Fundamental Information about the Group

The Group

We are a science and technology company. We are pioneers of human progress, driven by our curiosity.

We have a unique setup, with different disciplines under one roof. Our Life Science business sector provides the tools, high-grade chemicals, and consumables that accelerate scientific breakthroughs and enable the biopharmaceutical industry to ensure that medicines are safe and effective for a global population.

With a broad and deep portfolio of more than 300,000 products and an industry-leading e-commerce platform, we are focused on impacting life and health with science. In our Healthcare business sector, we advance innovation through our pipeline; enable life-changing therapies for serious illnesses; treat more than 90 million patients worldwide with cardiovascular, diabetes and thyroid disorders every day; and help many couples to realize their wish to have a child. In our Electronics business sector, we are the company behind the companies, advancing digital living. Our semiconductor and display solutions can be found in almost every electronic device. Thus, we are changing the way information is processed, releasing the potential of data and opening up possibilities for positively influencing the way we live. In addition, our specialists also explore visionary new solutions at the intersection of our three diversified business sectors.

Established in 1668, our exceptional track record shows we continuously reinvent ourselves and think long-term. This mindset is rooted in responsibility, care, and respect: for our work, our people, our customers, patients, society, and our planet. We want to become the global 21st century science and technology pioneer, working toward an ambitious future: sustainable progress for humankind.

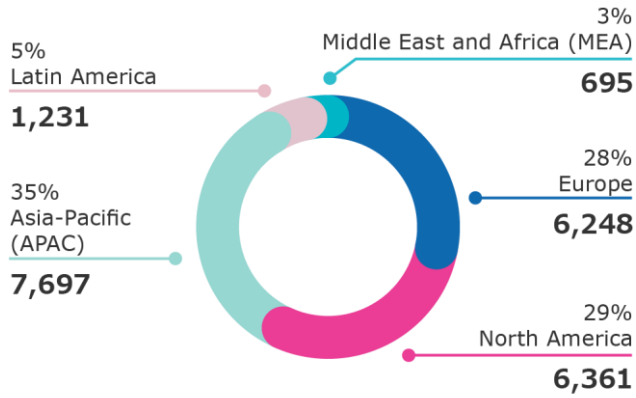
Merck KGaA, Darmstadt, Germany, holds the global rights to the company name and brand. The only exceptions are Canada and the United States. In these countries, we operate as MilliporeSigma in the Life Science business, as EMD Serono in the Healthcare business, and as EMD Electronics in the Electronics business.

Apart from our three business sectors, our financial reporting presents five regions: Europe, North America, Asia-Pacific, Latin America, the Middle East and Africa. As of December 31, 2022, we had 64,243 employees worldwide[1]. The figure as of December 31, 2021, was 60,348 employees. We have summarized further details on our employee structure and important aspects such as Diversity, Equity, and Inclusion in the "**Non-Financial Statement**."

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

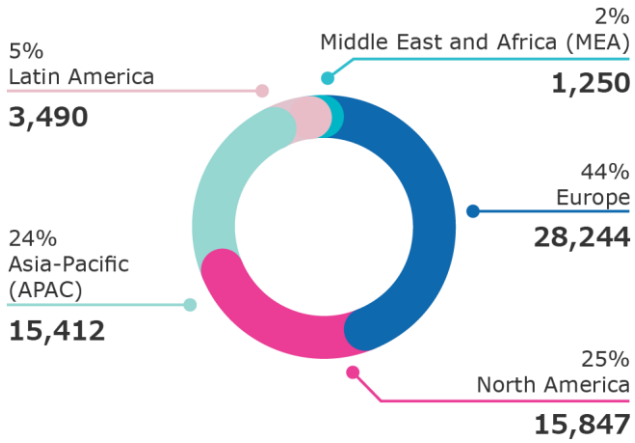
Group

Net sales by region – FY 2022
€ million/in % of net sales



Group

Employees by region as of December 31, 2022
Number/in %



Life Science

We are a leading global provider of tools, chemicals, and equipment to academic labs, biotech and pharmaceutical manufacturers, and the industrial sector. Together with our customers, our purpose is to impact life and health with science. With a strong focus on innovation, we are committed to delivering the products, services, and digital platforms to create a sustainable future for generations to come.

Across our Life Science business sector, we collaborate with the global scientific community to deliver breakthrough innovations supported by a broad and deep portfolio of more than 300,000 products. In early 2022, we announced the reorganization of the sector, with several organizational changes and a new operating model to support Life Science's long-term growth strategy and to better serve our global customers' evolving needs.

