income from miscellaneous services	13	7
Reversal of impairment losses on non-financial asset	6	–
Remaining other operating income	66	132
Other operating income	**445**	**486**

Income from asset disposals included income from the disposal of a non-strategic brand in the Healthcare business sector and a portfolio of licenses and patents in the Electronics business sector.

The increase in income from contingent consideration was due in particular to a revaluation following the achievement of milestones in connection with the biosimilars business that was sold to a subsidiary of Fresenius SE & Co. KGaA, Bad Homburg vor der Höhe, in 2017.

The reduction in upfront payments, milestone payments, and royalties was mainly due to the lower level of royalties for interferon beta products (Biogen Inc., United States) of € 45 million (2022: € 55 million) and the fact that no license income was recognized in the United States for the antidepressant Viibryd® (AbbVie Inc., United States) after income of € 27 million in the previous year.

For information on income from the reversal of provisions for litigation, see Note (27) "**Other provisions**".

(14) Other operating expenses

Accounting and measurement policies

Other operating expenses

Other operating expenses comprise all expenses that cannot be reasonably allocated to a functional cost type or finance costs.

The breakdown of other operating expenses was as follows:

€ million	2023	2022
Profit share agreements	-171	-275
Impairment losses on non-financial assets	-104	-232
Non-income related taxes and expenses from tax audits	-102	-68
Loss from hyperinflation accounting	-56	-67
Premiums, fees and contributions	-47	-45
Project expenses (including integration and IT projects)	-46	-67
Non-allocable personnel expenses	-39	-45
Infrastructure expenses	-26	-16
Expenses from Litigation	-26	-30
Expenses from a donation to the World Health Organization	-23	-7
Expenses from claims	-23	-9
Restructuring expenses	-20	-12
Expenses from fair value measurement of assets and liabilities at fair value	-19	-8
Expenses from disposal of businesses and assets	-5	-9
Expenses for miscellaneous services	-4	-11
Currency effects from operating activities	–	-154
Remaining other operating expenses	-120	-114
Other operating expenses	**-830**	**-1,170**

The reduction in profit transfer expenses was due in particular to the termination of the strategic alliance with Pfizer Inc., United States, for Bavencio® in the field of immuno-oncology with effect from June 30, 2023 (see Note (7) “**Collaboration and licensing agreements**”).

Impairments of non-financial assets were attributable to intangible assets (see Note (19) “**Other intangible assets**”) in the amount of € 81 million (2022: € 211 million) and to property, plant, and equipment (see Note (20) “**Property, plant, and equipment**”) in the amount of € 23 million (2022: € 21 million).

Currency effects from operating activities in the previous year primarily resulted from cash flow hedges in U.S. dollars.

(15) Income tax

Accounting and measurement policies

Current income taxes

Current income taxes for the reporting period and, where applicable, for prior periods, are calculated in the amounts that the tax authorities are expected to demand or reimburse. The calculation is based on the company-specific tax rate applicable in the relevant tax year.

Uncertain income tax assets and liabilities

Factual assessments are made to calculate uncertain income tax assets and liabilities. Uncertain income tax matters are recognized depending on the likelihood that the responsible tax authorities will accept the respective income tax treatment. If recognition by the tax authorities is considered unlikely, the respective uncertain tax asset or uncertain tax liability is measured at the most likely amount. Uncertain income tax liabilities are reported within income tax liabilities. Expected income tax-related penalties and interest that do not fall within the scope of IAS 12 are treated as provisions in line with IAS 37.

Deferred taxes

Deferred tax assets resulting from deductible temporary differences that exceed deferred tax liabilities relating to the same taxation authority and the same taxable entity are recognized if it is considered probable that taxable profit will be available against which they can be utilized. This corresponds to the recognition of deferred tax assets on unused tax credits and tax loss and interest carryforwards.

The recognition of deferred tax assets requires an estimate of the probability of future use. The influencing factors considered as part of this assessment include the following:

- temporary differences relating to the same taxation authority and the same taxable entity that will be subject to taxation in the future,
- results history,
- results planning, and
- existing tax planning of the respective Group company.

Deferred tax liabilities for planned dividend payments within the next twelve months of profits already generated are recognized.

Significant discretionary decisions and sources of estimation uncertainty

Income taxes

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

When assessing income tax assets and liabilities, the interpretation of tax provisions may be subject to particular uncertainty. The possibility that the relevant tax authorities will take a differing view concerning the application and interpretation of tax standards cannot be ruled out. Changes to the assumptions underlying the interpretation of tax standards, for example as a result of changes in legislation, are recognized in the balance sheet when the change comes into force.

With regard to deferred tax items, there is uncertainty as to when an asset will be realized or a liability settled. This applies in particular to deferred taxes recognized in the course of company acquisitions. Assessing the recoverability, particularly of tax credits and tax loss and interest carryforwards, requires assumptions and estimates concerning the future taxable income of the respective Group company. Furthermore, the extent to which a subsidiary’s planned dividend distribution is probable within the next twelve months is discretionary.

Income taxes in the consolidated income statement were broken down as follows:

€ million	2023	2022
Current income taxes in the period	-1,140	-1,344
Income taxes for previous periods	167	28
Deferred taxes in the period	323	369
thereof: from temporary differences	290	338
thereof: from changes in tax rates	-7	12
thereof: from tax loss carryforwards	40	19
Income taxes	**-650**	**-948**

Tax reconciliation

The following table presents the reconciliation from the theoretical income tax expense to the income tax expense according to the consolidated income statement. The theoretical income tax expense is determined by applying the statutory tax rate of a corporation headquartered in Darmstadt of 31.7% (2022: 31.7%).

€ million	2023	2022
Profit before income tax	3,484	4,287
Tax rate	31.7%	31.7%
Theoretical income tax expense	-1,105	-1,360
Tax rate differences	495	568
Tax effect of companies with a negative contribution to consolidated profit	-7	-71
Income tax for previous periods	167	28
Tax credits	-103	-79
Tax effect on tax loss carryforwards	32	14
Tax effect of non-deductible expenses/Tax-free income/Other tax effects	-129	-48
Income tax expense according to consolidated income statement	**-650**	**-948**
Tax ratio according to consolidated income statement	**18.7%**	**22.1%**

Income taxes consisted of corporation and trade taxes for the German companies and comparable income taxes for non-German companies. Income taxes relating to previous periods recognized in fiscal 2023 resulted in particular from completed tax audits, changes in income tax liabilities for risks from tax audits, and tax assessments for previous years.

Deferred taxes

The allocation of deferred tax assets and liabilities to the balance sheet items and the reconciliation of deferred taxes in the consolidated income statement and the consolidated balance sheet are presented in the following table:

	Jan 1, 2022				Dec. 31, 2022		
€ million	Deferred tax assets/liabilities (net)	Deferred taxes (consolidated income statement)	Deferred taxes credited/debited to equity	Changes in scope of consolidation/ Currency translation/ Other changes[1]	Deferred tax assets/liabilities (net)	Assets	Liabilities[1]
Intangible assets	-1,428	302	–	-135	-1,261	112	1,374
Property, plant and equipment	-68	-59	–	-3	-129	39	168
Current and non-current financial assets	-6	-4	-22	–	-32	–	32
Inventories	737	84	–	2	823	846	23
Current and non-current receivables/Other assets	81	-27	–	-3	51	66	15
Current and non-current provisions	803	-37	-296	6	475	526	51
Current and non-current liabilities	17	93	13	-2	122	170	49
Tax loss carryforwards	11	19	–	–	30	30	–
Tax refund claims/Other	-57	-2	1	3	-55	41	96
Deferred taxes (before offsetting)	**91**	**369**	**-305**	**-132**	**23**	**1,829**	**1,807**
Offset deferred tax assets and liabilities	–				–	-520	-520
Deferred taxes (consolidated balance sheet)	**91**				**23**	**1,310**	**1,287**

[1] Previous-year figures have been adjusted, please refer to Note (6) "**Acquisitions and Divestments**".

	Jan. 1, 2023				Dec. 31, 2023		
€ million	Deferred tax assets/liabilities (net)	Deferred taxes (consolidated income statement)	Deferred taxes credited/ debited to equity	Changes in scope of consolidation/ Currency translation/ Other changes	Deferred tax assets/liabilities (net)	Assets	Liabilities
Intangible assets	-1,261	235	–	47	-979	111	1,090
Property, plant and equipment	-129	5	–	5	-119	103	222
Current and non-current financial assets	-32	13	-17	–	-36	2	38
Inventories	823	42	–	-44	821	835	15
Current and non-current receivables/Other assets	51	9	–	-1	59	92	33
Current and non-current provisions	475	-10	50	-6	510	633	122
Current and non-current liabilities	122	-6	9	-6	119	181	62
Tax loss carryforwards	30	40	–	-2	67	67	–
Tax refund claims/Other	-55	-5	–	3	-57	117	174
Deferred taxes (before offsetting)	**23**	**323**	**42**	**-3**	**385**	**2,142**	**1,757**
Offset deferred tax assets and liabilities	–				–	-627	-627
Deferred taxes (consolidated balance sheet)	**23**				**385**	**1,514**	**1,130**

As in the previous year, the item “Changes in scope of consolidation/Currency translation/Other changes” mainly comprised exchange rate effects for items translated from U.S. dollars to the reporting currency (euro).

Furthermore, a non-recurring deferred tax income on intangible assets impacted in the amount of € 95 million.

Given the positive earnings forecasts, it was assumed that it will be possible to realize recognized deferred tax assets of € 597 million (December 31, 2022: € 191 million), which exceeded deferred tax liabilities relating to the same taxation authority and the same taxable entity, even though there was a loss in the current or previous period.

No deferred tax assets were recognized in the balance sheet for deductible temporary differences and other interest carryforwards in the amount of € 13,220 million (December 31, 2022: € 71 million). The increase in deductible temporary differences for which no deferred tax assets were recognized in the balance sheet is due to the change in the exercise of different tax-related options abroad compared with the previous year. The majority of these differences can only be utilized until 2029. Their utilization for tax purposes is not expected during this period.

Deferred tax liabilities from outside basis differences for planned dividend payouts were recognized in the amount of € 157 million (December 31, 2022: € 79 million). Retained earnings of subsidiaries for which no deferred taxes were recognized amounted to € 10,627 million as of December 31, 2023 (December 31, 2022: € 10,249 million). The resulting temporary differences that will be taxable in future periods in the event of dividend payments would amount to € 603 million as of December 31, 2023 (December 31, 2022: € 582 million).

Changes in tax loss carryforwards

Tax loss carryforwards were structured as follows:

	Dec. 31, 2023			Dec. 31, 2022[1]		
€ million	**Germany**	**Outside Germany**	**Total**	Germany	Outside Germany	Total
Tax loss carryforwards	**257**	**536**	**793**	**161**	**677**	**838**
Tax loss carryforwards for which a deferred tax asset is recognized	156	95	251	–	136	136
Tax loss carryforwards for which no deferred tax asset is recognized	101	441	542	161	541	702
Potential deferred tax assets for tax loss carryforwards	**78**	**124**	**202**	**49**	**165**	**214**
Recognized deferred tax assets on tax loss carryforwards	49	18	67	–	30	30
Not recognized deferred tax assets on tax loss carryforwards	29	106	135	49	135	184

[1] Prior year's figures for Germany were adjusted.

The majority of the tax loss carryforwards either had no expiry date or can be utilized for up to 20 years. This also applies to losses for which no deferred taxes were recognized.

Deferred tax assets resulting from tax loss carryforwards that exceed deferred tax liabilities relating to the same taxation authority and the same taxable entity are not recognized if it is not considered probable that taxable profit will be available against which they can be utilized.

Income tax receivables and income tax liabilities

Income tax receivables amounted to 482 million € as of December 31, 2023 (December 31, 2022: 456 million €) and mainly resulted from tax prepayments that exceeded the actual amount of tax payable for the past fiscal year and earlier fiscal years from refund claims for previous years and from withholding tax claims. As of December 31, 2023, income tax liabilities including liabilities for uncertain tax obligations totaled 1,473 million € (December 31, 2022: 1,522 million €).

(16) Operating cash flow

Accounting and measurement policies

Operating cash flow

The operating cash flow is calculated and presented based on the following principles:

- The operating cash flow is presented using the indirect method based on profit after taxes.
- The option to recognize interest received and interest payments made is exercised to the extent that such transactions are recognized in cash flow from operating activities.
- Tax payments are reported in operating cash flow. Only significant transactions where the associated tax payments can be practically calculated are recognized in the relevant item of the consolidated cash flow statement.

Tax payments made totaled € 1,053 million in fiscal 2023 (2022: € 1,344 million). Tax refunds received amounted to € 38 million (2022: € 145 million).

Interest paid totaled € 181 million (2022: € 185 million). Interest received amounted to € 77 million (2022: € 25 million).

The changes in provisions included a mid-double-digit million-euro amount for the recognition of restructuring provisions to align the Group functions more closely with the businesses, and a high double-digit million-euro amount for the recognition of provisions for acceptance and follow-on obligations in connection with the results of the two Phase III clinical trials to evaluate the efficacy and safety of evobrutinib (see Note (27) "**Other provisions**").

The item "Neutralization of gains/losses on disposal of fixed assets" included the effects recognized in income of the disposal of a non-strategic brand in the Healthcare business sector and a portfolio of licenses and patents in the Electronics business sector. The corresponding cash inflows are recognized in the cash flow from investing activities.

The change in other non-cash income and expenses contained the neutralization of revaluations of contingent consideration recognized in income (see Note (36) "**Other financial assets**"). The corresponding cash inflows are also recognized in the cash flow from investing activities.

(17) Earnings per share

Accounting and measurement policies

Earnings per share

Basic earnings per share is calculated by dividing the profit after taxes attributable to the shareholders of Merck KGaA, Darmstadt, Germany (net income) by the weighted average number of theoretical shares outstanding. The calculation of the theoretical number of shares is based on the fact that the general partner's equity is not represented by shares. Corresponding to the division of the subscribed capital of € 168 million into 129,242,252 shares (see Note (34) "**Equity**"), the general partner's equity of € 397 million equates to 305,535,626 theoretical shares. Overall, equity capital amounted to € 565 million or 434,777,878 theoretical shares outstanding.

As in the previous year, equity capital remained unchanged in fiscal 2023. The weighted average (basic) number of shares was 434,777,878 and thus corresponded to the number of theoretical shares outstanding. In fiscal 2023 and 2022, there were no shares with a potential diluting effect; as a result, the diluted earnings per share were equivalent to basic earnings per share.

Operating Assets, Liabilities, and Contingent Liabilities

(18) Goodwill

Accounting and measurement policies

Goodwill

In the course of business combinations, goodwill is recognized on the acquisition date. The option to measure non-controlling interests at fair value on the date of their acquisition (full goodwill method) is not utilized.

The purpose of impairment testing in accordance with IAS 36 is to ensure that the carrying amount of assets in the balance sheet is not higher than their recoverable amount. The recoverable amount is the higher of the fair value less costs of disposal and the value in use.

Method for impairment testing

Impairment testing for goodwill takes place at the level of the Life Science, Healthcare, and Electronics business sectors. These groups of cash-generating units (CGUs) are the lowest level at which goodwill in the Group is monitored for internal management purposes.

Impairment testing is performed on a scheduled basis in the third quarter of every year and on an ad hoc basis where there are indications of impairment. The existence of indications of impairment is monitored using various factors such as changes in medium-term planning, analyst forecasts, validation multiples, and the Group's average market capitalization compared to its balance sheet equity.

In the 2023 reporting year, the recoverable amount for all CGUs was primarily determined on the basis of the fair value less costs of disposal (2022: Life Science and Electronics on the basis of the fair value less costs of disposal; Healthcare on the basis of the value in use).

For both fair value less costs of disposal and value in use, the recoverable amount is calculated in accordance with the discounted cash flow method (Level 3 in the IFRS 13 fair value hierarchy).

In calculating the fair value, the expected post-tax cash flows are derived from the medium-term plans prepared by the business sectors. Due to extensive investments in the Life Science and Electronics CGUs, the fourth planning year after the detailed planning period for both of these CGUs is extrapolated for an additional four years in line with business-specific assumptions before being converted to the terminal value by applying a long-term growth rate. In the Healthcare CGU, the transition to the terminal value takes place after four years starting from the following year. Sales planning was based on internal past experience and largely non-observable input factors in the market, such as future market shares, selling prices and volumes, and new products from the development pipeline and expansion investments. Profit margins are based on past experience adjusted for expected profitability developments.

In calculating the value in use in the previous year, the most recent medium-term plan approved by the Executive Board, with a detailed planning period of four years starting from the following year, served as the basis for planning. Sales planning was based on past experience and assumptions regarding future market shares, selling prices, and volumes. Expected cash inflows and outflows from new products from the Healthcare development pipeline and expansion investments were not included in the calculation of value in use. Profit margins were based on past experience adjusted for expected profitability developments.

The discount factor after taxes is derived on the basis of the following input parameters:

Risk-free interest rate	Derived from the returns of long-term government bonds based on the Svensson method
Beta factor	Derived from the respective sector-specific peer group
Market risk premium	Based on a combination of different estimating methods, for example, historical and implied stock yields
Cost of debt and capital structure	Derived from the market data of the respective peer group companies

The long-term growth rate after the detailed planning period is determined taking into account expected long-term growth and long-term inflation expectations.

Significant measurement assumptions

In the Life Science CGU, the expected average sales growth in the period until the transition to the terminal value was a higher single-digit percentage (2022: higher single-digit percentage). The sales expectation for the Life Science CGU is supported primarily by the anticipated long-term positive development in the Process Solutions and Life Science Services business units, based on ongoing high market growth and the continuing expansion of the portfolio and production capacities. Taking into account Group costs allocated on a pro rata basis, the EBITDA pre margin applied in the period until the transition to the terminal value was around 31% (2022: around 34%).

The expected average sales growth in the Healthcare CGU in connection with the calculation of fair value less costs of disposal amounted to a mid-single-digit percentage rate in the detailed planning period (2022: mid-single-digit percentage rate). The sales performance reflected the probability of regulatory approval of drug candidates in the existing research and development programs. Taking into account Group costs allocated on a pro rata basis, the EBITDA pre margin for fair value less costs of disposal applied in the period until the transition to the terminal value in the impairment test for fiscal 2023 was around 30%.

The calculation of the recoverable amount of the Electronics CGU included the expected average sales growth in the period until the transition to the terminal value at a higher single-digit percentage (2022: higher single-digit percentage). The sales expectation for the Electronics CGU is primarily based on the long-term growth trend in the market for semiconductor materials and positive sales contributions from the Level Up growth program with an initial investment volume exceeding € 3 billion by the end of 2025. Taking into account Group costs allocated on a pro rata basis, the EBITDA pre margin applied in the period until the transition to the terminal value in the impairment test for fiscal 2023 was around 29% (2022: around 30%).

The additional significant value-relevant assumptions underlying the goodwill impairment tests are quantified below.

	Long-term growth rate		Weighted cost of capital after tax	
in %	**2023**	2022	**2023**	**2022**
Life Science	2.00%	2.00%	8.2%	7.5%
Healthcare[1]	1.00%	0.00%	6.3%	5.6%
Electronics	2.00%	2.00%	8.1%	7.1%

[1] The weighted cost of capital before taxes to determine the value in use of the CGU Healthcare for the previous year was 7.3%.

Net cash flows were discounted using the cost of capital after taxes. For the calculation of the value in use, which was applied in the Healthcare business sector in the previous year, the cost of capital before taxes as shown below the table was derived iteratively.

Significant discretionary decisions and sources of estimation uncertainty

Goodwill

The determination of the recoverable amount is subject to discretion and significant estimation uncertainty. Assumptions regarding the amount of net cash flows, long-term growth rates, and discount factors are considered a material source of estimation uncertainty due to their inherent uncertainty. Although the Group assumes that the assumptions applied in calculating the recoverable amount are appropriate, changes to these assumptions could result in goodwill impairment with an adverse impact on the net assets, financial position, and results of operations. In the Electronics CGU in particular, there is a high degree of dependence on the assumptions concerning the long-term growth trend in the market for semiconductor materials.

As in the previous year, the recoverable amount in impairment testing in fiscal 2023 was well above the carrying amount of the respective CGU – more than 15% higher, in fact. Regardless of this, the results of the valuation were checked for plausibility against externally available “sum of the parts” calculations and validated using multiples based on peer group information.

In addition, sensitivity analyses of the key assumptions were performed as part of the scheduled impairment tests. The following table presents the minimum amount by which individual key assumptions could have changed when viewed in isolation before the impairment test triggered the recognition of an impairment loss.

	Decrease in net cash flows		Decrease in long-term growth rate		Increase in cost of capital after tax	
	%		percentage points		percentage points	
	2023	2022	**2023**	2022	**2023**	2022
Life Science	>10	>10	>2	>2	>2	>2
Healthcare	>10	>10	>2	>2	>2	>2
Electronics	>10	>10	>2	>2	>2	>2

The goodwill shown below mainly resulted from the following acquisitions: Exelead Inc., United States; Versum Materials Inc., United States; Sigma-Aldrich Corporation, United States; AZ Electronic Materials S.A., Luxembourg; Millipore Corporation, United States; and Serono SA, Switzerland.

	Goodwill			
€ million	Life Science	Healthcare	Electronics	**Total**
Net carrying amounts, Jan. 1, 2022[1]	**11,059**	**1,525**	**4,420**	**17,004**
Other additions	515	–	42	557
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–
Transfers	–	–	–	–
Impairment losses	–	–	–	–
Currency translation difference	619	–	209	828
Net carrying amounts as of Dec. 31, 2022[1,2]	**12,193**	**1,525**	**4,671**	**18,389**
Net carrying amounts, Jan. 1, 2023[1]	**12,193**	**1,525**	**4,671**	**18,389**
Additions	–	–	–	–
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–
Transfers	–	–	–	–
Impairment losses	–	–	–	–
Currency translation difference	-406	–	-138	-544
Net carrying amounts as of Dec. 31, 2023[1]	**11,787**	**1,525**	**4,532**	**17,845**

[1] Net carrying amounts equal the gross amount.

[2] Previous year has been adjusted, please refer to Note (6) "**Acquisitions and Divestments**".

The changes in goodwill caused by foreign exchange rates resulted almost exclusively from translating the goodwill from the acquisitions of Versum Materials, Inc., United States; the Sigma-Aldrich Corporation, United States; AZ Electronic Materials S.A., Luxembourg; and the Millipore Corporation, United States, which were mostly denominated in U.S. dollars.

Goodwill impairment testing did not give rise to the need to recognize any impairment losses in either fiscal 2022 or fiscal 2023.

The additions in fiscal 2022 resulted in particular from the acquisition of Exelead Inc., United States (see Note (6) "**Acquisitions and divestments**").