The changes comprised the following: the existing Contract Development and Manufacturing Organization (CDMO) and Contract Testing (CTO) services were split from the Process Solutions business and consolidated into one global, fully integrated Life Science Services organization for traditional and novel modalities, including monoclonal antibodies, high-potency active pharmaceutical ingredients (HPAPIs), as well as antibody-drug conjugates and viral and gene therapies including mRNA. In addition to manufacturing, Life Science Services includes sales and marketing, research and development, and supply chain operations. In the fall of 2022, we launched a new brand encompassing our integrated services offering Millipore® CTDMO (Contract Testing, Development and Manufacturing Organization) Services to support clients with fully-integrated services from pre-clinical phases to commercial production. Millipore® CTDMO Services operates facilities throughout Europe, the United States, and Asia. Our Contract Testing Services remain under the BioReliance® brand.

The Process Solutions business will continue its focus on delivering our leading product offering for pharmaceutical development and manufacturing, including filtration devices, chromatography resins, single-use assemblies and systems, processing chemicals, and excipients.

The Research Solutions and Applied Solutions business units were combined into one organization called Science and Lab Solutions. This business unit serves the pharma and biotech, industrial and testing, academic and government, and diagnostics sectors, providing customers a more seamless experience and access to a broad portfolio including reagents, consumables, devices, instruments, software, and services for scientific discovery, in addition to lab water instruments, consumables and services, microbiology and biomonitoring products, test assays, analytical reagents, and flow cytometry kits and instruments.

Also announced was the newly created position of Chief Technology Officer, reporting to the Life Science business sector CEO. This leader is responsible for shaping the technology roadmap and long-term R&D strategy, systematically exploring emerging opportunities that lead to breakthrough innovations. Functions such as Integrated Supply Chain and Operations, the Transformation Office, Strategy, Business Development and Sustainability, Quality and Regulatory, and other Group functions remain unchanged.

A key goal for the Life Science business sector is to support customers that manufacture drugs, from small to large innovator companies, and bring safe and effective life-enhancing therapies and vaccines to millions of patients worldwide. To that end, we continued to leverage strategic opportunities to enhance our capabilities and expand our products and services offering.

In 2022, Life Science generated 47% of Group sales and 51% of EBITDA pre (excluding Corporate and Other).

Process Solutions*

In April, we announced the acquisition of the MAST® (Modular Automated Sampling Technology) platform from Lonza. The MAST® platform, now part of our BioContinuum™ Platform, is a leading automated, aseptic bioreactor sampling system developed in Bend, Oregon, USA. With this acquisition, we add automated sampling to our bioprocessing portfolio, enabling us to become the first provider of a fully integrated ecosystem for advanced process technologies.

In August, we launched the VirusExpress® 293 Adeno-Associated Virus (AAV) Production Platform, making us one of the first CDMOs and technology developers to provide a complete viral vector manufacturing offering including AAV, Lentiviral, CDMO, CTO, and process development. This new platform enables biopharmaceutical companies to increase the speed of clinical manufacturing while reducing process development time and costs. It is an extension of our VirusExpress® offering, which can reduce process development time by up to 40%, based on our experience as a CDMO. In the same month, we also launched Pellicon® capsule manifolds for single-use tangential flow filtration (TFF) production. Uniquely designed for faster installation and safer handling of filtration areas, Pellicon® Capsule manifolds offer ease-of-use for scale-up from clinical to small-volume production of biomolecules.

In December, we acquired Massachusetts-based Erbi Biosystems, a developer of the two milliliter (mL) micro-bioreactor platform technology known as the Breez™. The deal strengthens our upstream portfolio by enabling scalable cell-based perfusion bioreactor processes from 2 ml to 2,000 L with rapid lab-scale process development. It also offers future development opportunities in novel modality applications.

Life Science Services*

In January, we strengthened our CDMO services across the mRNA value chain with the acquisition of Exelead. Exelead specializes in complex injectable formulations, including Lipid Nanoparticle-based drug delivery technology. We plan to invest more than € 500 million in the technology scale-up of Exelead over the next ten years. This will further enable us to capture the significant potential of the fast-growing market for mRNA therapies by providing leading CDMO services to our customers.

In June, we doubled our high-potent active pharmaceutical ingredients production capacity with the expansion of our facility in Verona, near Madison, Wisconsin, USA. This new € 59 million, 6,500 square meter facility brings 50 new jobs to the area.