(19) Other intangible assets

Accounting and measurement policies

Recognition and initial measurement of purchased intangible assets

In in-licensing, the portion of the consideration paid by the Group to acquire intellectual property is recognized as an intangible asset. If research and development services to be performed by the seller are also agreed in conjunction with the transaction, the related share of consideration is separated and recognized in research and development expenses in line with the service performance.

Contingent consideration linked to milestone payments in connection with the purchase of intangible assets arising outside a business combination is recognized as an intangible asset and as a financial liability once the milestone is reached. Contingent consideration in the form of sales-based royalties is expensed when incurred.

Intangible assets acquired in business combinations are recognized at fair value on the acquisition date.

Recognition and initial measurement of internally generated intangible assets

Owing to the high level of uncertainty until pharmaceutical products are approved, the criteria for the capitalization of development costs in accordance with IAS 38 are not met in the Healthcare business sector for the development of drug candidates. Costs incurred after regulatory approval are insignificant and are therefore not recognized as intangible assets. In the Life Science and Electronics business sectors, development expenses are capitalized as soon as all the recognition criteria are met and can be verified accordingly. This also includes expenses that are required for REACH registration. Furthermore, development expenses for internal software projects and the enhancement of purchased ERP programs are capitalized providing that the relevant criteria have been fulfilled.

Subsequent measurement

Subsequent measurement is at amortized cost.

Purchased and internally generated intangible assets with finite useful lives are amortized using the straight-line method over their useful lives. The useful lives of customer relationships, brand names, and trademarks, as well as marketing authorizations, acquired patents, licenses and similar rights, and software, are usually between three and 24 years. In determining these useful lives, the Group considers factors including the typical product life cycles for each asset and publicly available information about the estimated useful lives of similar assets. The amortization expense is allocated to the respective functional costs or, if this is not possible, recognized under other operating expenses.

The identification of indications of impairment takes place with the involvement of the responsible departments, taking external and internal information sources into consideration. The Group examines the existence of indications of impairment using various factors, particularly deviations from sales forecasts and the analysis of changes in medium-term planning. An impairment test is performed if there are indications of impairment. In the event of impairment, an impairment loss is recognized under other operating expenses. Impairment losses are reversed up to amortized cost and reported in other operating income if the original reasons for impairment no longer apply.

Intangible assets with indefinite useful lives and purchased, as well as internally generated intangible assets not yet available for use, are not amortized, but rather tested for impairment when a triggering event arises or at least once a year.

Significant discretionary decisions and sources of estimation uncertainty

Purchased intangible assets

The identification and measurement of intangible assets acquired in the course of business combinations are subject to significant discretion and estimation uncertainty.

In connection with in-licensing agreements in the Healthcare business sector, a discretionary estimate is made of the extent to which upfront payments and milestone payments are remuneration for development services yet to be performed or whether such payments are acquisition costs of an intangible asset to be capitalized.

Determination of amortization

Significant assumptions and estimates are required to determine the appropriate amount of amortization of other intangible assets. This relates in particular to the determination of the underlying useful life.

If the amortization of intangible assets from customer relationships, brands, trademarks, marketing authorizations, patents, licenses and similar rights, and other had been 10% higher, for example, due to shortened useful lives, profit before income tax would have been € 78 million lower in fiscal 2023 (2022: € 83 million).

Identification of a need to recognize impairment loss and reverse impairment loss

Discretionary decisions are required in assessing substantial evidence of impairment as well as in identifying the need to reverse the impairment of other intangible assets. Significant valuation-related assumptions and estimates are also required to calculate the appropriate write-down amount in impairment testing.

	Customer relationships, brands, and trademarks	Marketing authorizations, patents, licenses, similar rights, and other items		Software and software in development	**Total**
€ million		Finite useful life[1]	Not yet available for use		
Cost as of Jan. 1, 2022	**9,825**	**11,305**	**1,235**	**1,058**	**23,423**
Additions due to business combinations	97	97	–	–	194
Other additions	–	55	166	93	314
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	–
Other disposals	-17	-236	-11	-83	-347
Transfers	0	23	-23	4	2
Currency translation	487	59	13	24	582
Dec. 31, 2022	**10,391**	**11,302**	**1,379**	**1,096**	**24,169**
Accumulated amortization and impairment losses as of Jan. 1, 2022	**-3,989**	**-10,443**	**-720**	**-659**	**-15,810**
Depreciation, amortization, and write-downs	-602	-229	–	-102	-932
Impairment losses	-9	-18	-180	-3	-211
Reversals of impairment losses	–	–	–	–	–
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	–
Other disposals	17	231	–	83	331
Transfers	–	-14	15	-1	–
Currency translation	-160	-36	-1	-13	-211
Dec. 31, 2022	**-4,743**	**-10,509**	**-887**	**-695**	**-16,833**
Net carrying amounts as of Dec. 31, 2022	**5,648**	**793**	**493**	**401**	**7,336**

	Customer relationships, brands, and trademarks	Marketing authorizations, patents, licenses, similar rights, and other items		Software and software in development	Total
Cost as of Jan. 1, 2023	**10,391**	**11,302**	**1,379**	**1,096**	**24,169**
Additions due to business combinations	–	–	–	–	–
Other additions	–	20	284	92	396
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	–
Other disposals	3	-25	-9	-13	-44
Transfers	–	16	-14	5	6
Currency translation	-351	-112	-3	-16	-482
Dec. 31, 2023	**10,043**	**11,200**	**1,637**	**1,165**	**24,045**
Accumulated depreciation and impairment losses as of Jan. 1, 2023	**-4,743**	**-10,509**	**-887**	**-695**	**-16,833**
Depreciation, amortization, and write-downs	-581	-202	–	-104	-887
Impairment losses	-26	-24	-31	–	-81
Reversals of impairment losses	–	–	5	–	5
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	–
Other disposals	-3	25	3	12	37
Transfers	–	–	–	–	–
Currency translation	156	91	2	16	265
Dec. 31, 2023	**-5,196**	**-10,619**	**-908**	**-770**	**-17,493**
Net carrying amounts as of Dec. 31, 2023	**4,847**	**580**	**729**	**395**	**6,551**

[1] Previous year has been adjusted, please refer to Note (6) "**Acquisitions and Divestments**".

Additions and disposals

The additions from business combinations in the previous year resulted in particular from the acquisition of Exelead Inc., United States (see Note (6) "**Acquisitions and divestments**").

Additions for intangible assets not yet available for use essentially related to the Healthcare business sector and mainly concerned the in-licensing from Jiangsu Hengrui Pharmaceuticals Co. Ltd., China, and Abbisko Therapeutics Co. Ltd., China; see Note (7) "**Collaboration and licensing agreements**". In the previous year, this item included an upfront payment in a mid-double-digit million-euro amount in connection with the acquisition of Chord Therapeutics SA, Switzerland, in the Healthcare business sector.

Software additions primarily related to the internal development of IT applications. The gross carrying amounts and accumulated amortization for the capitalized software primarily related to purchased software as well as internally generated applications and enhancements of purchased ERP programs that were already available for use.

Loss allowances

Impairment losses amounting to € 81 million (2022: € 211 million) were recognized on an ad hoc basis for other intangible assets in fiscal 2023. These were mainly attributable to the Life Science and Electronics business sectors. In the previous year, a high-double-digit million-euro amount related to the Healthcare business sector for the rights to the drug candidate berzosertib.

Other significant information

As in the previous year, the currency translation effects essentially resulted from the translation of other intangible assets denominated in U.S. dollars.

Marketing authorizations, patents, licenses, similar rights, and other items not yet available for use involved ongoing development projects that were not yet in the commercialization phase and thus did not yet have a defined useful life. These primarily related to the Healthcare business sector.

Overview of material other intangible assets

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

€ million	Remaining useful life in years	Life Science	Healthcare	Electronics	**Total Dec. 31, 2023**	Total Dec. 31, 2022
Customer relationships, brands, and trademarks		**3,175**	**–**	**1,672**	**4,847**	**5,648**
Customer relationships	2.5–14.8	2,879	–	1,663	4,542	5,216
thereof from the following acquisitions:						
Sigma-Aldrich Corporation	12.8–13.8	2,608	–	118	2,726	3,048
Versum Materials, Inc.	2.8–14.8	–	–	1,545	1,545	1,798
Millipore Corporation	2.5–3.5	170	–	–	170	239
Brands and trademarks	0.5–3.9	296	–	9	305	432
thereof from the following acquisition:						
Sigma-Aldrich Corporation	3.9	281	–	–	281	366
Marketing authorizations, patents, licenses and similar rights, and other						
Finite useful life[1]	**–**	**213**	**124**	**243**	**580**	**793**
Patents, licenses, and similar rights	0.3–9.3	212	–	235	447	657
thereof from the following acquisitions:						
AZ Electronic Materials S.A.	0.3–9.3	–	–	87	87	170
Versum Materials, Inc.	0.8–2.8	–	–	107	107	164
Others	–	2	124	8	134	135
Not yet available for use	**–**	**13**	**583**	**133**	**729**	**493**
thereof from the following acquisition:						
Versum Materials, Inc.	–	–	–	102	102	115

[1] Previous year has been adjusted, please refer to Note (6) "**Acquisitions and Divestments**".

(20) Property, plant, and equipment

Accounting and measurement policies

Recognition and initial measurement

In the course of determining cost, government grants received within the scope of IAS 20 are deducted. Grants receivable for financial support that are no longer linked to future costs are recognized in profit or loss.

Advance payments are disclosed together with the assets under construction.

Subsequent measurement

Subsequent measurement is based on amortized cost.

Property, plant, and equipment is depreciated using the straight-line method over the useful life of the asset concerned, and the corresponding expenses are allocated to the respective functional costs. Depreciation of property, plant, and equipment is based on the following useful lives:

	Useful life
Production buildings	No more than 33 years
Administration buildings	No more than 40 years
Plant and machinery	6 to 25 years
Operating and office equipment, other facilities	3 to 10 years

The useful lives of the assets are reviewed regularly and adjusted if necessary.

An impairment test is performed if there are indications of impairment. External and internal information is used in this context. In the event of impairment, an impairment loss is recognized under other operating expenses. Impairment losses are reversed up to amortized cost and reported in other operating income if the original reasons for impairment no longer apply.

Significant discretionary decisions and sources of estimation uncertainty

Determination of depreciation

Assumptions and estimates are required in determining the appropriate useful life and the expected residual value in order to calculate the amount of depreciation on property, plant, and equipment. This applies in particular to the determination of the underlying remaining useful life. In making these estimates, the Group considers the useful lives of the property, plant, and equipment derived from past experience.

Identification of a need to recognize impairment loss and reverse impairment loss

Discretionary decisions are required in the identification of objective evidence of impairment as well as in identifying the need to reverse impairment of property, plant, and equipment.

€ million	Land, land rights, and buildings[1]	Plant and machinery[1]	Other facilities, operating and office equipment	Construction in progress	**Total[1]**
Cost as of Jan. 1, 2022	**5,464**	**5,687**	**1,754**	**1,905**	**14,810**
Additions due to business combinations	48	19	4	11	82
Other Additions	182	42	77	1,429	1,730
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	–
Other Disposals	-88	-94	-95	-6	-282
Transfers	290	512	127	-930	-1
Currency translation difference	80	63	12	20	175
Dec. 31, 2022	**5,976**	**6,228**	**1,879**	**2,429**	**16,513**
Accumulated depreciation and impairment losses as of Jan. 1, 2022	**-2,304**	**-3,987**	**-1,287**	**-15**	**-7,593**
Depreciation	-319	-374	-173	–	-866
Impairment losses	–	-19	–	-3	-21
Reversals of impairment losses	–	–	–	–	–
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	–
Disposals	67	84	91	1	244
Transfers	-6	11	-1	-5	-1
Currency translation difference	-26	-35	-10	–	-70
Dec. 31, 2022	**-2,588**	**-4,319**	**-1,380**	**-21**	**-8,308**
Net carrying amounts as of Dec. 31, 2022	**3,389**	**1,909**	**499**	**2,408**	**8,204**
Cost as of Jan. 1, 2023	**5,976**	**6,228**	**1,879**	**2,429**	**16,513**
Changes in the scope of consolidation	–	–	–	–	–
Additions	169	32	56	1,723	1,981
Reclassification to assets held for sale	–	–	–	–	–
Disposals	-85	-93	-82	-18	-278
Transfers	385	542	120	-1,053	-6
Currency translation difference	-119	-84	-27	-37	-266
Dec. 31, 2023	**6,326**	**6,625**	**1,946**	**3,045**	**17,943**
Accumulated depreciation and impairment losses as of Jan. 1, 2023	**-2,588**	**-4,319**	**-1,380**	**-21**	**-8,308**
Depreciation	-332	-389	-173	–	-895
Impairment losses	-1	-8	-2	-12	-23
Reversals of impairment losses	–	1	–	–	1
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	–
Disposals	67	88	77	–	233
Transfers	-9	1	5	3	1
Currency translation difference	43	43	19	1	106
Dec. 31, 2023	**-2,820**	**-4,584**	**-1,454**	**-29**	**-8,887**
Net carrying amounts as of Dec. 31, 2023	**3,506**	**2,042**	**492**	**3,016**	**9,056**

[1] Previous year's figures have been adjusted, see Note (6) "**Acquisitions and divestments**".

The individual additions to construction in progress in fiscal 2023 with an investment volume of more than € 50 million each are presented below:

Business sector	**Investment project**	**Country**
Life Science	Filtration plant	Ireland
Life Science	Capacity expansion for drug safety testing	USA
Life Science	Membrane factory	Ireland
Healthcare	Research center	Germany
Life Science	Filling and logistics center	Germany

(21) Leasing

Accounting and measurement policies

Leasing

Scope of IFRS 16

The Group exercises the option provided by IFRS 16 to not recognize leases of intangible and low-value assets as leases. Right-of-use assets under leases are reported in the balance sheet item "Property, plant, and equipment" (see Note (20) "**Property, plant, and equipment**").

Where the provision of company cars to employees qualifies as an employee benefit within the meaning of IAS 19, IFRS 16 is not applied. In this case, its balance-sheet treatment is governed solely by IAS 19.

Separation of lease and non-lease components

Leases for land, land rights, and buildings are separated into lease and non-lease components. The Group otherwise elects to exercise the option not to separate non-lease components from lease components.

Depreciation of the right-of-use assets arising from leases

Basically, right-of-use assets are depreciated over the lease term. If it is considered sufficiently probable that an existing purchase option will be exercised or ownership will be automatically transferred at the end of the lease term, however, depreciation takes place over the period that applies for corresponding assets under property, plant, and equipment (see Note (20) "**Property, plant, and equipment**").

Determining the incremental borrowing rate

If the interest rate for the lease cannot be reliably determined, the incremental borrowing rate is applied in measuring the lease liability. In the Group, the incremental borrowing rate is determined on the basis of the risk-free interest rate of the respective Group company over a similar term and in the same currency. This interest rate is adjusted using a risk surcharge specific to the Group. The Group applies the repayment model to determine the current portion of the lease. The current portion of the lease corresponds to the repayment share of the next 12 months.

Determining the lease term

Where renewal or termination options are available, their exercise is assessed on a case-by-case basis, considering factors such as location strategies, leasehold improvements, and the degree of specificity.

Significant discretionary decisions and sources of estimation uncertainty

Leasing

Identification of a lease

Discretionary decisions can arise during the identification of leases in answering the question of whether a lessor's right of substitution is substantive. The Group classifies rights of substitution as not substantive if the facts and circumstances of the case do not support a different assessment.

Measurement of lease and non-lease components

In the case of leases for land, land rights, and buildings, separating the lease into lease and non-lease components is subject to discretion and estimation uncertainty if observable prices are not available from the contract partner or other potential lessors.

Determining the lease term

When determining the lease term, existing renewal and termination options must be evaluated to determine the probability that such options will be exercised. The assessment of the probability of exercise may be discretionary even though it relies on existing and material information on the general economic context, such as location strategies, leasehold improvements, or the degree of specificity. If the available information does not allow a reliable assessment, the Group uses historical experience for comparable situations.

The largest 30 leases accounted for around 50% of total lease liabilities in fiscal 2023 and 2022. They are essentially for right-of-use assets for office, warehouse, and laboratory buildings. If options to renew these leases were exercised in future, which is not yet considered likely, this would result in additional potential undiscounted cash outflows of up to € 235 million (2022: € 219 million).

Where individual contracts include termination options, it was considered unlikely that these would be exercised so that additional lease payments were already considered in the corresponding lease liability.

Determining the incremental borrowing rate

Determining the risk-free interest rate and determining the risk surcharge are both discretionary.

Initial measurement of the lease liability and the right-of-use asset

In measuring the lease liability, there is discretionary scope and significant estimation uncertainty regarding

- measuring any payments in the course of promised residual value guarantees, and
- assessing the probability that existing purchase, termination, and renewal options will be exercised.

In measuring right-of-use assets under leases, the Group is subject to estimation uncertainty regarding any demolition obligations and their resulting payments.

The reconciliation of net carrying amounts of right-of-use assets from leases was as follows:

	Right-of-use assets			
€ million	Land, land rights, and buildings	Plant and machinery	Other facilities, operating and office equipment	Total
Net carrying amounts as of Jan. 1, 2022	**382**	**9**	**56**	**447**
Changes in the scope of consolidation	7	–	–	7
Additions	160	–	43	203
Disposals	-16	-1	-3	-19
Depreciation	-112	-3	-37	-152
Impairment losses	–	–	–	–
Reversal of impairment losses	–	–	–	–
Other	-6	2	-1	-5
Dec. 31, 2022	**415**	**8**	**58**	**481**

	Right-of-use assets			
€ million	Land, land rights, and buildings	Plant and machinery	Other facilities, operating and office equipment	**Total**
Net carrying amounts as of Jan. 1, 2023	**415**	**8**	**58**	**481**
Changes in the scope of consolidation	–	–	–	–
Additions	157	4	45	206
Disposals	-23	–	-1	-25
Depreciation	-108	-2	-37	-147
Impairment losses	–	–	–	–
Reversal of impairment losses	–	–	–	–
Other	-13	1	-1	-14
Dec. 31, 2023	**427**	**10**	**64**	**500**

The net carrying amounts of other facilities, operating and office equipment mainly included the right-of-use assets for vehicles.

The additions to land, land rights, and buildings primarily related to newly agreed right-of-use assets for laboratories, office buildings, and warehouses as well as agreed lease renewals.

The expenses and income and the payments under the leases in accordance with IFRS 16 were reported in the consolidated income statement and the consolidated statement of cash flows as follows:

€ million	**2023**	2022
Right-of-use assets		
Depreciation	-147	-152
Impairment losses	–	–
Reversals of impairment losses	–	–
Expenses for leasing low-value assets	-11	-14
Expenses for leases with variable lease payments	–	–
Income from subleasing right-of-use assets	–	–
Income from sale-and-lease-back transactions	–	–
Interest expenses for lease liabilities	-14	-13
Total	**-173**	**-179**

€ million	**2023**	2022
Operating cash flow	-25	-26
Financing cash flow	-149	-150
Total	**-174**	**-176**

At the reporting date, the future lease payments were distributed over the following periods:

December 31, 2023

€ million	Within 1 year	1-5 years	After more than 5 years	**Total**
Future lease payments	130	278	152	560
Interest portion of future payments	-11	-22	-15	-47
Present value of future lease payments	**120**	**256**	**137**	**513**

December 31, 2022

€ million	Within 1 year	1-5 years	After more than 5 years	Total
Future lease payments	132	281	111	524
Interest portion of future payments	-9	-17	-9	-35
Present value of future lease payments	**123**	**264**	**101**	**488**

(22) Other non-financial assets

Accounting and measurement policies

Other non-financial assets

Other non-financial assets are carried at amortized cost. Impairments are recognized for any credit risks.

Other non-financial assets are broken down as follows:

	Dec. 31, 2023			Dec. 31, 2022		
€ million	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Receivables from non-income-related taxes	323	2	325	346	3	349
Prepaid expenses	182	37	219	210	29	239
Assets from defined benefit plans	33	–	33	46	–	46
Remaining other assets	95	76	171	103	67	170
Other non-financial assets	**633**	**115**	**748**	**705**	**99**	**804**

(23) Cash flow from investing activities

In the previous year, payments for investments in intangible assets included an upfront payment in a mid-double-digit million-euro amount in connection with the acquisition of Chord Therapeutics SA, Switzerland.

Payments from the disposal of intangible assets in fiscal 2023 primarily resulted from the disposal of the rights to a non-strategic brand in the Healthcare business sector and a portfolio of licenses and patents in the Electronics business sector.

Payments for acquisitions less acquired cash and cash equivalents in the previous year were primarily attributable to the acquisition of Exelead Inc., United States; M Chemicals Inc., Korea; and Erbi Biosystems Inc., United States (see Note (6) "**Acquisitions and divestments**").

Net cash outflows for investments in financial assets mainly resulted from short-term investments in securities and term deposits that did not meet the requirements for classification as cash and cash equivalents.

Net cash inflows from the disposal of other financial assets primarily resulted from repayments of short-term investments in securities and term deposits as well as from contingent consideration (see Note (36) "**Other financial assets**").

The payments made for and received from the acquisition and the disposal of non-financial assets resulted from the short-term investment of available funds in marketable greenhouse gas emissions certificates.

(24) Inventories

Accounting and measurement policies

Inventories

In addition to directly attributable unit costs, the cost of sales also includes overheads attributable to the production process, which are determined on the basis of normal capacity utilization of the production facilities. Goods for resale are recognized at cost. The "first-in, first-out" (FIFO) method is used to determine the amortized cost of manufactured, finished, and unfinished materials, raw materials, and merchandise. The weighted average cost formula is applied for items such as supplies.

Inventories are tested for impairment using a business-sector-specific method. Under this method, cost is compared to the net realizable values. If the net realizable value is lower than the amortized cost, the asset is written down by a corresponding amount, which is recognized as an expense in the cost of sales.

Impairments may be due to factors relating to the sales market, qualitative reasons, a lack of usability of the items, or their limited remaining shelf life. If the reason for impairment no longer applies, the carrying amount is adjusted to the lower of cost or the new net realizable value.

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

Inventory prepayments are reported under other non-financial assets.

Significant discretionary decisions and sources of estimation uncertainty

Identification of impairments or reversal of impairments

Discretionary decisions are required in the identification of impairment as well as in identifying the need to reverse impairment of inventories. There are estimation uncertainties with respect to the calculation of the net realizable value. In particular, changes in selling prices and expected costs of completion are considered in calculating this value.

Inventories consisted of the following:

€ million	**Dec. 31, 2023**	Dec. 31, 2022
Raw materials and supplies	1,164	1,076
Work in progress	1,428	1,418
Finished goods/goods for resale	2,045	2,139
Inventories	**4,637**	**4,632**

Measures to optimize inventory levels contributed to the reduction in inventories in the Life Science business sector. This was offset by an increase in the Healthcare business sector and in the Electronics business sector.