In October, we announced the opening of a new commercial facility to support our new Millipore® CTDMO Services offering at our site in Martillac, France. The 2,700 square meter facility will support our clients as they work with our global CTDMO network, including templates for drug development, manufacturing, and commercialization, to accelerate molecules to market.

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

In November, we entered into a collaboration with Biotheus, a China-based biotech company focused on developing treatments for cancer and autoimmune diseases. This collaboration will help accelerate the drug submission and approval process for the biopharmaceutical industry in China using our first-to-market Blazar® Rodent Panel for virus testing, reducing animal testing through molecular-based technology and biosafety turnaround time by up to 80%.

Science and Lab Solutions*

In February, we collaborated with Waters Corporation to build and expand an Extractables and Leachables (E&L) Reference Library to include ion mobility measurements. The library will enable analytical labs to identify potential extractables and leachable compounds in their samples by using Waters' ion mobility-enabled liquid chromatography-mass spectrometry (LC-MS) instruments and then confirm the identity and quantity using our Supelco® reference materials. The library is cross-linked to our Life Science business sector's online product catalog to provide users access to reference materials to confirm their results.

We also expanded our ZooMAb® recombinant monoclonal antibodies product portfolio with 72 new products and added 23 new products to the ColorWheel® flow cytometry antibodies and dyes portfolio. ZooMAb is the first-ever antibody to receive the ACT label designation and received the lowest environmental impact factor (EIF) scores in the chemicals and reagents category.

In the Life Science business sector, our dedication to the customer experience extends from the lab to our primary e-commerce platform, sigmaaldrich.com, which connects tens of millions of visitors in nearly every country around the world with the products, services, and technical expertise needed to advance their discovery, research, and development further and faster. We have accelerated our rate of eCommerce innovation by improving our site speed, expanding our product document library, and making it easier for customers to find what they need with new, differentiating user experiences.

Investments to expand capabilities and production*

In April, we announced a € 100 million investment for our first Asia-Pacific Mobius® Single-Use Manufacturing Center in Wuxi, China. This investment supports the fast-growing biotech innovation sector in China and is realized in close collaboration with the Administrative Management Committee of the Wuxi National High-Tech Industrial Development Zone to jointly cultivate and enhance the life science ecosystem in the Wuxi area and throughout China.

In May, we announced an investment of approximately € 440 million to increase membrane manufacturing capacity in Carrigtwohill and build a new manufacturing facility at Blarney Business Park, both in Cork, Ireland. The investment, the largest in a single site ever for the Life Science business sector, will create more than 370 permanent jobs by the end of 2027.

In July, we broke ground at our site in Sheboygan, Wisconsin, USA, for our first lateral flow membrane production facility in the United States. Lateral flow membranes are vital in rapid diagnostic test kits for various applications, ranging from Covid-19 to other infectious diseases. The new facility is supported by a € 121 million contract award from the U.S. Department of Defense on behalf of the U.S. Department of Health and Human Services. The Sheboygan location further supports our competitive advantage by providing improved supply security and reduced lead times for global customers.

In September, we announced an investment of more than € 130 million to strengthen our manufacturing capabilities for single-use assemblies, a key technology for the production of Covid-19 vaccines and other lifesaving therapies, in Molsheim, France. The investment is the largest ever in the 50-year history of the site and will create more than 800 jobs by the end of 2028.

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

Also in September, we opened a new viral clearance (VC) laboratory as part of the first building phase of our new € 29 million Shanghai-based China Biologics Testing Center. The 5,000 square meter center, the first of its kind for our company in China, is designed to meet the double-digit demand for VC testing services in the country. Customers will now be able to locally conduct viral clearance studies from pre-clinical development to commercialization, a critical step in drug development required by regulatory agencies to complete clinical trials necessary to move to commercial manufacturing. The second phase of the center's facilities will open in late 2023 and offer cell line characterization and lot release testing services.

In November, we announced a € 290 million investment in a new facility to support the increasing demand for biosafety testing services at our Rockville, Maryland, USA, site. The new 23,000 square meter facility will consolidate the multi-building campus into one facility that will open in 2024 to significantly increase our biosafety testing capacity, creating over 500 new jobs in the region. This is the largest testing investment in company history.

From pandemic to endemic*

As the Covid-19 pandemic devolves into an endemic, we continue providing customers with products and solutions that empower scientists to study long-term effects, detect and characterize viruses, and develop and manufacture vaccines and therapies. We have supported more than 35 testing solutions across RT-PCR, antigen, and antibody diagnostics for both high-throughput centralized and distributed point-of-care settings; more than 80 different vaccine programs, consisting of several platforms that include DNA, Inactivated, Live Attenuated Virus, Viral Vector, Protein Subunit and mRNA; and more than 50 monoclonal antibodies, plasma-derived products, and antiviral treatments.

Healthcare

Healthcare discovers, develops, manufactures, and markets innovative pharmaceutical and biological prescription drugs to treat cancer, multiple sclerosis (MS), infertility, growth disorders, and certain cardiovascular and metabolic diseases. Healthcare operates across four therapeutic areas with a clear ambition to become a global specialty innovator: Neurology and Immunology, Oncology, Fertility, and Cardiology Metabolism & Endocrinology. Our R&D pipeline positions us with a clear focus on strengthening our leadership positions in oncology, neurology, and immunology.

Since the start of the Covid-19 pandemic, we have been continuously making every effort to proactively handle the situation and minimize the impact of the pandemic and also of any challenges from the external context on the supply of our medicines locally and globally. To this end, we are using three main levers: the thorough implementation and further development of our business continuity plans across our network, the active management of our stocks, and the assessment of alternative transportation routes to reach our customers and patients.

In 2022, Healthcare generated 35% of Group sales and 33% of EBITDA pre (excluding Corporate and Other). Europe and North America generated 54% of Healthcare's net sales in 2022. In recent years, we have steadily expanded our presence in growth markets. In 2022, Asia-Pacific and Latin America accounted for 39% of sales.

Oncology*

Erbitux® (cetuximab) is the best-selling drug in terms of revenue in the portfolio of our Biopharma business, is our flagship product in oncology, reaching € 1 billion in sales in 2022. Treating more than 1 million patients since authorization, the product is a standard of care for patients with epidermal growth factor receptor (EGFR)-expressing, RAS wild-type metastatic colorectal cancer (mCRC), as well as both recurrent and/or metastatic and locally advanced squamous cell carcinoma of the head and neck (SCCHN). We continue to advance our

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

broad lifecycle management strategy, as well, with more than 200 active clinical trials involving Erbitux® including 17 Phase III studies, some of which have registrational purpose.

Together with Pfizer Inc., we have made significant progress in transforming the standard of care globally for patients with locally advanced or metastatic urothelial carcinoma (UC) as we continue to secure additional regulatory approvals and reimbursement decisions for our anti-PD-L1 antibody Bavencio® (avelumab) (for further details see "**Research and Development**"). As a key growth driver of our Biopharma business, Bavencio® is now approved as a first-line maintenance treatment for advanced UC in 63 countries and has become a standard of care in the treatment of this disease, based on the results of the JAVELIN Bladder 100 trial, the only Phase III study of an immunotherapy to demonstrate a significant overall survival benefit in the first-line setting. In combination with Inlyta, Bavencio® is also approved in the first-line treatment of advanced renal cell carcinoma, and it is considered a standard of care as monotherapy in metastatic Merkel cell carcinoma, a rare form of skin cancer.

We have also continued to expand the availability of Tepmetko® (tepotinib), our oral MET inhibitor designed to inhibit the oncogenic MET receptor signaling caused by *MET* (gene) alterations, with additional regulatory approvals. In February 2022, the European Commission approved Tepmetko® as monotherapy for the treatment of adult patients with advanced non-small cell lung cancer (NSCLC) harboring alterations leading to mesenchymal-epithelial transition factor gene exon *MET*ex 14 skipping, who require systemic therapy following prior treatment with immunotherapy and/or platinum-based chemotherapy.

With this approval, Tepmetko® became the first and only oral MET inhibitor to be approved in the European Economic Area for treating adult patients with advanced NSCLC harboring alterations leading to *MET*ex14 skipping, who require systemic therapy following prior treatment. Tepmetko® is now available in a number of countries globally.

With xevinapant, our potentially first-in-class IAP (Inhibitor of Apoptosis Protein) inhibitor, we are building on our long-standing leadership in the treatment of squamous cell carcinoma of the head and neck (SCCHN). Five-year results from the 96-patient Phase II study presented at the European Society of Medical Oncology (ESMO) Annual Meeting in September 2022 showed that adding xevinapant to chemoradiotherapy (CRT) markedly improved long-term efficacy outcomes in patients with unresected locally advanced SCCHN. This data reinforces the transformative potential of xevinapant over standard of care in the curative setting (for further details see "**Research and Development**"). We have advanced our global Phase III development program this year, with TrilynX and XRay Vision now recruiting patients.