Impairment losses included in the cost of sales are shown in Note (10) "**Cost of sales**".

(25) Trade and other receivables

Accounting and measurement policies

Trade and other receivables

Trade accounts receivable without significant financing components that are not the subject of a factoring agreement are measured at the amount of the unconditional claim for consideration on initial recognition. For additions to trade accounts receivable, loss allowances are recognized to allow for expected credit losses.

At initial recognition, other receivables are measured at fair value plus the direct transaction costs incurred upon acquisition of the asset.

Trade accounts receivable that are potentially designated to be sold on account of a factoring agreement are measured at fair value through other comprehensive income.

The measurement policies applied in determining loss allowances for trade and other receivables are shown in Note (42) "**Management of financial risks**" in the "**Credit risks**" section.

Loss allowances and reversals of loss allowances are reported under "Impairment losses and reversals of impairment losses on financial assets (net)" in the consolidated income statement if the asset is used in ordinary activities and hence has an operative nature. If the asset is not used in ordinary activities and hence can be characterized as financial, it is recognized in financial income or financial expenses.

Further information on the accounting and measurement policies governing financial assets can be found in Note (36) "**Other financial assets**".

Significant discretion and sources of estimation uncertainty

Trade and other receivables

Information on the significant discretion and estimation uncertainty concerning trade and other receivables can be found in Note (42) "**Management of financial risks**".

Trade and other receivables were measured as follows:

	Dec. 31, 2023			Dec. 31, 2022		
€ million	Subsequently measured at amortized cost	Subsequently measured at fair value through other comprehensive income	**Total**	Subsequently measured at amortized cost	Subsequently measured at fair value through other comprehensive income	Total
Gross trade accounts receivable	3,945	25	3,969	4,046	22	4,069
Gross other receivables	160	–	160	136	–	136
Gross trade and other receivables	**4,105**	**25**	**4,130**	**4,182**	**22**	**4,204**
Loss allowances on trade accounts receivable	-97	–	-97	-63	–	-63
Loss allowances on other receivables	-1	–	-1	-1	–	-1
Net trade and other receivables	**4,007**	**25**	**4,031**	**4,119**	**22**	**4,141**
thereof: current	3,979	25	4,004	4,091	22	4,114
thereof: non-current	28	–	28	27	–	27

The reduction in trade and other receivables is mainly attributable to foreign exchange effects and general operational performance.

In 2023, trade accounts receivable in Italy with a nominal value of € 69 million (2022: € 68 million) were sold for € 69 million (2022: € 68 million). These receivables did not involve any further rights of recourse against the Group.

(26) Contract assets

Accounting and measurement policies

Contract assets

Contract assets represent contractual claims to receive payment from customers for whom the contractual performance obligation has already been fulfilled, although an unconditional claim to payment has yet to arise.

The following table shows the change in contract assets:

€ million	**2023**	2022
Jan. 1	**128**	**207**
Additions due to business combinations	–	10
Other additions	339	360
thereof: attributable to performance obligations satisfied in prior periods	–	2
Disposals due to divestments/Reclassification to assets held for sale	–	–
Reclassification to trade accounts receivable	-361	-451
Currency differences	-3	1
Other	–	1
Dec. 31	**104**	**128**

Contract assets resulted in particular from rendering services and manufacturing of products in the Life Science and Electronics business sectors.

(27) Other provisions

Other provisions developed as follows:

€ million	Litigation	Restructuring	Environmental protection	Acceptance and follow-on obligations	Interest and penalties related to income taxes	Other	**Total**
Jan. 1, 2023	**85**	**134**	**148**	**127**	**88**	**91**	**672**
Additions	10	173	3	124	80	89	479
Utilizations	-10	-45	-4	-12	-1	-22	-95
Release	-25	-51	-3	-59	-39	-29	-205
Interest effect	–	–	5	–	–	–	6
Currency translation	–	-1	–	–	-1	-2	-4
Changes in scope of consolidation/Other	–	–	–	–	–	–	–
Dec. 31, 2023	**59**	**210**	**149**	**181**	**127**	**127**	**852**
thereof: current	42	139	19	166	127	82	575
thereof: non-current	17	71	130	15	–	45	277

Accounting and measurement policies

Provisions for litigation

To assess a recognition obligation in relation to provisions for litigation and to quantify future outflows of resources, the Group draws on the knowledge of the legal department as well as outside counsel.

Assessing the need for recognizing provisions for litigation is based on the likelihood of possible outcomes for proceedings. In particular, the factors influencing this likelihood are:

- the validity of the arguments brought forward by the opposing party, and
- the legal situation and current court rulings in comparable proceedings in the jurisdiction(s) in question.

The following factors are also relevant in measuring provisions for litigation:

- the duration of proceedings in pending legal disputes,
- the applicable license rate plus an expected infringement surcharge,
- the usual damages and fines for comparable legal disputes, and
- the discount factor to be used.

Provisions for restructuring

The Group uses formal restructuring plans and the expectations of the affected employees concerning the performance of the restructuring measures to assess the recognition obligation for provisions for restructuring projects and the amount of the expected outflow of resources.

Provisions for environmental protection

To assess a recognition obligation in relation to provisions for environmental protection and to quantify future outflows of resources, the Group draws on appraisals by independent external experts and the knowledge of in-house specialists.

The following are key parameters in calculating the present value of the future settlement amount of the provisions for environmental protection:

- the future settlement date,
- the extent of environmental damage,
- the applicable remediation methods,
- the associated future costs, and
- the discount factor.

Provisions for acceptance and follow-on obligations

The assessment of the recognition obligation for provisions for acceptance and follow-on obligations and the quantification of future outflows of resources is based on internal project plans as well as on the assessment of the respective matters by in-house and external specialists.

The main parameters in determining the amount of the provision are:

- the ability to use or potential for modification of secured manufacturing capacities at third-party providers, particularly for pharmaceutical compounds,
- the number of affected patients and the expected duration of their continued treatment in clinical development programs,
- the expected date or period of the outflow of resources, and
- the expectations concerning future events influencing the obligations.

Provisions for interest and penalties related to income taxes

Objective assessments are performed to determine the need to recognize provisions for interest and penalties related to income taxes not covered by IAS 12.

Significant discretion and sources of estimation uncertainty

Provisions for litigation

Like the measurement of provisions, the assessment of a recognition obligation for provisions for litigation is to a particular extent subject to a degree of estimation uncertainty. The uncertainties relate, in particular, to the assessment of the likelihood and the amount of the outflow of resources.

Provisions for restructuring

Estimation uncertainty about the provisions for restructuring primarily relates to determining the amount of the expected outflow of resources. This is largely influenced by the assumptions made concerning the change in or termination of the employment relationships of the affected employees and the planned implementation date of the restructuring plan.

Provisions for environmental protection

The assessment of a recognition obligation and the measurement of the provisions for environmental protection are subject to discretionary decisions and estimation uncertainties to a particular degree.

The estimation uncertainties relate in particular to the assessment of the timing and likelihood of a future outflow of resources and the extent of necessary remediation measures as well as the related calculation of the amount of the liability.

Provisions for acceptance and follow-on obligations

Estimation uncertainty regarding the provisions for acceptance and follow-on obligations primarily relates to determining the amount of the expected outflow of resources.

Provisions for interest and penalties related to income taxes

Estimation uncertainty concerning the provisions for interest and penalties related to income taxes mainly relates to the interpretation of tax codes and the effects of amended case law.

Antitrust and other proceedings

In connection with the generics business that was divested in 2007, the Group was accused of breaching EU antitrust law through agreements entered into by its former subsidiary Generics (UK) Ltd., United Kingdom, relating to the antidepressant Citalopram patented by Lundbeck A/S, Denmark. The European Commission imposed a fine in June 2013. Appeals against the decision were unsuccessful. Following the payment of the fine of around € 18 million, British health authorities brought legal claims for damages against the Group and other companies in a mid-triple-digit million-euro amount in fiscal 2023 due to alleged infringements of competition law. In addition, there were further claimants from various other jurisdictions who have not yet quantified their claims. In response to the latest developments in the proceedings, the provision was adjusted as of December 31, 2023, and is now recognized in a high-single-digit million-euro amount. A cash outflow within the next 12 months is considered possible.

Restructuring

The restructuring provisions recognized as of December 31, 2023, primarily relate to obligations for workforce reduction measures in connection with communicated restructuring plans.

A program to continuously improve processes and align the Group functions more closely with the businesses was launched in 2023. The implementation of this program will take until at least the end of fiscal 2024. Provisions in a mid-double-digit million-euro amount were recognized for the program in the current fiscal year. Furthermore, additional programs to improve efficiency and increase customer focus in the Electronics and Healthcare business sectors were initiated during the current fiscal year. This resulted in the recognition of provisions in a mid-double-digit million-euro amount that are largely expected to be utilized within the next two years.

Environmental protection

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

Acceptance and follow-on obligations

Provisions for acceptance and follow-on obligations primarily related to costs in connection with discontinued development projects in the Healthcare business sector as well as obligation surpluses from onerous contracts.

A significant proportion of the provisions for acceptance and follow-on obligations are attributable to the results of the two Phase III clinical trials to evaluate the efficacy and safety of evobrutinib. This resulted in the recognition of a provision for follow-on obligations in a high-double-digit million-euro amount in 2023. The outflow of resources is predominantly expected within the next 12 months.

Part of the provision is also attributable to the discontinuation of development projects under the strategic alliance with GlaxoSmithKline, United Kingdom (GSK), and relates to the winding up of clinical trials. On February 5, 2019, the Group entered into a global agreement in the field of immuno-oncology with a subsidiary of GSK to co-develop and co-commercialize the drug candidate bintrafusp alfa. In the third quarter of 2021, it was amicably decided with GSK that the agreement on bintrafusp alfa would end effective September 30, 2021. The provisions recognized in a mid-double-digit million-euro amount included expected expenses for follow-on obligations. The outflow of resources is mainly expected within the next 12 months.

Interest and penalties related to income taxes

Provisions for interest and penalties related to income taxes mainly included penalties arising from tax audits as well as interest payables associated with or resulting from tax payables.

Miscellaneous other provisions

Miscellaneous other provisions included provisions for asset retirement obligations, other tax risks not constituting income tax in accordance with IAS 12, risks in connection with employee participation programs and warranty obligations.

(28) Contingent liabilities

Accounting and measurement policies

Contingent liabilities

To identify contingent liabilities from litigation and tax matters, the Group draws on the knowledge of the legal department and the tax department as well as the opinions of external consultants and attorneys.

The key factors in the identification of contingent liabilities are:

- the validity of the arguments brought forward by the opposing party or the tax authority, and
- the legal situation and current court rulings in comparable proceedings in the jurisdiction in question.

The amount of the contingent liability is based on the best-possible estimate, which in turn is based on the likelihood of possible outcomes of proceedings and on the applicable license rate in patent disputes.

Significant discretionary decisions and sources of estimation uncertainty

Contingent liabilities

The identification and the measurement of contingent liabilities are both subject to considerable uncertainty.

This applies with regard to assessing the likelihood of an outflow of resources as well as determining its amount.

Contingent liabilities in the amount of € 204 million (December 31, 2022 (adjusted): € 231 million) related almost exclusively to litigation and tax matters.

Contingent liabilities from litigation mainly related to obligations under labor law and tort law. The contingent liabilities from tax matters primarily related to the determination of earnings under tax law, customs regulations, and excise tax matters.

In addition, there were contingent liabilities from various legal disputes with Merck & Co., Inc., Rahway, NJ, United States (outside the United States and Canada: MSD), among other things due to breach of the coexistence agreement entered into between the two companies and/or trademark/name right infringement regarding the use of the designation “Merck”. In this context, Merck KGaA, Darmstadt, Germany, 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 included in the total figure for contingent liabilities.

(29) Other non-financial liabilities

Accounting and measurement policies

Other non-financial liabilities

Accruals for personnel expenses reported in other non-financial liabilities include, in particular, liabilities resulting from vacation entitlements, variable and performance-related compensation components, and social security contributions.

Contract liabilities include payments received by the Group prior to completion of contractual performance.

Other non-financial liabilities comprises the following:

	Dec. 31, 2023			Dec. 31, 2022		
€ million	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Accruals for personnel expenses[1]	916	–	916	1,156	–	1,156
Payroll-related liabilities[1]	122	4	126	121	5	127
Liabilities from non-income-related taxes	163	1	164	200	1	202
Contract liabilities	249	3	252	282	3	285
Other accruals	29	8	38	26	10	36
Other non-financial liabilities[1]	**1,479**	**17**	**1,496**	**1,786**	**19**	**1,805**

[1] Previous year's figures have been adjusted, see Note (2) "**Reporting principles**".

The reduction in accruals for personnel expenses is due in particular to lower accruals for annual bonus payments for the past fiscal year and for the tranche of the Long-Term Incentive Plan of Merck KGaA, Darmstadt, Germany, that is payable in the months following the reporting date.

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

	2023			2022		
€ million	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Jan. 1	**282**	**3**	**285**	**198**	**3**	**202**
Additions due to business combinations	–	–	–	1	–	1
Other additions	1,290	–	1,290	1,276	1	1,277
Disposals due to divestments/Reclassification to assets held for sale	–	–	–	–	–	–
Recognition of income/reversal	-1,313	–	-1,313	-1,194	–	-1,195
Cumulative catch-up adjustments to revenue	–	–	–	–	–	–
Reclassification from non-current to current	–	–	–	1	-1	–
Currency translation	-11	–	-11	–	–	–z
Other	–	–	–	–	–	–
Dec. 31	**249**	**3**	**252**	**282**	**3**	**285**

As of January 1, 2023, contract liabilities amounted to € 285 million (January 1, 2022: € 202 million), of which a total of € 253 million (2022: € 181 million) was recognized through profit or loss in fiscal 2023.

(30) Trade and other payables

Accounting and measurement policies

Trade and other payables

Trade and other payables are subsequently measured at amortized cost.

Trade and other payables as of December 31, 2023, included accrued amounts of € 775 million (December 31, 2022: € 903 million) from outstanding invoices.

Employees

(31) Number of employees

The number of employees was 62,908 as of December 31, 2023 (December 31, 2022: 64,232 employees).

The following table shows the average number of employees broken down by function.

	2023	2022
Production	24,105	22,086
Administration	11,938	11,886
Research and development	6,516	7,334
Supply chain	4,971	4,850
Marketing and sales	14,436	15,087
Other	1,676	1,309
Average number of employees	**63,642**	**62,552**

(32) Personnel expenses

Personnel expenses comprised the following:

€ million	**2023**	2022
Wages and salaries	5,299	5,340
Compulsory social security contributions and other costs	853	844
Pension expenses	365	460
Personnel expenses	**6,517**	**6,644**

Personnel expenses comprised expenses of € 212 million (2022: € 200 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 addition, employer contributions amounting to € 93 million (2022: € 92 million) were transferred to the German statutory pension insurance system, and contributions amounting to € 122 million (2022: € 105 million) were transferred to statutory pension insurance systems abroad.

(33) Provisions for employee benefits

Provisions for employee benefits are composed as follows:

€ million	Dec. 31, 2023	Dec. 31, 2022
Provisions for pensions and other post-employment benefits	1,975	1,731
Non-current other employee benefit provisions	217	299
Non-current provisions for employee benefits	**2,192**	**2,030**
Current provisions for employee benefits[1]	**83**	**81**
Provisions for employee benefits	**2,275**	**2,111**

[1] Previous year's figures have been adjusted, see Note (2) "**Reporting principles**".

Provisions for other employee benefits included provisions for share-based payments, which are discussed in greater detail in the section on share-based payments in this note.

Provisions for pensions and other post-employment benefits

Accounting and measurement policies

Provisions for pensions and other post-employment benefits

In addition to retirement benefit obligations, provisions for pensions and other post-employment benefits include obligations for other post-employment benefits, such as medical care.

The present value of the defined benefit obligation is determined by expert third parties according to the actuarial projected unit credit method.

The discount rates for defined benefit pension plans are generally determined by reference to discount rates for similar durations and currencies calculated by external actuaries. This was based on bonds with ratings of at least "AA" or a comparable rating from at least one of the leading rating agencies as of the reporting date.

The other actuarial assumptions used as the basis for calculating the defined benefit obligation, such as rates of salary increases and pension trends, were determined on a country-by-country basis in line with the economic conditions prevailing in each country. The latest country-specific mortality tables are also applied (Germany: Heubeck 2018G; Switzerland: BVG 2020G; United Kingdom: S3PA).

Apart from the net balance of interest expense for the defined benefit obligations and interest income from the plan assets, which is reported in financial income and financial expenses, the expenses for defined benefit plans are allocated to the individual functional areas in the consolidated income statement.

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

	Germany		Switzerland		United Kingdom		Other countries	
	2023	2022	**2023**	2022	**2023**	2022	**2023**	2022
Discount rate	3.32%	3.74%	1.34%	2.15%	4.80%	4.95%	4.52%	4.49%
Future salary increases	2.75%	2.76%	3.84%	2.70%	–	–	3.81%	3.76%
Future pension increases	2.14%	2.14%	0.02%	0.03%	2.90%	2.89%	1.75%	2.20%
Duration	19	17	16	15	13	15	12	11

The lower interest rate level in the euro area and Switzerland resulted in an increase in the present value of the defined benefit obligations as well as in the duration of the obligations.

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

Significant discretionary decisions and sources of estimation uncertainty

Provisions for pensions and other post-employment benefits

The determination of the present value of the obligation from defined benefit pension plans primarily requires discretionary judgment regarding the selection of methods to determine the discount rate, the selection of suitable mortality tables, and estimates of future salary and pension increases.

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

December 31, 2023

€ million	Germany	Switzerland	United Kingdom	Other countries	Total
Increase (+)/decrease (-) in present value of all defined benefit obligations if					
the discount rate were 50 basis points lower	295	91	23	18	**426**
the discount rate were 50 basis points higher	-256	-80	-21	-16	-373
the expected rate of future salary increase were 50 basis points lower	-73	-17	–	-9	-98
the expected rate of future salary increase were 50 basis points higher	82	18	–	9	109
the expected rate of future pension increase were 50 basis points lower	-141	-3	-8	-5	-157
the expected rate of future pension increase were 50 basis points higher	155	44	9	5	212
the life expectancy were 1 year lower	-110	-28	-10		
the life expectancy were 1 year higher	109	27	10		

December 31, 2022

€ million	Germany	Switzerland	United Kingdom	Other countries	Total
Increase (+)/decrease (-) in present value of all defined benefit obligations if					
the discount rate were 50 basis points lower	256	69	26	18	**370**
the discount rate were 50 basis points higher	-224	-61	-24	-17	-325
the expected rate of future salary increase were 50 basis points lower	-66	-5	–	-9	-80
the expected rate of future salary increase were 50 basis points higher	74	5	–	10	89
the expected rate of future pension increase were 50 basis points lower	-128	-2	-12	-5	-148
the expected rate of future pension increase were 50 basis points higher	140	35	16	5	197
the life expectancy were 1 year lower	-96	-22	-9		
the life expectancy were 1 year higher	95	21	9		

Sensitivities are determined on the basis of the respective parameters in question, with all other measurement assumptions remaining unchanged.

Both the benefit obligations and the plan assets are subject to fluctuations over time. The reasons for such fluctuations could include changes in market interest rates and thus the discount rate, as well as adjustments to other actuarial assumptions (such as life expectancy or expected future increases in pension). This could lead to – or cause an increase in – underfunding. Depending on statutory regulations, it may become necessary in some countries to reduce underfunding and provide additional funding.

In order to minimize fluctuations of the net defined benefit liability, the Group, in managing its plan assets, also pays attention to potential fluctuations in liabilities. The portfolio is structured in such a way that, in the ideal scenario, the impact of exogenous factors on the plan assets and the defined benefit obligations offset each other.

Depending on the legal, economic, and fiscal circumstances prevailing in each country, different retirement benefit systems are provided for employees. Newly hired employees are only offered plans whose benefits are based on contributions and the return on their investments. Some of these plans require the employer to guarantee a minimum return on investment. Other plans are generally based on the employee's years of service and salary. Pension obligations comprise both obligations from current pensions and accrued benefits for pensions payable in the future.

The value recognized in the consolidated balance sheet for pensions and other post-employment benefits was derived as follows:

€ million	**Dec. 31, 2023**	Dec. 31, 2022
Present value of all defined benefit obligations	**4,787**	**4,287**
Fair value of the plan assets	-2,848	-2,634
Funded status	**1,939**	**1,652**
Effects of the asset ceilings	4	33
Net defined benefit liability	**1,943**	**1,685**
Assets from defined benefit plans	33	46
Provisions for pensions and other post-employment benefits	**1,975**	**1,731**

The increase in provisions was mainly due to the reduction in the discount rates in the euro area and Switzerland.

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

	Dec. 31, 2023				
€ million	Germany	Switzerland	United Kingdom	Other countries	**Total**
Benefit based on final salary					
Annuity	2,429	1	354	72	2,856
Lump sum	–	–	–	127	127
Installments	1	–	–	–	1
Benefit not based on final salary					
Annuity	613	1,060	–	59	1,732
Lump sum	10	–	4	29	43
Installments	4	–	–	–	4
Other	–	–	–	4	4
Medical plan	–	–	–	18	18
Present value of defined benefit obligations	**3,058**	**1,061**	**358**	**310**	**4,787**
Fair value of the plan assets	**1,281**	**1,022**	**384**	**160**	**2,848**

	Dec. 31, 2022				
€ million	Germany	Switzerland	United Kingdom	Other countries	Total
Benefit based on final salary					
Annuity	2,186	1	327	72	2,586
Lump sum	–	–	–	130	130
Installments	2	–	–	–	2
Benefit not based on final salary					
Annuity	555	879	–	62	1,496
Lump sum	4	–	4	33	41
Installments	5	–	–	–	5
Other	–	–	–	5	5
Medical plan	–	–	–	22	22
Present value of defined benefit obligations	**2,752**	**881**	**332**	**323**	**4,287**
Fair value of the plan assets	**1,202**	**909**	**372**	**152**	**2,634**

The vast majority of defined benefit obligations of German entities were attributable to plans that encompass old-age, disability, and surviving-dependent pensions. These obligations were based on benefit rules comprising benefit commitments dependent on years of service and final salary, as well as two different direct commitments for employees newly hired since January 1, 2005, that are not based on final salary. The benefit entitlement for new members from January 1, 2005, to December 31, 2020, resulted from the cumulative total of annually determined pension components calculated on the basis of a defined benefit expense and an age-based annuity table. The benefit entitlement for new members from January 1, 2021, resulted from the performance of salary-based employer contributions and voluntary employee contributions, topped up by the employer, to an external fund. A minimum return on contributions has been guaranteed by the Group. There were no statutory minimum funding obligations in Germany.

Pension obligations in Switzerland mainly comprised retirement, disability, and surviving-dependent benefits regulated by law. The employer and the employees made contributions to the plans. Statutory minimum funding obligations existed.