We made continued progress in our pipeline in 2022, as we advanced the first antibody-drug conjugate (ADC) developed in our labs, the anti-CEACAM5 ADC M9140, into Phase I.

Beyond our ADC platform, our broad portfolio of small-molecule DNA Damage Response (DDR) inhibitors represents multiple development paths as monotherapy or in combination with other DDR inhibitors, immunotherapy, chemotherapy, or radiotherapy.

In 2022, we advanced the development of our potentially best-in-class, potent and selective inhibitor of ataxia telangiectasia and Rad3-related (ATR), M1774. Following completion of the monotherapy dose-escalation part of the DDRiver Solid Tumors 301 study, a monotherapy dose for M1774 has been confirmed for further evaluation in Phase Ib (for further details see "**Research and Development**").

On June 3, 2022, we announced that, following an interim analysis of the ongoing global Phase II DDRiver SCLC 250 trial of berzosertib in combination with topotecan in patients with relapsed, platinum-resistant small cell lung cancer (SCLC), we decided to discontinue the study due to low probability of meeting the pre-defined objective of this trial (for further details see "**Research and Development**").

To further support our focused research and development efforts in the area of DDR inhibition, in September 2022 we entered a collaboration agreement with licensing option with Nerviano Medical Sciences S.r.l. for the next-generation highly selective and brain-penetrant PARP1 (poly (ADP-ribose) polymerase) inhibitor NMS-293 (for further details see "**Research and Development**"). The option to license this molecule provides us with the optionality to develop a next-generation PARP inhibitor in combination with our early pipeline of DDR inhibitors and DNA-damaging ADCs.

Neurology & Immunology*

We have a long-standing legacy in neurology and immunology, including more than two decades of experience in multiple sclerosis (MS). We are committed to people living with neuroinflammatory and immune-mediated diseases by focusing on finding solutions addressing unmet medical needs. Our current MS portfolio includes two approved products for the treatment of relapsing MS (RMS) – Rebif® (interferon beta-1a) and Mavenclad® (cladribine tablets). In addition, we are pioneering the therapeutic usage of Bruton's tyrosine kinase inhibition for MS through the discovery and development of evobrutinib, which targets both inflammatory activity in the central nervous system and immune cells in the periphery to address the underlying causes of ongoing disease progression. Evobrutinib is an investigational highly-selective, oral, CNS-penetrant BTK inhibitor with the potential to become a best-in-class treatment option for people living with RMS. Evobrutinib is in Phase III development for RMS.

Mavenclad® is approved in 88 countries worldwide, including those of the European Union, Switzerland, Australia, Canada, and the United States, for various forms of highly active RMS.

It is a short-course oral therapy for the treatment of adults with various forms of highly active RMS. Rebif®, a disease-modifying drug used to treat RMS, is and remains a well-established therapy. It has been a standard treatment in RMS for more than 20 years and has more than 1.8 million patient-years of therapy since approval.

In addition to our commitment to MS, we also have a pipeline focusing on discovering new therapies that have potential in other neuroinflammatory and immune-mediated diseases, including systemic lupus erythematosus (SLE) and cutaneous lupus erythematosus (CLE).

Enpatoran, a highly specific potential first-in-class immune modulator blocking the activation of Toll-like receptor (TLR)7 and TLR8, is being developed as a potential new oral therapy for systemic lupus erythematosus (SLE) and cutaneous lupus erythematosus (CLE). It aims to overcome limitations of available lupus therapies by providing selective inhibition of lupus-relevant disease drivers, which may increase efficacy while preserving immunity against infections. In March 2022, we announced that our first randomized patient was enrolled in our Phase II (WILLOW) study. We remain on track with recruitment of additional patients.

In January 2022, we entered into an out-licensing agreement for sprifermin with TrialSpark/High Line Bio, New York, USA. Sprifermin, a recombinant form of human fibroblast growth factor 18, is currently being investigated in patients with osteoarthritis.

Fertility*

As the global market leader in fertility drugs and treatments, our fertility franchise is an important contributor to our Healthcare business. According to updated data, more than five million babies have been born worldwide with the help of GONAL-f®, a leading therapeutic within our fertility portfolio.

Infertility continues to represent an increasing challenge globally due to demographic changes and ongoing lifestyle adjustments like delayed childbearing. In 2022, our fertility business grew and recorded significant progress across our fertility portfolio from launches to congress presentations and data studies.