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 from 2006 onward. The agreed benefits comprised retirement, disability, and surviving-dependent benefits. The employer and the employees made contributions to the plans. Statutory minimum funding obligations existed.

The development of the net defined benefit liability was as follows:

2022

€ million	Present value of the defined benefit obligations	Fair value of the plan assets	Effects of asset ceilings	**Net defined benefit liability**
January 1, 2022	**-5,995**	**2,999**	**–**	**-2,996**
Current service cost	-203	–	–	-203
Interest expense	-73	–	–	-73
Interest income	–	34	–	34
Plan administration costs recognized in income	–	-3	–	-3
Past service cost	-1	–	–	-1
Gains (+) or losses (-) on settlement	–	–	–	–
Currency effects recognized in income	-30	30	–	–
Other effects recognized in income	1	-2	–	-1
Items recognized in income	**-306**	**59**	**–**	**-247**
Remeasurements of defined benefit obligations				
Actuarial gains (+)/losses (-) arising from changes in demographic assumptions	7	–	–	7
Actuarial gains (+)/losses (-) arising from changes in financial assumptions	2,099	–	–	2,099
Actuarial gains (+)/losses (-) arising from experience adjustments	-205	–	–	-205
Remeasurements of plan assets				
Actuarial gains (+)/losses (-) arising from experience adjustments	–	-429	–	-429
Changes in the effects of the asset ceilings				
Actuarial gains (+)/losses (-)	–	–	-32	-32
Actuarial gains (+)/losses (-)	**1,901**	**-429**	**-32**	**1,440**
Pension payments	140	-52	–	88
Employer contributions	–	42	–	42
Employee contributions	-20	19	–	-1
Payment transactions	**120**	**9**	**–**	**129**
Changes in the scope of consolidation	-1	1	–	–
Currency translation recognized in equity	-3	-6	-1	-10
Other changes	-2	1	–	-1
Other	**-6**	**-4**	**-1**	**-11**
December 31, 2022	**-4,287**	**2,634**	**-33**	**-1,685**

2023

€ 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, 2023	**-4,287**	**2,634**	**-33**	**-1,685**
Current service cost	-109	–	–	-109
Interest expense	-150	–	–	-150
Interest income	–	89	–	89
Plan administration costs recognized in income	–	-3	–	-3
Past service cost	5	–	–	5
Gains (+) or losses (-) on settlement	–	–	–	–
Currency effects recognized in income	-37	37	–	–
Other effects recognized in income	–	–	–	–
Items recognized in income	**-291**	**123**	**–**	**-168**
Remeasurements of defined benefit obligations				
Actuarial gains (+)/losses (-) arising from changes in demographic assumptions	17	–	–	17
Actuarial gains (+)/losses (-) arising from changes in financial assumptions	-350	–	–	-350
Actuarial gains (+)/losses (-) arising from experience adjustments	10	–	–	10
Remeasurements of plan assets				
Actuarial gains (+)/losses (-) arising from experience adjustments	–	58	–	58
Changes in the effects of the asset ceilings				
Actuarial gains (+)/losses (-)	–	–	29	29
Actuarial gains (+)/losses (-)	**-323**	**58**	**29**	**-236**
Pension payments	147	-61	–	86
Employer contributions	–	57	–	57
Employee contributions	-22	21	–	-1
Payment transactions	**125**	**17**	**–**	**142**
Changes in the scope of consolidation	–	–	–	–
Currency translation recognized in equity	-16	20	–	4
Other changes	5	-4	–	1
Other	**-11**	**16**	**–**	**5**
December 31, 2023	**-4,787**	**2,848**	**-4**	**-1,943**

The actual income from plan assets amounted to € 147 million in the year under review (2022: loss of € 395 million).

Covering the benefit obligations with financial assets represents a means of providing for future cash outflows, which are required by law in some countries (for example, Switzerland and the United Kingdom) and voluntary in other countries (for example, Germany).

The fair value of the plan assets was allocated to the following categories:

	Dec. 31, 2023			Dec. 31, 2022		
€ 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	74	–	74	58	–	58
Equity instruments	620	–	620	636	–	636
Debt instruments	1,219	–	1,219	968	–	968
Real estate	180	193	373	179	321	500
Investment funds	48	392	439	140	204	344
Insurance contracts	–	61	61	–	64	64
Other	62	–	62	59	5	64
Fair value of the plan assets	**2,202**	**646**	**2,848**	**2,040**	**594**	**2,634**

Plan assets did not directly include financial instruments issued by Group companies or assets used by Group companies.

Employer contributions to plan assets and direct payments to plan beneficiaries for the next year are expected to amount to € 48 million (2022: € 42 million) and € 96 million (2022: € 95 million) respectively.

The expected payments of undiscounted benefits under the plans were as follows:

December 31, 2023

	Expected payments of undiscounted benefits				
€ million	**Germany**	**Switzerland**	**United Kingdom**	**Other countries**	**Total**
2024	88	26	17	22	153
2025	95	24	17	24	160
2026	99	25	18	29	171
2027	103	27	19	21	170
2028	108	27	19	21	175
2029-2033	607	151	103	133	994

December 31, 2022

	Expected payments of undiscounted benefits				
€ million	Germany	Switzerland	United Kingdom	Other countries	**Total**
2023	85	23	19	38	165
2024	91	22	19	22	155
2025	95	22	20	26	163
2026	99	22	20	23	164
2027	103	22	21	22	168
2028-2032	583	112	116	130	940

The weighted duration of defined benefit obligations amounted to 17 years (2022: 16 years).

Other employee benefit provisions

Accounting and measurement policies

Other employee benefit provisions

Other employee benefit provisions include obligations from share-based compensation programs. However, they do not contain the tranche of the Long-Term Incentive Plan of Merck KGaA, Darmstadt, Germany (LTIP) that is payable in the months following the reporting date, as this is no longer subject to value fluctuations following the reporting date. More information on these compensation programs can be found below.

Obligations for partial retirement programs and other severance payments not recognized in connection with restructuring programs, as well as obligations in connection with long-term working hour accounts and anniversary bonuses, are also included in other employee benefit provisions.

Other employee benefit provisions developed as follows:

€ million	Non-current other employee benefit provisions	Current other employee benefit provisions[1]	Total
Jan. 1, 2023	**299**	**81**	**380**
Additions	78	161	239
Utilizations	-26	-99	-125
Release	-41	-89	-130
Interest effect	2	–	2
Currency translation	-5	-3	-9
Reclassification from non-current to current/liabilities[1]	-90	32	-57
Changes in scope of consolidation/Other	–	–	–
Dec. 31, 2023	**217**	**83**	**299**

[1] Previous year's figures have been adjusted, see Note (2) "**Reporting principles**".

Share-based payments

Accounting and measurement policies

Share-based payments

Provisions are recognized for the share-based compensation program with cash settlement within the Group ("Long-Term Incentive Plan of Merck KGaA, Darmstadt, Germany") and reported in other employee benefit provisions.

The fair value of the obligations is calculated by an external expert using a Monte Carlo simulation as of the balance sheet date. The main parameters in the measurement of the share-based compensation programs with cash settlement are long-term indicators of company performance and the price movement of the shares of Merck KGaA, Darmstadt, Germany, in relation to the DAX®. A sustainability factor is also included in the valuation parameters for tranches issued from fiscal 2022 onward.

The expected volatilities are based on the implicit volatility of the 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 to the intrinsic value of share-based compensation programs are allocated to the respective functional costs according to the causation principle. Time value changes are recognized in financial income or finance costs.

Significant discretionary decisions and sources of estimation uncertainty

Share-based payments

The measurement of long-term share-based compensation programs implies extensive estimation uncertainty. The following overview shows the amounts by which the non-current provisions from share-based compensation programs (carrying amount as of December 31, 2023: € 7 million/carrying amount as of December 31, 2022: € 97 million) would have been impacted by changes in the DAX® or the closing price of the Group share on the balance sheet date. 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, 2023	Dec. 31, 2022
Variation of Group share price	10%	1	20
	-10%	-1	-18
Change in the DAX®	10%	–	-10
	-10%	–	8

Sensitivities were determined on the basis of the respective parameters in question, with all other measurement assumptions remaining unchanged. The 2021 tranche will not be subject to any value fluctuations between December 31, 2023, and the payout date, and was therefore excluded from the sensitivity analysis (December 31, 2022: exclusion of 2020 tranche).

These share-based compensation programs with cash settlement in place in the Group are aligned with target achievement based on key performance indicators as well as the long-term performance of the shares of Merck KGaA, Darmstadt, Germany. Certain employees are 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 the 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). When the three-year performance cycle ends, the number of MSUs to then be granted is determined based on the development of defined financial key performance indicators (KPIs). In addition to the financial KPIs, a sustainability factor is included in performance measurement for tranches issued from fiscal 2022 onward.

The calculation is based on the performance of the Group share price compared to the performance of the DAX® with a weighting of 50%, the development of the EBITDA pre margin during the performance cycle as a proportion of a defined target value with a weighting of 25%, and the development of organic sales growth as a proportion of a defined target value, also with a weighting of 25%. Depending on the development of these financial 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.

For tranches issued from fiscal 2022 onward, the MSUs measured on the basis of financial targets are multiplied by a sustainability factor composed of the three sustainability criteria: “Dedicated to human progress”, “Partnering for sustainable business impact”, and “Reducing our ecological footprint”.

The weighting of the three sustainability criteria for the 2023 LTIP tranche is as follows:

- “Dedicated to human progress” 30%
- “Partnering for sustainable business impact” 30%
- “Reducing our ecological footprint” 40%

The sustainability factor can range from 0.8 to 1.2. This means that, depending on the result of the financial KPIs (0% to -150%) and the sustainability factor, the eligible participants are granted between 0% and 180% of the MSUs they could be eligible to receive at the end of the respective performance cycle.

A cash payment is made based on the MSUs granted 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 the shares of Merck KGaA, Darmstadt, Germany, in Xetra® trading during the last 60 trading days prior to the end of the performance cycle. The payout amounts of the respective tranches are limited to two and a half times the individual grant.

The 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:

	2021 tranche	2022 tranche	2023 tranche
Performance cycle	Jan. 1, 2021 - Dec. 31, 2023	Jan. 1, 2022 - Dec. 31, 2024	Jan. 1, 2023 - Dec. 31, 2025
Term	3 Years	3 Years	3 Years
Reference price of the shares of Merck KGaA, Darmstadt, Germany, in € (60-day average Group share price prior to the start of the performance cycle)	132.43	212.16	173.46
DAX® value (60-day average of the DAX® prior to the start of the performance cycle)	12,995.23	15,684.57	13,722.30
Potential number of MSU			
Potential number offered for the first time in 2021	685,700	–	–
Forfeited	41,813	–	–
Paid out	–	–	–
Dec. 31, 2021	643,887	–	–
Potential number offered for the first time in 2022	–	509,033	–
Forfeited	40,704	20,282	–
Paid out	1,253	227	–
Dec. 31, 2022	601,930	488,524	–
Potential number offered for the first time in 2023	–	–	672,367
Forfeited	26,455	22,829	19,901
Paid out	2,016	1,673	1,266
Dec. 31, 2023	**573,459**	**464,022**	**651,200**

The value of the provisions as of December 31, 2023, was € 7 million (December 31, 2022: € 97 million). Net income of € 35 million was generated in fiscal 2023 (2022: net expenses of € 70 million). The three-year tranche issued in fiscal 2020 ended at the end of fiscal 2022; an amount of € 160 million was paid out in fiscal 2023. The three-year tranche issued in fiscal 2021 ended at the end of 2023 and was reclassified from current provisions for employee benefits to other current non-financial liabilities as of December 31, 2023. The tranche is expected to result in a payout of € 54 million in fiscal 2024. At the reporting date, the average closing price of the shares of Merck KGaA, Darmstadt, Germany, in Xetra® trading over the last 60 trading days was € 149.40.

Capital Structure, Investments, and Financing Activities

(34) Equity

Accounting and measurement policies

Accounting treatment of the general partner's equity

As a partnership limited by shares, Merck KGaA, Darmstadt, Germany, has two different shareholder groups who have contributed to the company: the general partner E. Merck KG, Darmstadt, Germany, as the personally liable partner; and the shareholders.

From an accounting perspective, the contributions of both shareholder groups are treated as equity, regardless of the general partner's option to terminate its capital share. This treatment is based on the provision in the Articles of Association of Merck KGaA, Darmstadt, Germany, stating that the limited liability shareholders may decide on the conversion of the company into a stock corporation and thus limit the general partner's settlement claim to fulfillment in equity instruments.

Equity capital/Capital reserves

The equity capital of the company consisted of the subscribed capital composed of shares and the equity interest held by the general partner E. Merck KG, Darmstadt, Germany (general partner's equity). As of the balance sheet date, the company's subscribed capital amounting to € 168 million was divided into 129,242,251 no-par value bearer shares plus one registered share. Each share therefore corresponded to € 1.30 of the subscribed 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 previous year, there were no changes in subscribed capital in fiscal 2023.

Retained earnings

Retained earnings developed as follows:

€ million	Retained earnings/net retained profit	Remeasurement of defined benefit plans	Fair value reserve for equity instruments	**Retained earnings**
Jan. 1, 2022	**16,610**	**-1,539**	**63**	**15,134**
Profit after tax	3,326	–	–	3,326
Gains/losses recognized in equity	–	1,140	-31	1,109
Comprehensive income	**3,326**	**1,140**	**-31**	**4,435**
Dividend payments	-239	–	–	-239
Capital increases	–	–	–	–
Profit transfer to/from E. Merck KG, Darmstadt, Germany, including changes in reserves	-868	–	–	-868
Transactions with no change of control	–	–	–	–
Change in scope of consolidation/Other	-19	-2	21	–
Dec. 31, 2022	**18,811**	**-401**	**53**	**18,463**
Jan. 1, 2023	**18,811**	**-401**	**53**	**18,463**
Profit after tax	2,824	–	–	2,824
Gains/losses recognized in equity	–	-187	160	-28
Comprehensive income	**2,824**	**-187**	**160**	**2,796**
Dividend payments	-284	–	–	-284
Capital increases	–	–	–	–
Profit transfer to/from E. Merck KG, Darmstadt, Germany, including changes in reserves	-746	–	–	-746
Transactions with no change of control	-1	–	–	-1
Change in scope of consolidation/Other	31	-4	-27	–
Dec. 31, 2023	**20,635**	**-592**	**186**	**20,228**

Gains/losses recognized in equity

Gains/losses recognized in equity developed as follows (see also Note (39) "**Derivative financial instruments**"):

€ million	Cash flow hedge reserve	Cost of cash flow hedge reserve	Currency translation difference	Gains/losses recognized in equity
Jan. 1, 2022	**-145**	**-23**	**1,992**	**1,824**
Profit after tax	–	–	–	–
Gains/losses recognized in equity	**91**	**11**	**1,159**	**1,261**
Fair value adjustment	-98	-15	1,230	1,117
Reclassification to profit or loss	194	16	-71	139
Reclassification to assets	–	–	–	–
Tax effect	-5	10	–	5
Dec. 31, 2022	**-54**	**-12**	**3,151**	**3,086**
Jan. 1, 2023	**-54**	**-12**	**3,151**	**3,086**
Gains/losses recognized in equity	**-2**	**5**	**-1,016**	**-1,013**
Fair value adjustment	98	-17	-1,001	-920
Reclassification to profit or loss	-95	22	-15	-88
Reclassification to assets	–	–	–	–
Tax effect	-5	–	–	-5
Dec. 31, 2023	**-56**	**-7**	**2,136**	**2,073**

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 subscribed capital (70.274% or 29.726% of the equity capital).

The allocation of net profit/loss is based on the net income of both E. Merck KG, Darmstadt, Germany, and Merck KGaA, Darmstadt, Germany, determined in accordance with the provisions of the German Commercial Code. These figures 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 must be paid by them directly. The adjustment thus ensures that the share in net profit corresponds to the respective interests held by the two shareholder groups.

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:

		2023		2022	
€ 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		-12	–	23	–
Net income of Merck KGaA, Darmstadt, Germany, before reciprocal profit transfer		–	980	–	919
Corporation tax		–	4	–	54
Basis for appropriation of profits	**(100%)**	**-12**	**985**	**23**	**974**
Profit transfer to E. Merck KG, Darmstadt, Germany (ratio of general partner's equity to equity capital)	(70.274%)	692	-692	684	-684
Profit/loss transfer to Merck KGaA, Darmstadt, Germany (ratio of subscribed capital to equity capital)	(29.726%)	4	-4	-7	7
Corporation tax		–	-4	–	-54
Net income		**683**	**285**	**700**	**242**

The result of E. Merck KG, Darmstadt, Germany, adjusted for trade tax, on which the appropriation of profits is based, amounted to € -12 million (2022: € 23 million). This resulted in a profit/loss transfer to Merck KGaA, Darmstadt, Germany, of € -4 million (2022: € 7 million). The net income of Merck KGaA, Darmstadt, Germany, adjusted for corporation tax, on which the appropriation of its profit is based, amounted to € 985 million (2022: € 974 million). Merck KGaA, Darmstadt, Germany, transferred a profit of € 692 million to E. Merck KG, Darmstadt, Germany (2022: € 684 million). In addition, an expense from corporation tax charges was reported in the amount of € 4 million (2022: expense of € 54 million).

Appropriation of profits

The profit distribution to be resolved 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 the net retained profit of Merck KGaA, Darmstadt, Germany, to which they are entitled, E. Merck KG, Darmstadt, Germany, shall be obliged to allocate to the profit carried forward/retained earnings of Merck KGaA, Darmstadt, Germany, a comparable sum determined according to the ratio of subscribed capital to general partner’s equity. This ensures that the retained earnings and the profit carried forward by 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, the available amount is the amount that results from 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 sum paid as a dividend to the shareholders and reflects their pro rata shareholding in the company.

Based on the profit transfer, the appropriation of profits by Merck KGaA, Darmstadt, Germany, was as follows:

	2023		2022	
€ million	**Portion E. Merck KG, Darmstadt, Germany**	**Portion limited liability shareholders**	Portion E. Merck KG, Darmstadt, Germany	Portion limited liability shareholders
Net income	683	285	700	242
Profit carried forward previous year	80	34	180	76
Withdrawal from revenue reserves	–	–	–	–
Transfer to revenue reserves	–	–	–	–
Retained earnings limited liability shareholders		**319**		**318**
Withdrawal by E. Merck KG, Darmstadt, Germany	-682		-801	
Profit carried forward E. Merck KG, Darmstadt, Germany	**81**		**80**	
Dividend proposal		-284		-284
Profit carried forward of limited liability shareholders (preliminary)		**34**		**34**

A dividend of € 2.20 per share was distributed for fiscal 2022. The dividend proposal for fiscal 2023 is unchanged at € 2.20 per share. With the proposed dividend payment to shareholders amounting to € 284 million (2022: € 284 million), the profit carried forward of the shareholders after the dividend payment would amount to € 34 million (2022: € 34 million). Based on the proposed dividend payment to the shareholders, E. Merck KG, Darmstadt, Germany, would be entitled to withdraw € 682 million (2022: € 801 million), meaning that E. Merck KG, Darmstadt, Germany, would be entitled to a profit brought forward of € 81 million (2022: € 80 million).

Appropriation of profits and changes in reserves

€ million	2023			2022		
	Merck & Cie KmG, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany	**Merck KGaA, Darmstadt, Germany**	**Total**	Merck & Cie KmG, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany	Merck KGaA, Darmstadt, Germany	Total
Profit transfer to E. Merck KG, Darmstadt, Germany	-52	-692	-743	-90	-684	-774
Profit/loss transfer to Merck KGaA, Darmstadt, Germany	–	-4	-4	–	7	7
Change in profit carried forward of E. Merck KG, Darmstadt, Germany	–	1	1	–	-100	-100
Profit transfer to E. Merck KG, Darmstadt, Germany, including changes in reserves	**-52**	**-694**	**-746**	**-90**	**-778**	**-868**
Result of E. Merck KG, Darmstadt, Germany, before reciprocal profit transfer adjusted for trade tax		-12			23	
Profit transfer to E. Merck KG, Darmstadt, Germany / withdrawal by E. Merck KG, Darmstadt, Germany	**-52**	**-682**		**-90**	**-801**	

Based on the proposed appropriation of profits, the profit transfer to E. Merck KG, Darmstadt, Germany, for fiscal 2023, including changes in reserves, amounted to € -746 million. This consisted of the profit/loss transfer to E. Merck KG, Darmstadt, Germany (€ -692 million), the profit transfer to Merck KGaA, Darmstadt, Germany (€ -4 million), the change in profit carried forward by E. Merck KG, Darmstadt, Germany (€ 1 million) and the profit transfer from Merck & Cie KmG, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany, to E. Merck KG, Darmstadt, Germany (€ -52 million). In the previous year, the profit transfer to E. Merck KG, Darmstadt, Germany, including changes in reserves amounted to -868 million. This consisted of the profit transfer to E. Merck KG, Darmstadt, Germany (€ -684 million), the profit transfer to Merck KGaA, Darmstadt, Germany (€ 7 million), the change in profit carried forward by E. Merck KG, Darmstadt, Germany (€ -100 million) and the profit transfer from Merck & Cie KmG, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany, to E. Merck KG, Darmstadt, Germany (€ -90 million) and was paid to E. Merck KG, Darmstadt, Germany, in fiscal 2023. Merck & Cie KmG, 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.

Non-controlling interests

The calculation of non-controlling interests was based on the reported equity of the subsidiaries concerned.

The non-controlling interests in consolidated equity and profit or loss essentially related to the non-controlling interests in Versum Materials Taiwan Co., Ltd., Taiwan; Merck Ltd., Bangkok, Thailand, a subsidiary of Merck KGaA, Darmstadt, Germany; and in the listed company PT Merck Tbk., Jakarta, Indonesia, a subsidiary of Merck KGaA, Darmstadt, Germany.

(35) Cash and cash equivalents

Accounting and measurement policies

Cash and cash equivalents

Cash and cash equivalents comprise short-term investments with a maximum maturity of up to three months, which can be readily converted to a determined amount of cash.

Cash and cash equivalents comprised the following items:

€ million	**Dec. 31, 2023**	Dec. 31, 2022
Cash, bank balances and cheques	501	610
Short-term cash investments (up to 3 months)	1,481	1,244
Cash and cash equivalents	**1,982**	**1,854**

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 € 404 million (December 31, 2022: € 456 million). This mainly related to cash and cash equivalents at subsidiaries that are subject to capital controls.

The maximum default risk was equivalent to the carrying amount of cash and cash equivalents.

(36) Other financial assets

Accounting and measurement policies

Other financial assets

This section does not cover the accounting and measurement policies for derivative financial instruments. They are presented separately in Note (39) “**Derivative financial instruments**”.

Recognition and initial measurement

Financial assets are initially measured at fair value and recognized as of the settlement date. For financial assets not subsequently measured at fair value through profit or loss in subsequent periods, initial measurement also includes directly attributable transaction costs. Any difference between the fair value of a financial instrument on initial recognition (Level 2 and 3) and the transaction price is recognized in income using the straight-line method over the duration.

Detailed information on the measurement methods for financial assets measured at fair value are presented in Note (43) “**Information on fair value measurement**”.

Classification and subsequent measurement

On initial recognition, financial assets are assigned to one of the following measurement categories which also correspond to the financial instrument classes as defined in IFRS 9:

- subsequent measurement at amortized cost,
- subsequent measurement at fair value through other comprehensive income, or
- subsequent measurement at fair value through profit or loss.

This classification is based on the business model and the structure of contractual payment flows. Financial assets subsequently measured at amortized cost are accounted for using the effective interest method and considering any impairment losses. The procedure for calculating impairment losses is described in Note

(42) “**Management of financial risks**”. Financial assets of this class are held in order to collect their contractual cash flows, which are exclusively principal repayments and interest payments on the outstanding capital amount.

Except for derivative financial instruments with positive market value, the Group only applies subsequent measurement at fair value through profit or loss for debt instruments with contractual properties resulting in cash flows that do not exclusively represent principal repayments and interest payments on the outstanding capital amount. In particular, this includes contingent consideration that was contractually agreed with the acquirer within the context of the disposal of businesses within the meaning of IFRS 3 (see Note (43) “**Information on fair value measurement**”). The Group does not utilize the option of the subsequent measurement of debt instruments at fair value through profit or loss.

Equity instruments not subject to mandatory subsequent measurement at fair value through profit or loss are measured at fair value through other comprehensive income in subsequent periods and if they are intended to be held for the longer term. Further details on the measurement of equity instruments at fair value are presented in Note (43) “**Information on fair value measurement**”.

Financial assets are only reclassified in the rare event of the Group changing its business model with regard to the management of financial assets.

Derecognition

Financial assets are derecognized if the claim for compensation is fulfilled by the other counterparty, if there is no longer a reasonable expectation that the counterparty will fulfill its contractual obligations, or if the Group transfers the contractual rights including all material risks and rewards of the financial asset to another counterparty.

Recognition

Measurement effects of debt instruments are reported in the consolidated balance sheet and the consolidated income statement as follows:

Category	Asset type	Impairment losses/reversals of impairment losses	Net gain and net loss on disposal/value adjustments	Foreign currency gains or losses	Interest income or expenses
Subsequent measurement at amortized cost	Operational	Impairment losses, and reversals of impairment losses of financial assets (net)	Other operating income or other operating expenses	Other operating income or other operating expenses	Financial income and expenses (applying the effective interest method)
	Financial	Financial income and expenses	Financial income and expenses	Financial income and expenses	
Subsequent measurement at fair value through other comprehensive income	Operational	Impairment losses, and reversals of impairment losses of financial assets (net)	Group equity (upon derecognition: reclassification to other operating income or other operating expenses)	Other operating income or other operating expenses	Financial income and expenses
	Financial	Financial income and expenses	Group equity (upon derecognition: reclassification to financial income and expenses)	Financial income and expenses	
Subsequent measurement at fair value through profit or loss	Operational		Other operating income or other operating expenses	Other operating income or other operating expenses	Financial income and expenses
	Financial		Financial income and expenses	Financial income and expenses	

The recognition of income from the unwinding of discounts and income and expenses from interest rate-induced changes in contingent considerations measured at fair value through profit or loss subsequent to initial recognition are reported in financial income and expenses.

The following table provides details on the measurement effects of equity instruments on the consolidated balance sheet and the consolidated income statement:

Category	**Asset type**	**Value adjustments**	**Foreign currency gains or losses**	**Dividend income**
Subsequent measurement at fair value through other comprehensive income	Operational	Results recognized directly in equity (value adjustments) Reclassification of the cumulative results previously recognized directly in equity in the retained earnings when asset is disposed	Foreign currency gains and losses recognized directly in equity	Other operating income
	Financial	Results recognized directly in equity (value adjustments) Reclassification of the cumulative results previously recognized directly in equity in the retained earnings when asset is disposed	Foreign currency gains and losses recognized directly in equity	Financial income
Subsequent measurement at fair value through profit or loss	Operational	Other operating income or other operating expenses	Other operating income or other operating expenses	Other operating income
	Financial	Financial income and expenses	Financial income and expenses	Financial income

At the reporting date, other financial assets were composed as follows:

	Dec. 31, 2023			Dec. 31, 2022		
€ million	current	non-current	Total	current	non-current	Total
Subsequent measurement at amortized cost	**201**	**4**	**204**	**122**	**4**	**126**
Loans against third parties	1	4	4	–	4	4
Other	200	–	200	122	–	122
Subsequent measurement at fair value through other comprehensive income	**198**	**644**	**842**	**80**	**517**	**597**
Equity instruments	–	643	643	–	516	516
Debt instruments	198	1	199	80	1	81
Subsequent measurement at fair value through profit and loss	**63**	**333**	**396**	**66**	**436**	**502**
Contingent consideration	–	125	125	14	235	250
Other debt instruments	33	161	194	28	154	182
Derivatives without a hedging relationship (financial transactions)	27	–	27	16	–	16
Derivatives without a hedging relationship (operational)	3	47	50	7	46	53
Derivatives with a hedging relationship (operational)	**37**	**–**	**37**	**53**	**–**	**53**
Financial assets	**499**	**981**	**1,480**	**321**	**957**	**1,278**

The increase in other current financial assets with subsequent measurement at amortized cost related to deposits with banks. Debt instruments with subsequent measurement at fair value through other comprehensive income increased in the year under review due to the purchase of commercial papers.

As in the previous year, contingent consideration primarily included claims arising from the sale of the biosimilars business to Fresenius SE & Co. KGaA, Bad Homburg vor der Höhe, in 2017. The reduction in contingent consideration was mainly attributable to payments received.

Equity interests with subsequent measurement at fair value through other comprehensive income mainly related to shares in the following companies in particular:

€ million	**Fair value as of Dec. 31, 2023**	Fair Value: hierarchy level IFRS 13	Fair value as of Dec. 31, 2022	Fair Value: hierarchy level IFRS 13
M Ventures portfolio	**436**		**422**	
DNA Script S.A.S., France	<50	Level 3	<50	Level 3
Vera Therapeutics, Inc., United States	<50	Level 1	<50	Level 1
Precigen, Inc., United States	<50	Level 1	<50	Level 1
Artios Pharma Limited, UK	<25	Level 3	<50	Level 3
Wiliot Ltd., Israel	<25	Level 3	<25	Level 3
Celestial AI Inc., United States	<25	Level 3	<15	Level 3
Mosa Meat B.V., Netherlands	<25	Level 3	<50	Level 3
Storm Therapeutics Limited, UK	<15	Level 3	<15	Level 3
Asceneuron SA, Switzerland	<15	Level 3	<15	Level 3
ElectronInks Inc., United States	<15	Level 3	<15	Level 3
Formo Bio GmbH, Germany	<15	Level 3	<15	Level 3
Nouscom AG, Switzerland	<15	Level 3	-	-
Plexium Inc., United States	<15	Level 3	<15	Level 3
Other (notation in an active market)	1	Level 1	4	Level 1
Other (no notation in an active market)	200	Level 3	181	Level 3
Other minority interests	**207**		**94**	
MoonLake Immunotherapeutics Ltd., Cayman Islands	152	Level 1	0	Level 1
MoonLake Immunotherapeutics AG, Switzerland	0	Level 1	34	Level 1
IDRX, Inc., United States	17	Level 3	10	Level 3
InfraServ GmbH & Co. Wiesbaden KG, Germany	13	Level 3	22	Level 3
Telios Pharma, Inc., United States	9	Level 3	10	Level 3
Other (notation in an active market)	2	Level 1	–	Level 1
Other (no notation in an active market)	14	Level 3	18	Level 3
Total	**643**		**516**	

(37) Financial debt/Capital management

Accounting and measurement policies

Financial debt/capital management

Except for lease liabilities and derivatives with negative market values, financial debt is initially recognized at fair value and subsequently measured at amortized cost using the effective interest method.

The accounting and measurement policies for lease liabilities and derivatives are presented in Notes (21) "**Leasing**" and (39) "**Derivative financial instruments**".

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

	Dec. 31, 2023 € million	Dec. 31, 2022 € million	Maturity	Interest rate %	Nominal value million	Nominal value Currency
Eurobond 2019/2023	–	600	Dec. 2023	0.005	600	€
Bonds (current)	**–**	**600**				
Bank loans	277	203				
Liabilities to related parties	206	259				
Loans from third parties and other financial debt	20	11				
Liabilities from derivatives (financial transactions)	77	30				
Lease liabilities (IFRS 16)	122	125				
Current financial debt	**702**	**1,228**				
USD bond 2015/2025	1,444	1,498	March 2025	3.250	1,600	USD
Eurobond 2020/2025	748	747	July 2025	0.125	750	€
Eurobond 2022/2026	499	498	July 2026	1.875	500	€
Eurobond 2019/2027	598	598	July 2027	0.375	600	€
Eurobond 2020/2028	748	747	July 2028	0.500	750	€
Eurobond 2022/2030	497	497	July 2030	2,375	500	€
Eurobond 2019/2031	797	797	July 2031	0.875	800	€
Hybrid bond 2014/2074	499	499	Dec. 2074[1]	3,375	500	€
Hybrid bond 2019/2079	499	498	June 2079[2]	1.625	500	€
Hybrid bond 2019/2079	632	749	June 2079[3]	2.875	750	€
Hybrid bond 2020/2080	840	998	Sep. 2080[4]	1.625	1,000	€
Bonds (non-current)	**7,802**	**8,126**				
Bank loans	7	–				
Liabilities to related parties	990	660				
Loans from third parties and other financial debt	47	48				
Liabilities from derivatives (financial transactions)	–	–				
Lease liabilities (IFRS 16)	393	366				
Non-current financial debt	**9,239**	**9,200**				
Financial debt	**9,941**	**10,428**				
less:						
Cash and cash equivalents	1,982	1,854				
Current financial assets[5]	459	247				
Net financial debt[6]	**7,500**	**8,328**				

[1] The Group has the right to prematurely repay this tranche of the hybrid bond issued in December 2014 for the first time in December 2024.
[2] The Group has the right to prematurely repay this tranche of the hybrid bond issued in June 2019 for the first time in December 2024.
[3] The Group has the right to prematurely repay this tranche of the hybrid bond issued in June 2019 for the first time in June 2029.
[4] The Group has the right to prematurely repay this hybrid bond issued in September 2020 for the first time in September 2026.
[5] Excluding current derivatives (operational) and contingent considerations, which are recognized in the context of business combinations according to IFRS 3.
[6] Not defined by International Financial Reporting Standard (IFRS).

The hybrid bonds issued by Merck KGaA, Darmstadt, Germany, are bonds for which the leading rating agencies have given equity credit treatment to half of the issuances, thus making the issuances more favorable to the Group's credit rating than traditional bond issues. The bonds are recognized in full as financial liabilities in the balance sheet. Although the Group intends to repay them at the earliest possible date, these bonds are principally reported as non-current financial debt for accounting purposes.

A partial buyback of the nominal volume of € 250 million of a hybrid bond issued in 2019 took place on September 9, 2022.

A partial buyback of the nominal volume of € 275 million of hybrid bonds issued in 2019 and 2020 took place on November 20, 2023.

The financial debt was not secured by liens or similar forms of collateral. The loan agreements do not contain any financial covenants. The average borrowing cost on December 31, 2023, was 2.1% (December 31, 2022: 1.9%).

Non-current liabilities to related parties in the amount of € 990 million (December 31, 2022: € 660 million) consisted of liabilities to E. Merck Beteiligungen KG, Darmstadt, Germany, a related party of E. Merck KG, Darmstadt, Germany.

Information on liabilities to related parties can be found in Note (45) "**Related party disclosures**".

Capital management

The objective of capital management is to ensure the necessary financial flexibility in order to maintain long-term business operations and 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. In this context, net financial debt as well as gearing, calculated as the ratio of EBITDA pre to net financial debt, are important capital management indicators in the Group.

Traditionally, the capital market represents a major source of financing for the Group, for instance via bond issues. As of December 31, 2023, there were liabilities of € 3.9 billion from a debt issuance program most recently renewed in fiscal 2023 (December 31, 2022: € 4.5 billion). In addition, the Group had access to a commercial paper program to meet short-term capital requirements with a volume of € 2.5 billion (December 31, 2022: € 2 billion), none of which was utilized as of December 31, 2023, or the prior-year reporting date.

Loan agreements represent another major source of financing for the Group. On the balance sheet date, the financing commitments from banks in respect of the Group were as follows:

	Dec. 31, 2023		Dec. 31, 2022			
€ million	**Financing commitments from banks**	**Utilization**	Financing commitments from banks	Utilization	Interest	Maturity of financing commitments
Syndicated loan	2,500	–	2,500	–	variable	2027
Bilateral credit agreement with banks	375	–	375	–	variable	<3 Jahre
Various bank credit lines	277	277	203	203	variable	< 1 year
Project financing	7	7	–	–	fix	2027
	3,158	**284**	**3,078**	**203**		

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

(38) Other financial liabilities

Accounting and measurement policies

Other financial liabilities

With the exception of liabilities from derivatives and contingent considerations, which are recognized in the context of business combinations according to IFRS 3, other financial liabilities are initially measured at fair value and in subsequent periods at amortized cost, applying the effective interest method. The accounting and measurement policies of derivatives are presented in Note (39) “**Derivative financial instruments**”.

Other financial liabilities comprised the following:

	Dec. 31, 2023			Dec. 31, 2022		
in Mio. €	**Current**	**Non-current**	**Total**	Current	Non-current	Total
Miscellaneous other financial liabilities[1]	998	129	1,127	1,119	122	1,241
thereof: liabilities to related parties	732	–	732	861	–	861
thereof: interest accruals	47	–	47	50	–	50
Liabilities from derivatives (operational)	7	18	25	34	19	53
Other financial liabilities[1]	**1,005**	**147**	**1,152**	**1,153**	**141**	**1,294**

[1] Previous year has been adjusted, please refer to Note (2) "**Reporting principles**".

The liabilities to related parties primarily consist of liabilities to E. Merck KG, Darmstadt, Germany.

(39) Derivative financial instruments

Accounting and measurement policies

Derivative financial instruments

The IFRS 9 provisions are applied for hedge accounting. Hedging transactions are entered into for highly probable forecast transactions in foreign currencies and for hedging fair values of assets on the balance sheet. Cash flow hedge accounting for forecast transactions in foreign currency means the hedged item is recognized at a fixed exchange rate on a net basis instead of being recognized at the spot exchange rate at the transaction date. As a result of hedging fair values of assets on the balance sheet, the compensating changes in value of the corresponding hedged item and hedging instrument offset each other.

The Group only uses derivatives as hedging instruments. The Group uses the dollar offset method as well as regression analyses to measure hedge effectiveness.

Hedging ineffectiveness may occur in the timing of forecast cash flows or if hedged items are dissolved. Derivatives that do not or no longer meet the documentation or effectiveness requirements for hedge accounting, whose hedged item no longer exists, or for which hedge accounting rules are not applied are classified as financial assets or liabilities at fair value through profit or loss depending on their balance.

Where options are used as hedging instruments, only their intrinsic value is designated as the hedging instrument. Changes in the fair value of the time value component of options that are used for hedge accounting are recognized in other comprehensive income and in the reserve for the cost of cash flow hedging within equity. The subsequent accounting of these amounts depends on the type of hedged transaction.

Where forward contracts are used 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 recognized in other comprehensive income in the reserve for the cost of cash flow hedging within equity. The subsequent accounting of these amounts depends on the type of hedged transaction.

The Group has concluded virtual power purchase agreements. As these agreements are designed as contracts for difference, they fulfill the definition of contracts to buy non-financial items that can be settled net in cash with the characteristics of derivative financial instruments and are measured at fair value through profit or loss in accordance with IFRS 9. As no physical electricity is purchased, the own use exemption that allows certain derivative financial instruments to be treated as executory contracts does not apply.

Derivative financial instruments are recognized in the consolidated balance sheet, the consolidated income statement, and the consolidated statement of comprehensive income – with the exception of the balance sheet treatment of amounts included directly from the reserve in the initial cost or in the other carrying amount of a non-financial asset or liability – as follows:

					Changes in fair value in the consolidated income statement and the consolidated statement of comprehensive income	
Hedging relationship	**Type of collateral**	**Type of hedged item**	**Market value**	**Presentation on the balance sheet**	**during the term**	**at maturity**
Derivatives with a cash flow hedging relationship	Currency	Transactions in operating business	Positive market values	Other financial assets	Fair value adjustments (in equity)	Other operating income
			Negative market values	Other financial liabilities	Fair value adjustments (in equity)	Other operating expenses
Derivatives without a hedging relationship	Currency	Financial transactions	Positive market values	Other financial assets	Financial income and expenses	
			Negative market values	Financial debt		
	Virtual power purchase agreements	Transactions in operating business	Positive market values	Other financial assets	Other operating income	
			Negative market values	Other financial liabilities	Other operating expenses	

The nominal amounts of the derivatives held by the Group at the respective reporting dates were as follows:

	Dec. 31, 2023		Dec. 31, 2022	
€ million	current	non-current	current	non-current
Cash flow hedge	2,075	–	4,760	–
Currency	2,075	–	4,760	–
No hedge accounting	7,412	–	5,255	–
Currency	7,412	–	5,255	–
Virtual power purchase agreements[1]				
	9,487	**–**	**10,014**	**–**

[1] The virtual power purchase agreements do not have fixed nominal amounts.

The fair values of the derivatives were as follows:

December 31, 2023

	Positive market values				Negative market values			
	Financial transactions		Transactions in operating business		Financial transactions		Transactions in operating business	
€ million	**current**	**non-current**	**current**	**non-current**	**current**	**non-current**	**current**	**non-current**
Cash flow hedge	**–**	**–**	**37**	**–**	**–**	**–**	**5**	**–**
Currency	–	–	37	–	–	–	5	–
No hedge accounting	**27**	**–**	**3**	**47**	**77**	**–**	**2**	**18**
Currency	27	–	–	–	77	–	–	–
Virtual power purchase agreements	–	–	3	47	–	–	2	18
	27	**–**	**40**	**47**	**77**	**–**	**7**	**18**

December 31, 2022

	Positive market values				Negative market values			
	Financial transactions		Transactions in operating business		Financial transactions		Transactions in operating business	
€ million	current	non-current	current	non-current	current	non-current	current	non-current
Cash flow hedge	**–**	**–**	**53**	**–**	**–**	**–**	**30**	**–**
Currency	–	–	53	–	–	–	30	–
No hedge accounting	**16**	**–**	**7**	**46**	**30**	**–**	**4**	**19**
Currency	16	–	–	–	30	–	–	–
Virtual power purchase agreements	–	–	7	46	–	–	4	19
	16	**–**	**60**	**46**	**30**	**–**	**34**	**19**

As in the previous year, all hedging relationships were transaction related. Netting of derivatives from an economic perspective was possible due to the existing framework agreements on derivatives trading that the Group had entered into with commercial banks. Actual netting only takes place in the case of insolvency of the contract partner. Derivatives were not offset on the face of the balance sheet.

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

December 31, 2023

				Potential netting volume		
€ million	**Gross presentation**	**Netting**	**Net presentation**	**due to master netting agreements**	**due to financial collateral**	**Potential net amount**
Derivative assets	114	–	114	40	–	74
Derivative liabilities	-102	–	-102	-40	–	-62

December 31, 2022

				Potential netting volume		
€ million	Gross presentation	Netting	Net presentation	due to master netting agreements	due to financial collateral	Potential net amount
Derivative assets	123	–	123	60	–	63
Derivative liabilities	-83	–	-83	-60	–	-23

The reserves for cash flow hedges and the cost of cash flow hedging of the Group related to the following hedging instruments (see also Note (34) "**Equity**"):

	Cost of cash flow hedge reserve			Cash flow hedge reserve			
€ million	Time value of options	Forward component of currency forwards	**Total**	Intrinsic value of options	Spot component of currency forwards	Interest rate swaps	**Total**
Jan. 1, 2022	**-11**	**-12**	**-23**	**-40**	**-93**	**-11**	**-145**
Fair value adjustment (directly recognized in equity)	11	-26	-15	-73	-26	–	-98
Reclassification to profit or loss	–	16	16	106	74	13	194
Reclassification to assets	–	–	–	–	–	–	–
Tax effect	-1	11	10	2	-5	-3	-5
Dec. 31, 2022	**-1**	**-11**	**-12**	**-4**	**-50**	**–**	**-54**
Jan. 1, 2023	**-1**	**-11**	**-12**	**-4**	**-50**	**–**	**-54**
Fair value adjustment (directly recognized in equity)	-5	-12	-17	31	67	–	98
Reclassification to profit or loss	–	22	22	-36	-59	–	-95
Reclassification to assets	–	–	–	–	–	–	–
Tax effect	–	–	–	–	-4	–	-5
Dec. 31, 2023	**-6**	**-1**	**-7**	**-10**	**-46**	**–**	**-56**

(40) Finance income and expenses/Net gains and losses from financial instruments

Finance income and expenses were as follows:

€ million	**2023**	2022
Interest income and similar income	153	69
Capital gain from disposal of debt instruments with subsequent measurement at amortized cost	1	1
Income from fair value changes from debt instruments with subsequent measurement at fair value through profit or loss	25	10
Income from the change of the fair value of share-based compensation programs	–	7
Other interest income	19	2
Finance income	**197**	**90**
Interest expense and similar expenses	-319	-235
Capital loss from disposal of debt instruments with subsequent measurement at amortized cost	–	–
Expenses from fair value changes from debt instruments with subsequent measurement at fair value through profit or loss	2	-15
Expenses from fair value changes of share-based compensation programs	-2	–
Currency differences from financing activities	-1	-26
Other interest expenses	-2	–
Finance costs	**-322**	**-277**
Financial result	**-125**	**-187**

Interest and similar income and expenses arose as follows:

	2023		2022	
€ million	**Interest income**	**Interest expenses**	Interest income	Interest expenses
Financial instruments	90	-203	33	-161
thereof: Financial assets				
Subsequent measurement at fair value at amortized cost	76	–	22	-3
Subsequent measurement at fair value through other comprehensive income	1	–	–	–
Subsequent measurement at fair value through profit or loss	14	–	11	-2
thereof: Financial debt				
Subsequent measurement at fair value at amortized cost	–	-202	–	-155
Subsequent measurement at fair value through profit or loss	–	–	–	-1
Leases	–	-14	–	-13
Pension provisions	–	-61	–	-39
Tax items	39	-50	12	-7
Other non-current provisions	–	-5	–	-2
Other interest income/expenses and similar income and expenses	24	-9	25	-30
Capitalized borrowing costs for		22		17
Property, plant and equipment		18		10
Other intangible assets		4		6
Interest income/expenses and similar income and expenses	**153**	**-319**	69	**-235**

The following table shows the development of net gains and losses, currency differences as well as dividend income from financial instruments (excluding items recognized in other comprehensive income) by measurement category:

€ million		Currency differences	Dividends	Net gains and losses: Impairment losses/reversal of impairment losses (net)	Net gains and losses: Fair value adjustments	Net gains and losses: Disposal gains/losses	Total
Financial assets							
Subsequent measurement at amortized cost	**2023**	-3		-51		1	-50
	2022	-4		-6		1	-5
Subsequent measurement at fair value through other comprehensive income							
Equity Instruments	**2023**		–				
	2022		–				
thereof: investments derecognized	**2023**		–				
	2022		–				
thereof: investments held	**2023**		–				
	2022		–				
Debt Instruments	**2023**	–		–		–	–
	2022	–		–		2	2
Subsequent measurement at fair value through profit or loss (without derivatives)	**2023**	–	–		95		95
	2022	1	–		30		30
Financial debt							
Subsequent measurement at amortized cost	**2023**	–				–	–
	2022	–				–	–
Subsequent measurement at fair value through profit or loss (without derivatives)	**2023**	–			1		1
	2022	–			30		30
Derivatives without a hedging relationship (net)	**2023**	–			-18		-18
	2022	–			-27		-27
Total	**2023**	**-3**	**–**	**-51**	**79**	**1**	**29**
	2022	**-3**	**–**	**-5**	**34**	**3**	**31**

In the table above, interest income or expenses relating to derivatives without a hedging relationship, with the exception of the virtual power purchase agreements, are reported as a component of fair value adjustments.