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

Our GONAL-f® 150 IU pen contains the active substance follitropin alfa, a copy of the natural hormone FSH. Treatment with GONAL-f® results in more follicles, oocytes, and embryos than urinary gonadotropins, increasing the chance of pregnancy and live birth. In 2022, GONAL-f® 150 IU pen was further launched in several European and APAC (Asia Pacific) countries, including France, the Baltic countries, Indonesia, Malaysia, and Singapore. Further launches are expected in Europe, APAC, and MEAR (Middle East, Africa, Turkey, Russia, and the Commonwealth of Independent States) regions in 2023, and in Japan in 2024.

Our Pergoveris® pen is the first product with a combination of recombinant human follicle-stimulating hormone (r-hFSH) and recombinant human luteinizing hormone (r-hLH) in a ready-to-use liquid version, eliminating the need for mixing. This makes it a suitable treatment option for women with severe FSH and LH deficiency. In 2022, the Pergoveris® pen was successfully launched in Saudi Arabia and Argentina, among others. It is now available in 51 countries. Launches around the globe will continue in order to provide patients with access to this therapeutic.

Cardiology Metabolism & Endocrinology*

Every day, more than 90 million patients around the world use our trusted Cardiology Metabolism & Endocrinology (CM&E) medications. Concor®, Euthyrox®, Glucophage®, and Saizen® are CM&E brands and contribute to making CM&E the largest business franchise of the Healthcare business sector in terms of sales, with strong growth in all major therapeutic areas of focus, contributing significantly to our overall profitability.

Concor®/Concor Cor®, containing bisoprolol, is a beta-blocker for treating hypertension and cardiovascular diseases such as coronary heart diseases and chronic heart failure. In addition to Concor®/Concor Cor®, the Concor® family offers fixed-dose combinations such as Concor Plus®/Lodoz® (bisoprolol with hydrochlorothiazide).

Euthyrox®, with the active ingredient levothyroxine, is the worldwide market leader for the treatment of hypothyroidism, a disease with high prevalence but still low diagnosis rates in most emerging markets.

Glucophage®, containing the active ingredient metformin, is the drug of choice for first-line treatment of type 2 diabetes available in more than 100 countries. During 2021, multiple health authorities worldwide continued to approve Glucophage® in prediabetes when intensive lifestyle changes have failed. This indication for Glucophage® is now registered in 89 countries. Overall, considering the high prevalence of prediabetes and diabetes, we continue seeing great potential for Glucophage®.

Saizen®, with its active ingredient somatropin, is our main endocrinology product and is indicated for the treatment of growth hormone deficiency in children and adults. Saizen® can be delivered with the Easypod® electromechanical injection device, the only growth hormone injection device able to wirelessly transfer data such as injection times, dates, and doses to the web-based software system Easypod® Connect, making it easier for healthcare practitioners and patients to manage adherence and helping to reach their treatment goals. Aluetta® (the new Saizen® pen) is now available in 28 countries with the objective of expanding the reach of Saizen®, offering additional options for healthcare practitioners and patients and expanding our devices portfolio.

In endocrinology, we differentiate ourselves from competitors through leadership in the eHealth space, both by building evidence and by leveraging the meaningful use of technology to provide new solutions for patient engagement, partnership with healthcare practitioners and better payer value proposition.

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

Electronics

Electronics starts with us. We are the company behind the companies, advancing digital living. Our main focus is on materials and solutions for the electronics market. We realigned our portfolio toward the accelerated digitization and the growth of data. This drives the need for more and higher sophisticated semiconductor chips and displays. Today, we are optimally positioned to leverage our key strengths: With a well-balanced and broad technology portfolio of materials and equipment, industry leading R&D and a global production network close to our customers, we have become one of the most relevant suppliers of materials and solutions for the semiconductor and display industries – and are on track to further expand our position. In addition, our decorative and functional solutions for innovative surfaces of all kinds make life more colorful. The business sector consists of three business units: Semiconductor Solutions, Display Solutions, and Surface Solutions.

In recent years, we successfully developed into a leading player in the global electronic materials market. In 2021, we introduced our growth program “Level Up” and announced our plans to invest significantly more than € 3 billion in innovation and capacities until the end of 2025.

Electronics accounted for 18% of Group sales in 2022, and its share of EBITDA pre (excluding Corporate and Other) was 16%. The EBITDA pre margin was 29.7% of net sales.