The currency result from equity instruments with subsequent measurement at fair value through other comprehensive income was recognized in other comprehensive income.

(41) Financing cash flow

Accounting and measurement policies

Financing cash flow

The option to recognize dividend payments and profit withdrawals in the cash flows from financing activities is exercised in determining the cash flows from financing activities.

Furthermore, the net reporting option has been exercised to report cash receipts and payments for items in which the turnover is quick, the amounts large, and the maturities short. This primarily relates to rolling financing by way of commercial paper and short-term bank loans reported under "Payments from new borrowings of other current and non-current financial debt" and "Repayment of other current and non-current financial debt".

The change in financial debt was as follows:

2023

		Cash			Non-cash					
€ million	**Jan. 1, 2023**	Cash inflows	Repay-ments	Lease interest	Change in lease liabilities	Ex-change rate effects	Fair value adjust-ment	Other	Changes in scope of consoli-dation	**Dec. 31, 2023**
Financial liabilities to E. Merck KG, Darmstadt, Germany and E. Merck Beteiligungen KG, Darmstadt, Germany, a related party of E. Merck KG, Darmstadt, Germany	918	697	-420	–	–	–	–	–	–	1,195
Other current and non-current financial liabilities	9,510	519	-1,973	-14	201	-83	603	-15	–	8,746
Financial debt	**10,428**	**1,216**	**-2,394**	**-14**	**201**	**-83**	**603**	**-15**	**–**	**9,941**
Derivative assets (current and non-current)	-16	609	–	–	–	–	-620	–	–	-27

2022

		Cash			Non-cash					
€ million	**Jan. 1, 2022**	Cash inflows	Repay-ments	Lease interest	Change in lease liabilities	Ex-change rate effects	Fair value adjust-ment	Other	Changes in scope of consoli-dation	**Dec. 31, 2022**
Financial liabilities to E. Merck KG, Darmstadt, Germany and E. Merck Beteiligungen KG, Darmstadt, Germany, a related party of E. Merck KG, Darmstadt, Germany	894	1,637	-1,613	–	–	–	–	–	–	918
Other current and non-current financial liabilities[1]	9,906	1,281	-2,604	-12	187	97	663	-13	7	9,510
Financial debt	**10,801**	**2,917**	**-4,217**	**-12**	**187**	**97**	**663**	**-13**	**7**	**10,428**
Derivative assets (current and non-current)	-37	711	–	–	–	–	-691	–	–	-16

[1] The previous year's figures have been adjusted, see **consolidated cash flow statement**.

Interest payments for leases were recognized in operating cash flow but served as a reconciliation item in the above table as the underlying lease liabilities were a component of financial debt. Changes in lease liabilities included additions and retirements of right-of-use from leases and the effects from unwinding of the discount on lease liabilities.

Fair value adjustments of other current and non-current financial liabilities were entirely attributable to liabilities from derivatives. In the consolidated cash flow statement, cash changes of assets from derivatives of € 609 million (2022: € 711 million) were reported together with repayments of other current and non-current financial debt of € 1,973 million (2022: € 2,604 million) in the item “Repayments of other current and non-current financial debt” with a net amount of € 1,364 million (2022: € 1,893 million). In the above reconciliation, changes of assets from derivatives were reported separately, as they did not form part of financial liabilities.

The amount of unused credit lines that could be employed for future operating activities and to meet obligations and information on changes in financial debt can be found in Note (37) “**Financial debt/Capital management**”.

(42) Management of financial risks

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

The Group uses marketable forward exchange contracts, options and interest swaps as hedging instruments. The strategy to hedge interest rate and foreign exchange rate fluctuations arising from forecast transactions and transactions already recognized in the balance sheet is set by a risk committee, which meets on a regular basis. The use of derivatives is regulated by extensive guidelines and subject to ongoing risk controls by Group Treasury. Speculation is prohibited. The strict separation of functions between trading, settlement and control functions is ensured. Derivatives are only entered into with banks that have a good credit rating. Related default risks are continuously monitored.

The **Report on Risks and Opportunities** included in the combined management report provides further information on the management of financial risks.

Foreign exchange risks

Owing to the international nature of its business, 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.

The entire foreign exchange exposure is divided into several defined subsets with different risk profiles and systematically hedged using suitable hedging instruments. Hedging is performed based on a regularly reviewed basket of currencies. The maximum time horizon for hedging is 12 months.

Foreign exchange risks from the following transactions are economically hedged through the use of foreign exchange contracts and currency options:

- intragroup financing in non-functional currency, and
- receivables from and liabilities to third parties in non-functional currency.

Foreign exchange risks from the following transactions are hedged using foreign exchange contracts and currency options applying hedge accounting:

- forecast transactions in non-functional currency, the expected probability of which is very high for the next 12 months, and
- firm purchase commitments over the next 12 months in non-functional currency.

The following table shows the net exposure and the effects of transactional exchange rate movements of the key currencies against the euro in relation to the net income and equity of the Group on the balance sheet date:

December 31, 2023

€ million		CHF	CNY	JPY	KRW	TWD	USD
Net exposure		**-593**	**474**	**31**	**294**	117	420
Exchange rate -10% (appreciation vs. €)	Consolidated income statement	-59	47	3	29	12	42
	Equity (other comprehensive income)	2	-93	-10	-9	-6	-58
Exchange rate +10% (depreciation vs. €)	Consolidated income statement	59	-47	-3	-29	-12	-42
	Equity (other comprehensive income)	-2	77	9	7	5	52

December 31, 2022

€ million		CHF	CNY	JPY	KRW	TWD	USD
Net exposure		**-591**	**997**	**163**	**216**	151	867
Exchange rate -10% (appreciation vs. €)	Consolidated income statement	-59	100	16	22	15	87
	Equity (other comprehensive income)	–	-61	-9	-17	-15	-182
Exchange rate +10% (depreciation vs. €)	Consolidated income statement	59	-100	-16	-22	-15	-87
	Equity (other comprehensive income)	–	42	7	14	12	141

In this presentation, effects of cash flow hedges are taken into consideration in the equity of the Group. The net exposure of each of the above currencies consisted of the following components:

- planned cash flows in the next 12 months in the respective currency, less
- the nominal values of hedging instruments of these planned cash flows.

The planned cash flows in the next 12 months are analyzed and divided into subsets in accordance with the risk management strategy. In the first subset, 25% of a regularly reviewed basket of currencies is hedged. The second subset hedges a more flexible basket of currencies selected on the basis of hedging costs and correlation with the euro. The hedging strategy achieves an economic hedge ratio of at least 40% across all hedging subsets. Depending on scenario analyses, this can be increased to up to 90% using a rule-based approach. As in the previous year, balance sheet items in the above currencies were economically hedged by derivatives in full if they did not correspond to the functional currency of the respective Group company. Accordingly, they do not affect the net exposure presented above.

The impact of cash flow hedge accounting for forecast transactions in foreign currency was as follows for the major currencies:

December 31, 2023

€ million	CNY	JPY	KRW	TWD	USD
Notional amount	922	114	78	52	839
thereof: current	922	114	78	52	839
thereof: non-current	–	–	–	–	–
Fair Value of the hedging instrument	22	5	1	–	6
thereof: positive market values	23	5	1	1	8
thereof: negative market values	-2	–	–	-1	-2
Maturity profile	January 2024 – December 2024	January 2024 – December 2024	January 2024 – December 2024	January 2024 – December 2024	January 2024 – December 2024
Hedge ratio[1]	1:1	1:1	1:1	1:1	1:1
Change in value of outstanding hedging instruments since January 1, 2023	22	5	1	–	6
Change in value of hedged item used to determine hedge effectiveness since January 1, 2023	-22	-5	-1	0	-6
Weighted average hedging rate	7.63	146.50	1,415.00	33.26	1.10

[1] The hedging instruments and the corresponding hedged items were denominated in the same currency, therefore the hedge ratio was 1:1.

December 31, 2022

€ million	CNY	JPY	KRW	TWD	USD
Notional amount	933	92	158	134	3,408
thereof: current	933	92	158	134	3,408
thereof: non-current	–	–	–	–	–
Fair value of the hedging instrument	8	2	-3	5	10
thereof: positive market values	10	2	–	5	45
thereof: negative market values	-2	–	-3	–	-34
Maturity profile	January 2023 – December 2023	January 2023 – December 2023	January 2023 – December 2023	January 2023 – December 2023	January 2023 – December 2023
Hedge ratio[1]	1:1	1:1	1:1	1:1	1:1
Change in value of outstanding hedging instruments since January 1, 2022	8	2	-3	5	10
Change in value of hedged item used to determine hedge effectiveness since January 1, 2022	-8	-2	3	-5	-10
Weighted average hedging rate	7.32	136.00	1,373.00	31.16	1.07

[1] The hedging instruments and the corresponding hedged items were denominated in the same currency, therefore the hedge ratio was 1:1.

In addition to the transactional foreign exchange risks described previously, currency translation risks resulted from the fact that many of the Group’s subsidiaries are located outside the euro area and have functional currencies other than the reporting currency. Exchange differences resulting from translation of the assets and liabilities of these companies into euro, 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, 2023**	Dec. 31, 2022
Short-term or variable interest rate monetary deposits	2,403	2,083
Short-term or variable interest rate monetary borrowings	-625	-1,228
Net interest rate exposure	**1,778**	**855**

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	**2023**		2022	
Change in market interest rate	**+100 basis points**	**-100 basis points**	**+100 basis points**	**-100 basis points**
Effects on consolidated income statement	21	-21	17	-17
Effects on equity (other comprehensive income)	–	–	–	–

Electricity price risks

As part of the implementation of its sustainability strategy, the Group has concluded so-called virtual power purchase agreements in order to cover the purchased electricity volumes in Europe and the United States with energy certificates from renewable sources. At the reporting date, agreements were in place with wind and solar farm operators in the United States and Spain. With the exception of a wind farm in the United States, the other wind and solar farms in Spain and the United States were still under construction. The fundamental structure of all of the agreements was identical, involving a fixed exercise price for the Group and the assumption of the exposure from variable spot energy prices in the respective market regions. The Group receives green electricity certificates for the volumes of electricity produced and attributed to the Group. The Group uses the certificates it receives solely for itself. The agreements have remaining terms of between 10 and 17 years as of the reporting date.

In financial terms, the most important agreement is the one concluded between the Group and a wind energy project developer in the United States for an installed capacity attributable to the Group of 68 megawatts. The wind farm was commissioned in fiscal 2022. The fair value of the agreement was € 44 million as of the end of the reporting period (2022: € 50 million). The electricity price of around 40% of the expected production volume under this virtual power purchase agreement is hedged by a separate hedging instrument. Consequently, the net effect of the fixed price for the virtual power purchase agreement is zero for this quantity. The accounting provisions on hedge accounting were not applicable.

In total, the agreements including the hedging instrument resulted in a net gain on fair value measurement of € 3 million (2022: € 16 million) that was recognized in other operating income.

A change in the material valuation parameters would have had the following impact on the fair value of the agreements excluding the hedging instrument:

December 31, 2023

	Change in expected future electricity prices		Change in expected annual production volume		Change in cost of capital after tax	
	percentage points		percentage points		percentage points	
€ million	**+10**	-10	**+10**	-10	**+1**	-1
Change in the fair value of the virtual power purchase agreements	19	-19	6	-6	-3	3

December 31, 2022

	Change in expected future electricity prices		Change in expected annual production volume		Change in cost of capital after tax	
	percentage points		percentage points		percentage points	
€ million	+10	-10	+10	-10	+1	-1
Change in the fair value of the virtual power purchase agreements	9	-9	5	-5	-2	2

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 (37) "**Financial debt/Capital management**".

Liquidity risks are monitored and reported to management on a regular basis.

The following liquidity risk analysis presents the undiscounted, contractually fixed cash flows such as repayments and interest on financial liabilities and the net cash flows of derivatives with a negative fair value:

December 31, 2023

		Cash flows < 1 year		Cash flows 1–5 years		Cash flows > 5 years	
€ million	**Carrying amount**	**Interest**	**Repayment**	**Interest**	**Repayment**	**Interest**	**Repayment**
Subsequent measurement at amortized cost							
Bonds and commercial paper[1]	7,802	-164	-1,000	-241	-4,888	-63	-1,934
Bank loans	283	-8	-277	-1	-7	–	–
Trade accounts payable	2,545	–	-2,545	–	–	–	–
Liabilities to related parties	1,928	-37	-938	-97	-550	-35	-440
Other financial liabilities	393	–	-266	–	-127	–	–
Loans from third parties and other financial debt	68	-5	-20	-9	-47	–	–
Subsequent measurement at fair value through profit or loss							
Contingent considerations	2	–	–	–	-2	–	–
Derivatives without a hedging relationship	96	–	-79	–	-8	–	-10
Derivatives with a hedging relationship	**5**	**–**	**-5**	**–**	**–**	**–**	**–**
Refund liabilities	**877**	**–**	**-877**	**–**	**–**	**–**	**–**
Lease liabilities	**515**	**-11**	**-120**	**-22**	**-256**	**-15**	**-137**
	14,515	**-225**	**-6,127**	**-370**	**-5,885**	**-113**	**-2,521**

[1] For the hybrid bonds, repayment is assumed at the earliest possible date.

December 31, 2022

		Cash flows <1 year		Cash flows 1–5 years		Cash flows >5 years	
€ million	Carrying amount	Interest	Repayment	Interest	Repayment	Interest	Repayment
Subsequent measurement at amortized cost							
Bonds and commercial paper[1]	8,726	-147	-600	-363	-5,352	-111	-2,801
Bank loans	203	-5	-203	–	–	–	–
Trade accounts payable[2]	2,499	–	-2,499	–	–	–	–
Liabilities to related parties	1,780	-25	-1,121	-81	-110	-53	-550
Other financial liabilities[2]	376	–	-258	–	-118	–	–
Loans from third parties and other financial debt	59	-5	-10	-10	-48	–	–
Subsequent measurement at fair value through profit or loss							
Contingent considerations	4	–	–	–	-4	–	–
Derivatives without a hedging relationship	53	–	-34	–	-7	–	-12
Derivatives with a hedging relationship	**30**	**–**	**-30**	**–**	**–**	**–**	**–**
Refund liabilities	**912**	**–**	**-912**	**–**	**–**	**–**	**–**
Finance lease liabilities	**491**	**-9**	**-123**	**-17**	**-264**	**-9**	**-101**
	15,134	**-191**	**-5,790**	**-471**	**-5,904**	**-173**	**-3,463**

[1] For the hybrid bonds, repayment is assumed at the earliest possible date.

[2] Previous year has been adjusted, please refer to Note (2) "**Reporting Principles**".

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 exposed to credit risks mainly due to existing trade accounts receivable, other receivables, other debt instruments, derivatives and contract assets.

Credit risks are monitored on an ongoing basis. The risks arising from extending credit to customers and in the course of other business relationships are also managed.

The Group analyzes all trade accounts receivable that are more than 90 days past due in order to establish whether default exists. In addition, all other financial instruments that are more than 30 days past due are examined in order to establish whether there has been a significant increase in the credit risk. Both methods are used to examine whether there is objective evidence of an impairment requiring the recognition of additional loss allowances.

Accounting and measurement policies

Credit risks

Impairment of trade accounts receivable and contract assets

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 losses, the assets are grouped based on the existing credit risk structure and the respective maturity structure.

The customer groups with comparable default risks to be considered are determined according to the specific business sector and the place of business of the respective customers.

The expected credit loss rates used in the simplified impairment model are derived on the basis of past default rates and current macroeconomic expectations. In doing so, country-specific ratings are taken into consideration since many of the Group’s customers depend directly or indirectly on the economic trends in the country where their place of business is located (public and private healthcare systems, universities, and research companies from within the pharmaceutical industry, as well as industries subsidized under development plans, particularly in Asia). These country ratings are aggregated into three separate rating groups. Under the impairment model, past default rates and country ratings are used as an approximation of the defaults to be expected in the future.

When a country’s rating changes, the historical default rates of the rating group to which the respective country has been reallocated have to be applied accordingly, rather than the historical default rates of the previous rating group.

If there is objective evidence that certain trade accounts receivable or contract assets are fully or partially impaired, additional loss allowances are recognized to account for expected credit losses.

A default generally exists when the debtor cannot fully meet its liabilities.

A debtor’s creditworthiness is assumed to be impaired if there are objective indications that the debtor is in financial difficulties, such as the disappearance of an active market for its products or impending insolvency. The nominal amounts of trade accounts receivable considered as originated credit-impaired financial assets are recognized using the risk-adjusted effective interest rate, which reflects the expected credit losses over the original lifetime.

Impairment of other receivables

When recognizing impairment losses, the general three-stage impairment model is used for financial instruments included in other receivables, and the simplified approach is used for non-current leasing receivables. The individual credit rating of the contract partner is used to determine the impairment loss of other receivables. If there is considered to be a substantially increased risk of default, the expected credit loss is calculated over the entire lifetime.

Individual cases are also analyzed to ascertain whether objective findings suggest that the value of other receivables is impaired. Such suggestions may include, for example, economic difficulties of the debtor, contractual breaches, or the renegotiation of contractual payment obligations.

Impairment of other financial assets

Investments in debt instruments subsequently measured either at amortized cost or at fair value through other comprehensive income are fundamentally considered to be investments with low risk, meaning that the expected credit loss in the upcoming 12 months is used to determine the impairment loss.

For financial assets with only a minimal default risk, the rules concerning the mandatory recognition of a risk provision for the lifetime expected credit loss are not applied at initial recognition or during subsequent measurement. Therefore, no assessment of whether there has been a significant increase in the credit risk is carried out 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 are indications that the debtor’s creditworthiness has worsened but that this is not yet reflected in its existing credit rating, the credit risk assessment is adjusted and the impairment allowances recognized for expected credit losses are increased. In all other cases, there are no new risk assessments as of the balance sheet date and the risk profile initially assumed is maintained.

Wherever a considerable increase in the default risk is assumed, the lifetime expected credit loss of the financial asset is considered.

On the balance sheet date, the theoretical maximum default risk for all items referenced above corresponds to the net carrying amounts less any compensation from credit insurance.

Significant discretionary decisions and sources of estimation uncertainty

Credit risks

Impairment of trade accounts receivable and contract assets

In terms of the impairment of trade accounts receivable and of contract assets, there is significant discretion and estimation uncertainty regarding:

- the identification of customer groups with identical default risks,
- the identification of impaired creditworthiness, and
- the calculation of the expected credit losses.

Impairment of other financial assets

Discretionary judgment is applied in determining individual impairment allowances.

The following table shows impairments for financial assets from operative transactions and contract assets as well as gains from their reversals recognized in the consolidated income statement:

€ million	**2023**	2022
Impairment losses	**-51**	**-6**
of trade accounts receivable	-50	-7
of contract assets	–	–
of debt instruments subsequently measured at amortized cost	-1	1
of debt instruments subsequently measured at fair value through other comprehensive income	–	–

The loss allowances and reversals recognized for trade accounts receivable as shown above applied entirely to receivables resulting from contracts with customers. The increase in loss allowances for trade accounts receivable was mainly attributable to a distribution partner in the Healthcare business sector in a mid-double-digit million-euro amount.

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 considers additional factors such as the general default risk in the respective industry and country in which the customer operates.

The credit risk of customers is assessed using established credit management processes. This is done in particular by analyzing the aging structure of trade accounts receivable.

The Group continuously reviews and monitors the open positions of all its customers in the corresponding countries and takes steps to mitigate credit risks if necessary.

The tables below contain an overview of the credit risk by business sector and country rating as established by leading rating agencies:

December 31, 2023

€ million	Life Science	Healthcare	Electronics	Other	**Group**
External rating of at least A- or comparable	1,260	1,003	565	10	2,838
External rating of at least BBB- or comparable	158	280	15	–	454
External rating lower than BBB- or comparable	66	609	2	–	676
Trade accounts receivable before loss allowances	**1,484**	**1,892**	**582**	**10**	**3,969**

December 31, 2022

€ million	Life Science	Healthcare	Electronics	Other	Group
External rating of at least A- or comparable	1,363	994	648	7	3,012
External rating of at least BBB- or comparable	153	302	17	–	471
External rating lower than BBB- or comparable	60	521	4	–	585
Trade accounts receivable before loss allowances	**1,575**	**1,817**	**669**	**7**	**4,069**

Goods were generally sold under retention of title so that a reimbursement claim existed in the event of default. Other guarantees generally were not demanded. The scope of credit-insured receivables was immaterial for the Group.

Loss allowances based on expected credit losses for trade accounts receivable as of December 31, 2023, were as follows:

December 31, 2023

€ million	Not yet due	Up to 90 days past due	Up to 180 days past due	Up to 360 days past due	More than 360 days past due	Total
Expected loss rate	0.4%	0.8%	7.4%	39.0%	72.4%	
Trade accounts receivable before loss allowances	3,342	432	67	55	73	3,969
thereof: credit impaired	10	1	4	18	46	80
Loss allowances	**-15**	**-3**	**-5**	**-22**	**-53**	**-97**
thereof credit impaired trade accounts receivable	-9	-1	-4	-18	-46	-78

Loss allowances based on expected credit losses for trade accounts receivable as of December 31, 2022, were as follows:

December 31, 2022

€ million	Not yet due	Up to 90 days past due	Up to 180 days past due	Up to 360 days past due	More than 360 days past due	Total
Expected loss rate	0.3%	0.8%	3.2%	19.6%	54.6%	
Trade accounts receivable before loss allowances	3,394	472	75	64	64	4,069
thereof: credit impaired	5	–	1	3	27	36
Loss allowances	**-9**	**-4**	**-2**	**-12**	**-35**	**-63**
thereof credit impaired trade accounts receivable	-3	–	–	-3	-26	-32

Credit risks from other receivables

Gross other receivables amounted to € 160 million as of December 31, 2023 (December 31, 2022: € 136 million). Other receivables of € 157 million were allocated to Level 1 of the three-level impairment model (December 31, 2022: € 126 million), meaning that the credit loss expected in the next 12 months was used to determine the amount of impairment when examining the individual credit risk of the respective contract partner. In addition, non-current leasing liabilities amounting to € 3 million (December 31, 2022: € 2 million) were allocated to Level 2 of the simplified impairment model. The next table shows the impairment losses recognized for other receivables.

Credit risks from other financial assets

The Group limits credit risks from other financial assets by entering into contracts almost exclusively with contract partners whose creditworthiness is good. The credit risk from financial contracts is monitored daily on the basis of market information on credit default swap rates and regularly on the basis of rating information.

Impairment losses on financial assets developed as follows:

2023

€ million	**Jan. 1**	Net Additions	Utilizations	Reclassification within levels	Effects of currency translation	Changes in scope of consolidation	**Dec. 31**
Trade and other receivables (including current leasing receivables)	-63	-50	11	–	4	–	-97
thereof: Level 1/2	-31	2	–	7	1	–	-20
thereof: Level 3	-31	-50	11	-7	2	–	-74
thereof: POCI[1]	-1	-2	–	–	–	–	-3
Contract Assets	–	–	–	–	–	–	–
thereof: Level 1/2	–	–	–	–	–	–	–
thereof: Level 3	–	–	–	–	–	–	–
Other Receivables (including non-current leasing receivables)	-1	-1	–	–	–	–	-1
thereof: Level 1	–	–	–	–	–	–	–
thereof: Level 2	–	–	–	–	–	–	–
thereof: Level 3	–	-1	–	–	–	–	-1
Loss allowances for financial assets	**-64**	**-51**	**11**	**–**	**4**	**–**	**-99**

[1] Purchased or originated credit-impaired receivables.

2022

€ million	Jan. 1	Net Additions	Utilizations	Reclassification within levels	Effects of currency translation	Changes in scope of consolidation	Dec. 31
Trade and other receivables (including current leasing receivables)	-59	-7	4	–	-2	–	-63
thereof: Level 1/2	-23	-7	–	–	-1	–	-31
thereof: Level 3	-34	-1	4	–	-1	–	-31
thereof: POCI[1]	-2	1	–	–	–	–	-1
Contract Assets	–	–	–	–	–	–	–
thereof: Level 1/2	–	–	–	–	–	–	–
thereof: Level 3	–	–	–	–	–	–	–
Other Receivables (including non-current leasing receivables)	-2	1	–	–	–	–	-1
thereof: Level 1	–	–	–	–	–	–	–
thereof: Level 2	–	–	–	–	–	–	–
thereof: Level 3	-1	1	–	–	–	–	–
Loss allowances for financial assets	**-61**	**-6**	**4**	**–**	**-2**	**–**	**-64**

[1] Purchased or originated credit-impaired receivables.

Changes in the expected credit loss rates used in the simplified impairment model did not result in any significant changes in the additions to and reversals of impairment losses in Level 2.

(43) Information on fair value measurement

Accounting and measurement policies

Information on fair value measurement

The measurement techniques and main input factors used to determine the fair value of financial instruments are as follows:

Fair value determined by official prices and quoted market values (Level 1)

	Financial instruments concerned	Description of the measurement technique	Main input factors used to determine fair values
Financial assets			
Subsequent measurement at fair value through other comprehensive income			
Equity instruments	Shares	Derived from active market	Quoted prices in an active market
Other debt instruments	Bonds		
	Other short-term cash investments		
Subsequent measurement at fair value through profit or loss			
Other debt instruments	Publicly-traded funds	Derived from active market	Quoted prices in an active market
	Other short-term cash investments		
Financial liabilities			
Subsequent measurement at amortized cost			
Financial debt	Bonds	Derived from active market	Quoted prices in an active market

Fair value determined using input factors observable in the market (Level 2)

	Financial instruments concerned	Description of the measurement technique	Main input factors used to determine fair values
Financial assets			
Subsequent measurement at fair value through profit or loss			
Derivatives (without a hedging relationship)	Forward exchange contracts and currency options	Use of recognized actuarial methods	Spot and forward rates observable on the market as well as exchange rate volatilities
	Interest rate swaps		Interest rate curves available on the market
Derivatives (with a hedging relationship)	Forward exchange contracts and currency options	Use of recognized actuarial methods	Spot and forward rates observable on the market as well as exchange rate volatilities
Financial liabilities			
Subsequent measurement at fair value through profit or loss			
Derivatives (without a hedging relationship)	Forward exchange contracts and currency options	Use of recognized actuarial methods	Spot and forward rates observable on the market as well as exchange rate volatilities
	Interest rate swaps		Interest rate curves available on the market
Derivatives (with a hedging relationship)	Forward exchange contracts and currency options	Use of recognized actuarial methods	Spot and forward rates observable on the market as well as exchange rate volatilities
Subsequent measurement at amortized cost			
Financial liabilities	Liabilities to banks and other loan liabilities	Discounting of future cash flows	Interest rates observable on the market

Fair value determined using input factors unobservable in the market (Level 3)

	Financial instruments concerned	Description of the measurement technique	Main input factors used to determine fair values
Financial assets			
Subsequent measurement at fair value through other comprehensive income			
Equity instruments	Equity investments in unlisted companies	Discounting of expected future cash flows	Expected cash flows from recent business planning, average cost of capital, expected long-term growth rate
		Derived from observable prices within the scope of equity refinancing sufficiently close to the balance sheet date, considered risk allowances	Observable prices derived from equity refinancing
		Cost-based determination	Acquisition cost
Trade and other receivables	Trade accounts receivable that are intended for sale due to a factoring agreement	Nominal value less factoring fees	Nominal value of potentially sold trade accounts receivable, average fees for sales of trade accounts receivable
Subsequent measurement at fair value through profit or loss			
Derivatives (without a hedging relationship)	Virtual power purchase agreements	Discounting of expected future cash flows	Electricity future price curves, expected electricity production volumes, discount factors
Contingent consideration	Contingent considerations from the sale of businesses or shares in corporations	Discounting of probability-weighted future milestone payments and license fees	Sales planning, milestone payments, probabilities of regulatory and commercial events, discount rates
Other debt instruments	Loans with variable repayments	Discounting of expected future cash flows	Expected cash flows from recent business planning, discount rates
	Interests in unlisted funds	Consideration of the fair value of companies in which the funds are invested	Net asset values of the fund interests
	Bonds with embedded settlement option for equity in an unlisted company	Use of recognized actuarial methods	Interest rates observable on the market
Financial liabilities			
Subsequent measurement at fair value through profit or loss			
Derivatives (without a hedging relationship)	Hedging instrument for virtual power purchase agreements	Use of recognized actuarial methods	Electricity future price curves, expected electricity production volumes, discount factors
Contingent consideration	Contingent considerations from the purchase of businesses	Discounting of probability-weighted future milestone payments and license fees	Sales planning,milestone payments,probabilities of regulatory and commercial events, discount rates

Counterparty credit risk is taken into consideration for measurements of financial instruments at fair value. In the case of non-derivative financial instruments, such as other liabilities or interest-bearing securities, this is reflected using risk premiums on the discount rate, while discounts on market value (credit valuation adjustments and debit valuation adjustments) are used for derivatives. Transfers between the individual hierarchy levels at fair value are made at the end of the month in which the triggering event – for example an initial public offering – took place.

Assets from contingent considerations (Level 3)

The fair values of assets from contingent considerations are calculated by weighting the expected future cash flows from milestone payments and royalties using their probability of occurrence and discounting them. The main parameters when determining contingent considerations are:

- the estimated probability of reaching the individual milestone events,
- the underlying sales planning used to derive royalties, and
- the discount factor used.

When determining the probability of occurrence of the individual milestone events in connection with the development of drug candidates, the focus is on empirically available probabilities of success of development programs in comparable phases of clinical development in the relevant therapeutic areas. To determine the sales plan, internal sales plans and sales plans of external industry services are used. The discount rate (after tax) of 6.6% as of December 31, 2023 (December 31, 2022: 6.3% to 7.3%) was calculated using the weighted average cost of capital.

Income and expenses from the discounting of probability-weighted future milestone payments and license fees and from changes in discount rates are reported in the financial result.

Significant discretionary decisions and sources of estimation uncertainty

Equity investments in unlisted companies

Determining the parameters that are to be included in discounted cash-flow-methods and deriving the fair value from observable prices within the scope of equity refinancing are both subject to discretionary decisions and estimation uncertainty.

Assets from contingent consideration

The calculation of the fair value of assets from contingent considerations is subject to significant discretionary judgment.

The most significant contingent consideration was the future purchase price claim from the sale of the biosimilars business to a subsidiary of Fresenius SE & Co. KGaA, Bad Homburg vor der Höhe, Germany, on August 31, 2017. It was calculated by an external valuation expert on initial recognition in 2017 and continued on this basis. As of December 31, 2023, the carrying amount was € 118 million (December 31, 2022: € 219 million).

If, in the context of determining the fair value of this contingent consideration at the balance sheet date, the probability of approval as well as the discount factor of the most important development programs had been estimated to be lower or higher, this would have led to the following changes in the measurement and the corresponding effects on the profit before income tax:

December 31, 2023

		Change in probability of regulatory approval		
€ million		-10%	unchanged	10%
Change of discount rate	6.1%	-3	3	9
	6.6% (unchanged)	-6	–	6
	7.1%	-8	-3	3

December 31, 2022

		Change in probability of regulatory approval		
€ million		-10%	unchanged	10%
Change of discount rate	5.8%	-18	3	24
	6.3% (unchanged)	-21	–	20
	6.8%	-24	-3	17

The following table presents the carrying amounts and the fair values of the individual financial assets and liabilities as of December 31, 2023, for each individual financial instrument class pursuant to IFRS 9:

December 31, 2023

		Carrying amount			Fair value[1]			
€ million	Consoli-dated notes	Current	Non-current	Total	Fair value determined by official prices and quoted market values (Level 1)	Fair value determined using input factors observable in the market (Level 2)	Fair value determined using input factors not observable in the market (Level 3)	Total
Financial assets								
Subsequent measurement at amortized cost								
Cash and cash equivalents	35	1,982	–	1,982				
Trade and other receivables (excluding leasing receivables)	25	3,973	25	3,998				
Other debt instruments	36	201	4	204				
Subsequent measurement at fair value through other comprehensive income								
Equity instruments	36	–	643	643	207	–	436	643
Trade and other receivables	25	25	–	25	–	–	25	25
Other debt instruments	36	198	1	199	199	–	–	199
Subsequent measurement at fair value through profit or loss								
Contingent considerations	36	–	125	125	–	–	125	125
Other debt instruments	36	33	161	194	98	–	95	194
Derivatives without a hedging relationship	36, 39	30	47	77	–	27	50	77
Derivatives with a hedging relationship	36, 39	37	–	37	–	37	–	37
Lease receivables (measured in accordance with IFRS 16)[2]	25	6	3	9				
Total		**6,485**	**1,008**	**7,493**	**505**	**65**	**731**	**1,300**
Financial liabilities								
Subsequent measurement at amortized cost								
Trade payables and other liabilities	30	2,545	–	2,545				
Financial debt	37	503	8,846	9,349	7,367	2,665	–	10,032
Other financial liabilities	38	998	127	1,125				
Subsequent measurement at fair value through profit or loss								
Contingent considerations	38	–	2	2	–	–	2	2
Derivatives without a hedging relationship	37, 38, 39	79	18	96	–	77	20	96
Derivatives with a hedging relationship	38, 39	5	–	5	–	5	–	5
Refund liabilities	9	877	–	877				
Lease liabilities (measured in accordance with IFRS 16)[2]	37	122	393	515				
Total		**5,129**	**9,387**	**14,515**	**7,367**	**2,747**	**22**	**10,136**

[1] The simplification option under IFRS 7.29(a) was used for disclosures of certain fair values. IFRS 7.29(d) explicitly does not require disclosure of the fair value of lease liabilities.

[2] Measurements within the scope of IFRS 16 are exempted from the requirements of IFRS 13 (IFRS 13.6(b)).

The following table presents the carrying amounts and the fair values of the individual financial assets and liabilities as of December 31, 2022, for each individual financial instrument class pursuant to IFRS 9:

December 31, 2022

		Carrying amount			Fair value[1]			
€ million	Consoli-dated notes	Current	Non-current	**Total**	Fair value determined by official prices and quoted market values (Level 1)	Fair value determined using input factors observable in the market (Level 2)	Fair value determined using input factors not observable in the market (Level 3)	**Total**
Financial assets								
Subsequent measurement at amortized cost								
Cash and cash equivalents	35	1,854	–	1,854				
Trade accounts receivable and other receivable (excluding leasing receivables)	25	4,087	25	4,112				
Other debt instruments	36	122	4	126				
Subsequent measurement at fair value through other comprehensive income								
Equity instruments	36	–	516	516	102	–	415	516
Trade accounts receivable and other receivable	25	22	–	22	–	–	22	22
Debt instruments	36	80	1	81	81	–	–	81
Subsequent measurement at fair value through profit or loss								
Contingent consideration	36	14	235	250	–	–	250	250
Other debt instruments	36	28	154	182	89	–	93	182
Derivatives without a hedging relationship	36, 39	23	46	69	–	17	53	69
Derivatives with a hedging relationship	36, 39	53	–	53	–	53	–	53
Finance lease receivables (to be measured in accordance with IFRS 16)[2]	25	5	2	7				
Total		**6,289**	**984**	**7,273**	**271**	**70**	**833**	**1,174**
Financial liabilities								
Subsequent measurement at amortized cost								
Trade accounts payable[3]	30	2,499	–	2,499				
Financial debt	37	1,073	8,834	9,907	7,989	1,188	–	9,177
Other financial liabilities[4]	38	1,119	118	1,237				
Subsequent measurement at fair value through profit or loss								
Contingent consideration	38	–	4	4	–	–	4	4
Derivatives without a hedging relationship	37, 38, 39	34	19	53	–	30	23	53
Derivatives with a hedging relationship	38, 39	30	–	30	–	30	–	30
Refund liabilities	9	912	–	912				
Finance lease liabilities (to be measured in accordance with IFRS 16)[2]	37	125	366	491				
Total		**5,792**	**9,342**	**15,134**	**7,989**	**1,248**	**27**	**9,265**

[1] The simplification option under IFRS 7.29(a) was used for disclosures of certain fair values. IFRS 7.29(d) explicitly does not require disclosure of the fair value of lease liabilities.

[2] Measurements within the scope of IFRS 16 are exempted from the requirements of IFRS 13 (IFRS 13.6(b)).

[3] Previous year's figures have been adjusted, see Note (6) "**Acquisitions and Divestments**".

[4] Previous year's figures have been adjusted, see Note (2) "**Reporting Principles**".

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

2022

€ million	Financial assets					Financial liabilities		Total
	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		
	Other debt instruments	Contingent consideration	Derivatives without a hedging relationship	Equity instruments	Trade and other receivables	Contingent consideration	Derivatives without a hedging relationship	Total
Net carrying amounts as of Jan. 1, 2022	**78**	**271**	**24**	**345**	**20**	**-39**	**-10**	**689**
Additions	27	–	–	87	70	–	–	184
Transfers into Level 3 from Level 1/Level 2	–	–	–	–	–	–	–	–
Fair value changes								
Gains (+)/losses (-) recognized in the consolidated income statement (other operating result)	17	15	30		–	30	-13	79
thereof: attributable to assets/liabilities held as of the balance sheet date	17	7	30		–	4	-13	44
Gains (+)/losses (-) recognized in the consolidated income statement (financial income and expenses)	-4	10	1		–	-1	–	6
thereof: attributable to assets/liabilities held as of the balance sheet date	-4	9	1		–	–	–	6
Gains (+)/losses (-) recognized in other comprehensive income				-11	–			-11
Currency translation difference	2	–	2	-1	–	-3	–	–
Disposals	-21	-46	-4	-1	-68	10	–	-131
Transfers out of Level 3 into Level 1/Level 2	–	–	–	-11	–	–	–	-11
Other	-7	–	–	7	–	–	–	–
Net carrying amounts as of Dec. 31, 2022	**93**	**250**	**53**	**415**	**22**	**-4**	**-23**	**806**

The changes in financial assets and liabilities for each of the individual classes of financial instruments allocated to Level 3 and measured at fair value were as follows in fiscal 2023:

2023

	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	Other debt instruments	Contingent consideration	Derivatives without a hedging relationship	Equity instruments	Trade and other receivables	Contingent consideration	Derivatives without a hedging relationship	**Total**
Net carrying amounts as of Jan. 1, 2023	**93**	**250**	**53**	**415**	**22**	**-4**	**-23**	**806**
Additions	21	–	–	59	72	–	–	**152**
Transfers into Level 3 from Level 1/Level 2	–	–	–	–	–	–	–	**–**
Fair value changes								
Gains (+)/losses (-) recognized in the consolidated income statement (other operating result)	10	56	2		–	–	1	**69**
thereof: attributable to assets/liabilities held as of the balance sheet date	10	6	-2		–	–	1	**16**
Gains (+)/losses (-) recognized in the consolidated income statement (financial income and expenses)	5	10	–		–	–	–	**14**
thereof: attributable to assets/liabilities held as of the balance sheet date	5	10	–		–	–	–	**14**
Gains (+)/losses (-) recognized in other comprehensive income				47	–			**47**
Currency translation difference	-2	–	-3	-1	–	–	–	**-5**
Disposals	-21	-190	-2	-29	-69	2	3	**-307**
Transfers out of Level 3 into Level 1/Level 2	–	–	–	-3	–	–	–	**-3**
Other	-11	–	–	-51	–	–	–	**-62**
Net carrying amounts as of Dec. 31, 2023	**95**	**125**	**50**	**436**	**25**	**-2**	**-20**	**710**

Disposals during the reporting period related in particular to payments received in connection with the contingent consideration arising from the sale of the biosimilars business to Fresenius SE & Co. KGaA, Bad Homburg vor der Höhe, as well as trade accounts receivable under factoring agreements. The reclassification of the fair value of Calypso Biotech B.V., Netherlands, to assets held for sale is included in the “Other” line item. 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”.

The following equity instruments measured at fair value through other comprehensive income were disposed of in 2023 and 2022:

€ million	Reasons for the disposal	Fair value on the date of derecognition	The cumulative gain (+) or loss (-) on disposal recognized in other comprehensive income	Transfer of the cumulative gains (+) or losses (-) within group equity to retained earnings
2023[1]				
M Ventures Portfoliogesellschaften	Portfolio adjustment/restructuring and full acquisition by third parties	29	18	17
MoonLake Immunotherapeutics Ltd., Cayman Islands	Partial sale	11	10	10
2022[1]				
M Ventures Portfoliogesellschaften	Portfolio adjustment/restructuring and full acquisition by third parties	4	-19	-19

[1] Disposals due to liquidations are not included.

M Ventures portfolio companies mainly include minority interests in listed and unlisted companies. The mandate of M Ventures is to invest in innovative technologies and products.

(44) Other financial obligations

Other financial obligations comprised the following:

€ million	Dec. 31, 2023	Dec. 31, 2022
Acquisition of intangible assets	1,431	1,050
Acquisition of property, plant, and equipment	483	280
Other financial obligations	**1,914**	**1,330**

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 unlikely event that all of the milestones are achieved, the Group would be obligated to pay up to € 1,431 million (December 31, 2022: € 1,050 million) for the acquisition of intangible assets. The table above does not contain any other financial obligations from possible future sales-based license fees and milestone payments.

The expected maturities of the obligations to acquire intangible assets were as follows:

€ million	Dec. 31, 2023	Dec. 31, 2022
Within 1 year	278	48
In 1-5 years	548	326
After more than 5 years	604	676
Obligations to acquire intangible assets	**1,431**	**1,050**

Other financial obligations were recognized at nominal value.

Other Disclosures

(45) Related party disclosures

Accounting and measurement policies

Related party disclosures

Related parties in respect of the Group are E. Merck KG, Darmstadt, Germany, Emanuel-Merck-Vermögens-KG, Darmstadt, Germany, a related party of E. Merck KG, Darmstadt, Germany, and E. Merck Beteiligungen KG, Darmstadt, Germany, a related party of E. Merck KG, Darmstadt, Germany. Furthermore, direct or indirect subsidiaries of Merck KGaA, Darmstadt, Germany, associates of the Group, joint ventures of the Group, 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 or jointly controlled by this group of persons.

Transactions were conducted with related parties as follows:

	Income		Expenses		Receivables		Liabilities	
€ million	**2023**	2022	**2023**	2022	**Dec. 31, 2023**	Dec. 31, 2022	**Dec. 31, 2023**	Dec. 31, 2022
E. Merck KG, Darmstadt, Germany	2.3	1.9	11.3	4.0	0.1	0.0	826.5	1,118.8
E. Merck Beteiligungen KG, Darmstadt, Germany, a related party of E. Merck KG, Darmstadt, Germany	0.4	0.5	32.4	0.6	0.0	0.0	1,100.1	660.1
Engel-Apotheke, Darmstadt[1]	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0
Joint ventures	2.3	3.2	0.0	0.0	0.6	0.5	0.0	0.0
Associated companies	0.9	0.1	0.0	0.0	19.5	3.0	0.0	0.0
Majority interest in non-controlled companies	0.3	0.4	0.0	0.0	0.0	6.7	0.9	1.2
Non-consolidated subsidiaries	0.2	0.1	0.6	0.6	2.9	1.8	0.2	0.4

[1] The owner of Engel-Apotheke, Darmstadt, is a member of the Supervisory Board of Merck KGaA, Darmstadt, Germany.

As in the previous year, the liabilities of Group companies in respect of E. Merck KG, Darmstadt, Germany, primarily resulted from mutual profit transfers between Merck KGaA, Darmstadt, Germany, and E. Merck KG, Darmstadt, Germany, as well as the profit transfer by Merck & Cie KmG, Altdorf, Switzerland, a subsidiary of Merck KGaA, Darmstadt, Germany, to E. Merck KG, Darmstadt, Germany. They included financial debt of € 94.7 million (December 31, 2022: € 258.0 million), subject to standard market interest rates. The financial debt in respect of E. Merck Beteiligungen KG, Darmstadt, Germany, a related party of E. Merck KG, Darmstadt, Germany, in the amount of € 1,100.0 million (December 31, 2022: € 660.0 million) were also subject to standard market interest rates. There was no collateral or guarantees either in favor of or at the expense of the Group.