Semiconductor Solutions*

Semiconductor Solutions is at the heart of Electronics and is enabling the digital transformation in communications, mobility, and healthcare. The overall semiconductor market is seeing strong growth with the rising adoption of digital technologies driven by recovering automotive markets and increasing smartphone demand amid wider availability of 5G networks. As almost every electronic device uses one of our products, we are advancing virtually every aspect of digital living. We are developing solutions for smaller, faster, and more powerful devices. Semiconductor Solutions is the largest business unit in terms of sales within Electronics and offers materials, delivery systems, and services for the semiconductor industry.

The Semiconductor Materials business supplies products for every major production step in wafer processing, including doping, patterning, deposition, planarization, etching, and cleaning. Specialty cleans, photoresists, and conductive pastes for semiconductor packaging round off the portfolio. Intermolecular is our center for complex material solutions in Electronics, located in San Jose, California, USA. There, we explore, test, and develop combinations of advanced materials for next-generation electronics. Compared to conventional methods, our approach provides significant time savings in the material development process, faster learning cycles, and detailed findings on new material combinations to provide a unique service for customers.

We recently completed the acquisition of the chemical business of Mecaro Co. Ltd., a publicly listed company based in Korea. The combination of Mecaro’s thin films technology competencies and our global footprint will provide our customers with additional value. The acquisition will support our capacity expansion plans and the execution of our Level Up investments in Korea.

Delivery Systems & Services develops and deploys reliable delivery equipment to ensure the safe and responsible handling of gases and liquid materials with the highest quality and safety standards for electronic manufacturers. We are increasing the global manufacturing capacity of our state-of-the-art specialty gas, liquid chemical, and slurry delivery equipment to meet the growing demand in memory and foundry. In October 2022, we inaugurated our new DS&S site in Kaohsiung, Taiwan, which will more than double the current regional supply and serve Taiwanese as well as global customers. The facility will complement the existing thin film materials R&D and production site, bringing together key expertise for integrated semiconductor manufacturing solutions. We also continued to make progress in ramping up our manufacturing capacity in the United States with our new facility in Chandler, Arizona, USA, which will begin operations in the first half of 2023. These new factories will supplement our ability to support customers’ increasing demand and boost our overall global footprint of manufacturing facilities around the globe. At many customer sites, semiconductor technologies and equipment are operated and maintained by our MEGASYS® Total Gas and Chemical Services

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

team. As part of a global operations infrastructure, we are a premier supplier of semiconductor fab and sub-fab services to the worldwide electronics industry.

Display Solutions*

Our Display Solutions business unit includes the businesses Liquid Crystals (LC), Organic Light-Emitting Diodes (OLED), Photoresists, Smart Antenna and Liquid Crystal Glazing. With the proliferation of multiple applications and display trends, the display industry's technological requirements are significantly expanding. We support our display customers in developing novel display technologies and product concepts for applications, while also addressing new requirements that have emerged from the Covid-19 pandemic. We are active in a broad range of display materials, including LCs, OLED, and Display Patterning Materials (DPM).

To meet the increasing demand for high-purity OLED materials in Asia, we completed our OLED manufacturing capacity expansion project in Korea in June 2022. We have invested around € 20 million to install sublimation equipment and OLED vacuum deposition units at our OLED Application Center (OAC) in Poseung, Korea. This investment is also expected to ease the supply chain disruptions caused by Covid-19 and build supply agility and resilience for our customers. By bringing production closer to customers, we are also demonstrating our commitment to a more sustainable future. We aim to reduce our product carbon footprint by choosing the shortest supply routes, expanding capacity for circular material flows and adopting the latest production technologies.

In Liquid Crystals, we continue to see very dynamic market developments. Covid-19 has accelerated the market shift toward China and increased competition. We maintained our position as a technology leader with our XtraBright™ products, winning new projects for large-area displays as well as high-resolution mobile devices. Our OLED and photoresist materials are used in multiple free-form display products. Our low-temperature processable positive tone photoresists are widely used to pattern on-cell touch sensors. These sensors enable a thinner display structure, which is crucial for foldable devices.

Our Liquid Crystal Glazing business is receiving an increasing number of commercial orders as real estate investors regard eyrise® s350 instant solar shading as one of the key elements to deliver on their ESG (Environment, Social, Governance) objectives. One of the largest real estate investors in Switzerland is currently installing eyrise® on all facades of its signature project in the center of Zurich.

In 2022, our customer Kymeta announced a cooperation with OneWeb, a Low Earth Orbit (LEO) satellite communications company. Our LC-based licriOn™ technology is leading the way to various mobility applications of the future. LicriOn™ enables extensive connectivity access, even in remote areas where fast internet connections are unavailable or unaffordable today.