Loss allowances on receivables from non-consolidated subsidiaries recognized in the reporting period and previous periods amounted to € 19.0 million in total as of December 31, 2023 (December 31, 2022: € 12.0 million). The expense from impairment losses recognized in 2023 amounted to € 7.0 million (2022: € 0.0 million).

Information on pension funds that are classified as defined benefit plans in accordance with IAS 19 can be found in Note (33) “**Provisions for employee benefits**”.

Information on Executive Board and Supervisory Board compensation can be found in Note (46) "**Executive Board and Supervisory Board compensation**". Above and beyond this, no material activities 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 in either fiscal 2023 or the previous year.

(46) Executive Board and Supervisory Board compensation

The compensation of the Executive Board of Merck KGaA, Darmstadt, Germany, is recognized by the general partner, E. Merck KG, Darmstadt, Germany, which is not included in these consolidated financial statements. It was composed as follows:

€ million	**2023**	2022
Fixed compensation	6.3	6.3
Variable compensation	18.5	17.7
Other compensation	0.6	0.4
Additional benefits	0.2	0.2
Short-term benefits	**25.6**	**24.6**
Post-employment benefits	2.6	2.4
Other long-term benefits	0.7	0.0
Termination benefits	0.0	0.0
Share-based payments	3.8	5.8
Total compensation pursuant to IAS 24.17	**32.7**	**32.7**

The total compensation granted to members of the Executive Board as referred to by section 314 (1) no. 6 a) HGB amounted to € 30.1 million in fiscal 2023 (2022: € 30.4 million). In addition to the short-term benefits shown in the table above, this also includes compensation under the standalone long-term incentive plan for the Executive Board, the structure of which is essentially as described in Note (33) "**Provisions for employee benefits**", and other long-term benefits. On the basis of the long-term incentive plan, 57,164 virtual shares, also referred to as Share Units of Merck KGaA, Darmstadt, Germany (MSU), were made potentially available in fiscal 2023 (2022: 43,436 MSU).

Payments to former members of the Executive Board and their surviving dependents in accordance with section 314 (1) no. 6 b) HGB were made as pension payments, as profit sharing, under the long-term incentive plan and waiting allowance for a post-contractual non-competition clause. These payments amounted to € 14.4 million in fiscal 2023 (2022: € 21.7 million). Provisions for defined benefit pension commitments carried by E. Merck KG, Darmstadt, Germany, amounted to € 123.8 million as of December 31, 2023 (December 31, 2022: € 123.1 million).

The compensation of the Supervisory Board in accordance with section 314 (1) no. 6 a) HGB and IAS 24.17 was composed as follows:

€ thousand	**2023**	2022
Fixed portion	808	815
Meeting attendance fees	58	48
Committee membership compensation	95	105
Total compensation granted in the fiscal year	**961**	**968**

As in the previous year, no compensation was paid to former members of the Supervisory Board in fiscal 2023.

As in the previous year, the members of the Executive Board and the Supervisory Board did not receive any advances or loans in fiscal 2023 from companies included in the consolidated financial statements. As in the previous year, no contingent liabilities were entered into for the benefit of these persons in fiscal 2023.

Further individualized information and disclosures, as well as a presentation of the compensation system for the members of the Executive Board and the Supervisory Board, can be found in the compensation report.

(47) Auditor's fees

The auditor of the consolidated financial statements changed to Deloitte GmbH Wirtschaftsprüfungsgesellschaft, Germany, in fiscal 2023. The costs for the auditor of the consolidated financial statements were composed as follows:

	2023	
€ million	**Group**	**thereof: Deloitte GmbH Wirtschafts-prüfungs-gesellschaft, Germany**
Audits of financial statements	10.6	3.9
Other audit-related services	0.4	0.3
Tax consultancy services	–	–
Other services	–	–
Total	**11.0**	**4.2**

The expenses for other audit-related services to Deloitte GmbH Wirtschaftsprüfungsgesellschaft primarily arose for the audit of the non-financial statement and the sustainability report.

Scope of Consolidation

(48) List of shareholdings

The shareholdings of Merck KGaA, Darmstadt, Germany, as of December 31, 2023, are presented below:

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	AmpTec GmbH A)	Hamburg	100.00	
Germany	AZ Electronic Materials GmbH A)	Darmstadt	100.00	
Germany	Biochrom GmbH A)	Berlin	100.00	
Germany	Chemitra GmbH A)	Darmstadt	100.00	100.00
Germany	Emedia Export Company mbH	Gernsheim	100.00	
Germany	Merck 12. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	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 A)	Darmstadt	100.00	
Germany	Merck 20. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Darmstadt	100.00	
Germany	Merck 21. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck 24. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Darmstadt	100.00	100.00
Germany	Merck Chemicals GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Darmstadt	100.00	
Germany	Merck Consumer Health Holding Germany GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Display Trading GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Darmstadt	100.00	
Germany	Merck Electronics KGaA, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Darmstadt	100.00	
Germany	Merck Export GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Darmstadt	100.00	100.00
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	
Germany	Merck Gernsheim Holding GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Darmstadt	100.00	
Germany	Merck Healthcare Germany GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Weiterstadt	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 A)	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

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
Germany	Merck Internationale Beteiligungen GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck Life Science Holding GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck Life Science KGaA, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Darmstadt	100.00	
Germany	Merck LS RTU GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Darmstadt	100.00	100.00
Germany	Merck Patent GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	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 A)	Darmstadt	100.00	100.00
Germany	Merck Schuchardt OHG, a subsidiary of Merck KGaA, Darmstadt, Germany	Hohenbrunn	100.00	
Germany	Merck Site Management GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Gernsheim	100.00	100.00
Germany	Merck Surface Solutions GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany A)	Gernsheim	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 A)	Darmstadt	100.00	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 Verwaltungs GmbH	Steinheim	100.00	100.00
Germany	Versum Materials Germany GmbH	Darmstadt	100.00	
Other European countries				
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 NV/SA, a subsidiary of Merck KGaA, Darmstadt, Germany	Hoeilaart	100.00	
Belgium	Merck Life Science BV, a subsidiary of Merck KGaA, Darmstadt, Germany	Hoeilaart	100.00	
Belgium	Merck NV/SA, a subsidiary of Merck KGaA, Darmstadt, Germany	Hoeilaart	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 Life Science spol. s r.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Prague	100.00	
Czech Republic	Merck spol. s r.o., a subsidiary of Merck KGaA, Darmstadt, Germany	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	

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
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	
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	99.86	
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 Commercial Industrial Pharmaceutical Chemical Single Member S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Maroussi	100.00	
Hungary	Merck Kft., a subsidiary of Merck KGaA, Darmstadt, Germany	Budapest	100.00	
Hungary	Merck Life Science Kft., a subsidiary of Merck KGaA, Darmstadt, Germany	Budapest	100.00	
Ireland	Merck Finance Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Carrigtwohill	100.00	
Ireland	Merck Life Science Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Arklow	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	Sigma-Aldrich Ireland Ltd.	Arklow	100.00	
Ireland	Versum Materials Ireland Limited	Dublin	100.00	
Italy	Istituto di Ricerche Biomediche Antoine Marxer RBM S.p.A.	Colleretto Giacosa	100.00	
Italy	Merck Life Science S.r.l., a subsidiary of Merck KGaA, Darmstadt, Germany	Milan	100.00	
Italy	Merck S.r.l., 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	Versum Materials Italia 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	Merck Chemicals Holding S.à r.l., a subsidiary of Merck KGaA, Darmstadt, Germany	Luxembourg	100.00	
Luxembourg	Merck Finance S.à r.l., a subsidiary of Merck KGaA, Darmstadt, Germany	Luxembourg	100.00	
Luxembourg	Merck Finanz S.à.r.l., a subsidiary of Merck KGaA, Darmstadt, Germany	Luxembourg	100.00	

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
Luxembourg	Merck Holding S.à 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	Millipore International Holdings S.à 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 Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Pietà	100.00	50.29
Malta	Merck Capital Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Pietà	100.00	
Netherlands	eyrise B.V.	Veldhoven	100.00	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	100.00	
Netherlands	Merck Europe B.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Amsterdam	100.00	
Netherlands	Merck Holding Netherlands B.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Schiphol-Rijk	100.00	
Netherlands	Merck Life Science N.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Amsterdam	100.00	
Netherlands	Merck Ventures B.V., a subsidiary of Merck KGaA, Darmstadt, Germany	Amsterdam	100.00	
Netherlands	Serono Tri Holdings B.V.	Schiphol-Rijk	100.00	
Netherlands	Sigma-Aldrich B.V.	Amsterdam	100.00	
Netherlands	Versum Materials Asia B.V.	Amsterdam	100.00	
Netherlands	Versum Materials Holdings Nederland B.V.	Amsterdam	100.00	
Netherlands	Versum Materials International B.V.	Amsterdam	100.00	
Netherlands	Versum Materials Netherlands B.V.	Amsterdam	100.00	
Netherlands	Versum Materials Netherlands International B.V.	Amsterdam	100.00	
Netherlands	Versum Materials Pacific B.V.	Amsterdam	100.00	
Norway	Merck Life Science AS, a subsidiary of Merck KGaA, Darmstadt, Germany	Oslo	100.00	
Poland	Merck Business Solutions Europe Sp. z o.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Wroclaw	100.00	
Poland	Merck Life Science Sp. z o.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Poznan	100.00	
Poland	Merck Sp. z o.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Warsaw	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 Life Science LLC, a subsidiary of Merck KGaA, Darmstadt, Germany	Moscow	100.00	
Russia	Merck LLC, a subsidiary of Merck KGaA, Darmstadt, Germany	Moscow	100.00	
Serbia	Merck d.o.o. Beograd, a subsidiary of Merck KGaA, Darmstadt, Germany	Belgrade	100.00	
Slovakia	Merck Life Science spol. s r.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Bratislava	100.00	
Slovakia	Merck spol. s r.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Bratislava	100.00	
Slovenia	Merck d.o.o., a subsidiary of Merck KGaA, Darmstadt, Germany	Ljubljana	100.00	

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
Spain	Merck Chemicals and Life Science S.A.U., a subsidiary of Merck KGaA, Darmstadt, Germany	Madrid	100.00	
Spain	Merck Life Science S.L.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	
Sweden	Merck AB, a subsidiary of Merck KGaA, Darmstadt, Germany	Solna	100.00	
Sweden	Merck Life Science AB, a subsidiary of Merck KGaA, Darmstadt, Germany	Solna	100.00	
Switzerland	Ares Trading SA	Aubonne	100.00	
Switzerland	Chord Therapeutics SA	Eysins	100.00	
Switzerland	Merck & Cie KmG, 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	Eysins	100.00	
Switzerland	Merck Serono SA, a subsidiary of Merck KGaA, Darmstadt, Germany	Aubonne	100.00	
Switzerland	SeroMer Holding SA	Eysins	100.00	
Switzerland	Sigma-Aldrich (Switzerland) Holding AG	Buchs	100.00	
Switzerland	Sigma-Aldrich Chemie GmbH	Buchs	100.00	
Switzerland	Sigma-Aldrich International GmbH	Buchs	100.00	
Switzerland	Sigma-Aldrich Production GmbH	Buchs	100.00	
Türkiye	Merck Ilac, Ecza Ve Kimya Ticaret Anonim Sirketi, a subsidiary of Merck KGaA, Darmstadt, Germany	Istanbul	100.00	
United Kingdom	BioReliance Limited	Aberdeen	100.00	
United Kingdom	Epichem Group Limited	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 Life Science UK Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Gillingham	100.00	
United Kingdom	Merck Performance Materials Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Merck Serono Europe Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Merck Serono Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Millipore (U.K.) Limited	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	Versum Materials UK Limited	Feltham	100.00	
North America				
Canada	EMD Crop BioScience Canada Inc.	Toronto	100.00	
Canada	EMD Inc.	Mississauga	100.00	
Canada	MilliporeSigma Canada Ltd.	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	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	Electron Transfer Technologies, Inc.	West Trenton	100.00	
United States	EMD Accounting Solutions & Services America, Inc.	Rockland	100.00	

Footnotes follow at the end of the table.

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 Group Holding, Inc.	Wilmington	100.00	
United States	EMD Holding Corp.	Rockland	100.00	
United States	EMD Invest LLC	Wilmington	100.00	
United States	EMD Millipore Corporation	Burlington	100.00	
United States	EMD Performance Materials Corp.	Wilmington	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	Exelead Inc.	Wilmington	100.00	
United States	FloDesign Sonics, Inc.	Wilmington	100.00	
United States	Intermolecular, Inc.	Wilmington	100.00	
United States	J.C. Schumacher Company	Glendale	100.00	
United States	Millipore Asia Ltd.	Wilmington	100.00	
United States	MilliporeSigma Distribution 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 Manufacturing LLC	St. Louis	100.00	
United States	Sigma-Aldrich Missouri Insurance Company	St. Louis	100.00	
United States	Sigma-Aldrich Research Biochemicals, Inc.	Wilmington	100.00	
United States	Sigma-Aldrich RTC, Inc.	Laramie	100.00	
United States	Sigma-Aldrich, Inc.	Madison	100.00	
United States	Sigma-Genosys of Texas LLC	The Woodlands	100.00	
United States	Supelco, Inc.	Bellefonte	100.00	
United States	Versum Materials Manufacturing Company, LLC	Wilmington	100.00	
United States	Versum Materials Technology LLC	Wilmington	100.00	
United States	Versum Materials US International, Inc.	Wilmington	100.00	
United States	Versum Materials US, LLC	Wilmington	100.00	
United States	Versum Materials, Inc.	Wilmington	100.00	
Asia-Pacific (APAC)				
Australia	Merck Healthcare Pty. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Macquarie Park	100.00	
Australia	Merck Pty. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Bayswater	100.00	
Australia	Sigma-Aldrich Oceania Pty. Ltd.	Macquarie Park	100.00	
Australia	Sigma-Aldrich Pty. Ltd.	Macquarie Park	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	
China	Merck Electronics (Zhangjiagang) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Suzhou	100.00	
China	Merck Holding (China) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Shanghai	100.00	
China	Merck Innovation Hub (Guangdong) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Guangzhou	100.00	

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
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 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	Merck Testing and Certification (Shanghai) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Shanghai	100.00	
China	SAFC Hitech (Shanghai) Co., Ltd.	Shanghai	100.00	
China	Sigma-Aldrich (Shanghai) Trading Co., Ltd.	Shanghai	100.00	
China	Sigma-Aldrich (Wuxi) Life Science & Technology Co., Ltd.	Wuxi	100.00	
China	Versum Materials (Dalian) Co., Ltd.	Dalian	100.00	
China	Versum Materials (Shanghai) Co., Ltd.	Shanghai	100.00	
India	Merck Life Science Pvt. Ltd., 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	Merck Biopharma Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Tokyo	100.00	
Japan	Merck Electronics Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Tokyo	100.00	
Japan	Merck Holdings G.K., a subsidiary of Merck KGaA, Darmstadt, Germany	Tokyo	100.00	
Japan	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Tokyo	100.00	
Japan	Merck Performance Materials G.K., a subsidiary of Merck KGaA, Darmstadt, Germany	Tokyo	100.00	
Japan	Sigma-Aldrich Japan G.K.	Tokyo	100.00	
Japan	Versum Materials Japan Inc.	Tokyo	100.00	
Malaysia	Merck Sdn Bhd, a subsidiary of Merck KGaA, Darmstadt, Germany	Petaling Jaya	100.00	
Malaysia	Sigma-Aldrich (M) Sdn Bhd	Petaling Jaya	100.00	
Malaysia	Versum Materials Malaysia Sdn Bhd	Kuala Lumpur	100.00	
New Zealand	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Auckland	100.00	
New Zealand	Sigma-Aldrich New Zealand Co.	Auckland	100.00	

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
Philippines	Merck Business Solutions Asia Inc., a subsidiary of Merck KGaA, Darmstadt, Germany	Taguig	99.99	
Philippines	Merck Inc., a subsidiary of Merck KGaA, Darmstadt, Germany	Taguig	100.00	
Republic of Korea	M Chemicals Inc.	Eumseong	100.00	
Republic of Korea	Merck Electronic Materials Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Seoul	100.00	
Republic of Korea	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Seoul	99.99	
Republic of Korea	Merck Performance Materials Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Pyeongtaek-shi	100.00	
Republic of Korea	Sigma-Aldrich Korea Ltd.	Seoul	100.00	
Republic of Korea	Versum Materials ADM Korea Inc.	Ansan-si	100.00	
Republic of Korea	Versum Materials HYT Inc.	Ansan-si	100.00	
Republic of Korea	Versum Materials Korea Inc.	Siheung-si	100.00	
Republic of Korea	Versum Materials PM Korea Inc.	Siheung-Si	100.00	
Republic of Korea	Versum Materials SPC Korea Ltd.	Pyeongtaek-shi	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	
Singapore	Versum Materials Singapore International Pte. Ltd.	Singapore	100.00	
Singapore	Versum Materials Singapore Pte. Ltd.	Singapore	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	
Taiwan	Versum Materials Taiwan Co., Ltd.	Taipei	74.00	
Thailand	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany B)	Bangkok	45.11	
Vietnam	Merck Healthcare Vietnam Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Ho Chi Minh City	100.00	
Vietnam	Merck Vietnam Company Limited, 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.	Barueri	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	

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
Panama	Merck, S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Panama City	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	
Israel	Merck Serono Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Herzliya Pituach	100.00	
Israel	PMatX Ltd.	Yavne	90.91	
Israel	QLight Nanotech Ltd.	Jerusalem	100.00	
Israel	Sigma-Aldrich Israel Ltd.	Rehovot	100.00	
Israel	Versum Materials Israel Ltd.	Tel Aviv	100.00	
Kenya	Merck Healthcare and Life Science Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Nairobi	100.00	
Saudi Arabia	MERCK Limited, a subsidiary of Merck KGaA, Darmstadt, Germany	Riyadh	100.00	
South Africa	Merck (Pty) Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Modderfontein	100.00	
South Africa	Merck Life Science (Pty) Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Modderfontein	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	
II. Companies accounted for using the equity method				
Other European countries				
United Kingdom	MM Domain Holdco Limited	London	50.00	50.00
North America				
United States	Syntropy Technologies LLC	Wilmington	50.00	

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
III. Companies measured at fair value through other comprehensive income in accordance with IFRS 9 due to immateriality and other equity investments				
Germany				
Germany	BEEoled GmbH	Dresden	21.76	
Germany	GreenTech Accelerator Gernsheim GmbH	Gernsheim	20.00	20.00
Germany	Merck 25. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 26. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 27. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 28. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 29. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 37. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck 38. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	
Germany	Merck 39. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 40. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 41. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 42. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 43. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 44. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 45. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 46. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 47. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 48. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Germany	Merck 49. Allgemeine Beteiligungs-GmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
Other European countries				
Belgium	ReWind Therapeutics NV	Leuven-Heverlee	25.72	
France	MERCK 8ème S.A.S., a subsidiary of Merck KGaA, Darmstadt, Germany	Lyon	100.00	
France	MERCK Holding S.A.S., a subsidiary of Merck KGaA, Darmstadt, Germany	Lyon	100.00	
France	Scipio Bioscience S.A.S.	Montrouge	21.69	
Netherlands	Calypso Biotech B.V.	Amsterdam	27.49	
Netherlands	iOnctura B.V.	Amsterdam	32.41	
Netherlands	Kivu BioScience B.V.	Naarden	21.66	
Russia	Chemical Trade Limited LLC	Moscow	100.00	
Switzerland	Asceneuron SA	Lausanne	21.54	
Switzerland	CAM AG Chemie-Erzeugnisse und Adsorptionstechnik AG	Muttenz	39.11	
United Kingdom	Macrophage Pharma Limited	London	22.21	
United Kingdom	Merck Cross Border Trustees Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Merck Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Merck Pension Trustees Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Feltham	100.00	
United Kingdom	Outrun Therapeutics Limited	Dundee	35.40	
United Kingdom	Sigma Chemical Co. Ltd.	Gillingham	100.00	
United Kingdom	Theolytics Ltd.	Oxford	23.80	
North America				
Canada	Future Fertility Inc.	Toronto	21.65	
United States	Actithera Inc.	Dover	50.00	
United States	EMD Biotech LLC	Wilmington	100.00	
United States	ImmuneBridge Inc.	Wilmington	25.43	
United States	Indi Molecular, Inc.	Wilmington	32.16	
United States	MemryX Inc.	Ann Arbor	20.67	
United States	Pictor Labs, Inc.	Los Angeles	23.55	
United States	Polaris Electro-Optics, Inc	Wilmington	24.99	
United States	Prolog Healthy Living Fund II, L.P. C)	St. Louis	44.50	
United States	Prolog Healthy Living Fund, L.P. C)	St. Louis	35.61	
United States	Surface Solutions, LLC	Wilmington	100.00	
Asia-Pacific (APAC)				
China	Merck Testing (Shanghai) Co., Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Shanghai	100.00	
Japan	Resonac Versum Materials Co. LTD D)	Kawasaki	35.00	
Singapore	Merck Life Science Testing Services Pte. Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Singapore	100.00	
Latin America				
Dominican Republic	Merck Dominicana, S.R.L., a subsidiary of Merck KGaA, Darmstadt, Germany	Santo Domingo	100.00	

Footnotes follow at the end of the table.

Country	Company	Registered office	Equity interest (%)	thereof: Merck KGaA, Darmstadt, Germany (%)
Middle East and Africa (MEA)				
Algeria	Novapharm Production SARL	Wilaya de Tipiza	20.00	
Israel	PxE Computational Imaging Ltd.	Lachish Darom	26.92	
Israel	Sentaur Bio Ltd.	Yavne	98.37	
Nigeria	Merck Pharmaceutical and Life Sciences Ltd., a subsidiary of Merck KGaA, Darmstadt, Germany	Lagos	100.00	
IV. Majority interest in non-controlled companies				
Germany				
Germany	Merck Foundation gGmbH, a subsidiary of Merck KGaA, Darmstadt, Germany	Darmstadt	100.00	100.00
Latin America				
Venezuela	Merck S.A., a subsidiary of Merck KGaA, Darmstadt, Germany	Caracas	100.00	
Venezuela	Representaciones MEPRO S.A.	Caracas	100.00	

A) Companies opting for exemption as provided for by section 264 (3) and section 264b of the German Commercial Code.

B) Fully-consolidated due to majority of voting rights.

C) Closed-end funds classified as debt instruments in accordance with IFRS 9.

D) This is an affiliate within the meaning of IFRS 11 (joint activity).

Darmstadt, February 14, 2024

Belén Garijo

Kai Beckmann

Peter Guenter

Matthias Heinzel

Helene von Roeder