Surface Solutions*

In our Surface Solutions business, we provide our customers with solutions that help them to create innovative surfaces of all kinds. Our materials enable more beautiful, more resistant, and more effective product designs. Our main focus is on proactive solution development in close cooperation with our customers as well as expanding our portfolio through innovation in all areas. The core markets for Surface Solutions are automotive coatings, cosmetics, and, to a smaller extent, industrial applications. We are serving these markets with functional and decorative solutions. With a broad portfolio of active ingredients, we enable cosmetics manufacturers to enrich their skin care products with moisturizing, protecting, and anti-aging effects. Moreover, our functional solutions serve many innovative applications, from dirt-repellent and easy-care surfaces to laser markings of plastic parts and cables.

Surface Solutions is successfully implementing its strategic transformation. After substantial investments in expanding our production capacities in 2021, we are now further investing in digitalizing and modernizing our effect pigment production plants around the globe. In September, we opened the first fully automated unit for the digital color measurement of our pigment products in Gernsheim, Germany. The investment of nearly € 10 million is just one example of how we are further advancing the digitalization of our production processes. In the past two years, Surface Solutions was adversely impacted by the Covid-19 crisis. Despite the current challenging economic environment, the business is back on a successful organic growth track.

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

Strategy*

Strategy fundamentals

We are curious minds dedicated to human progress. We believe that scientific exploration and responsible entrepreneurship are key to technological advances that benefit us all. Our values – courage, achievement, responsibility, respect, integrity, and transparency – guide us in every step we take and in every decision we make. As a company, we have a strong foundation. These fundamentals have been defined by the Merck family. We always take them into consideration when discussing and deciding on our Enterprise strategy.

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

Enterprise strategy

Our ambition

Our ambition is to become the global 21st century science and technology pioneer. To achieve this, we will continue to focus on our “Big 3” businesses: Process Solutions and Life Science Services, new Healthcare products, and Semiconductor Solutions. Until 2025, these businesses are expected to generate approximately 80% of the targeted sales growth, and more than 50% of total sales by 2025.

Despite the current turbulent environment, which is a stress test for our business model and strategy, we remain fully on track to reach our mid-term growth target of € 25 billion in sales by 2025. We confirm our mid-term forecast for the business sectors: In the Life Science business sector, organic sales will grow 7% to 10% per year on average, driven by the strong development of the core business. Consequently, the forecast would be achieved even amid a complete absence of pandemic-related demand. The Healthcare business sector will show average annual organic sales growth in the mid-single-digit percentage range. In addition to positive contributions of the established portfolio products, growth is expected to come from new medicines and potential market launches including evobrutinib (multiple sclerosis) and xevinapant (head and neck cancer). In the Electronics business sector, our expected mid-term organic sales growth will amount to 3% to 6% per year on average driven by the strong above market performance of Semiconductor Solutions and our comprehensive portfolio in this field.

Our highly resilient business sectors are the foundation for our bold plans to accelerate efficient growth and seize organic and inorganic opportunities.

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

We attribute our high capacity for resilience to several factors, notably:

- Good financial position: strong balance sheet, sufficient cash reserves and moderate fixed cost exposure
- High degree of diversification in the three business sectors amid low cyclicality
- Robust supply networks due to increasing localization
- Lower dependency on single regions thanks to diversified footprint
- Strong focus on sustainability as an integral part of the company strategy, linked with clear sustainability goals.

Up until 2025, we expect to grow sales organically by at least 6% on average per year, equating to an increase of more than € 1 billion annually. To this end, we are making targeted investments worldwide to expand our regional capacities, such as the expansions of our Life Science manufacturing sites in Rockville, USA, in Molsheim, France and in Wuxi, China, as well as the construction of our Translational Science Center and Launch & Technology Center for our Healthcare business sector in Darmstadt, Germany. In Electronics – as part of our Level Up program – we are investing in our highly attractive growth markets such as semiconductors by expanding our global production and innovation footprint in close proximity to our customers.

In addition to our organic growth objectives, we plan further in-licensing and bolt-on acquisitions. For example, we announced the closing of the transaction to acquire the chemicals business of Mecaro, a Korean supplier to the semiconductor industry. Another recent example is the collaboration agreement including licensing option with Nerviano Medical Sciences S.r.L. (NMS) for the development of a novel oncology drug. In addition, as of 2023, we will once again consider potential larger-scale acquisitions as an option. Our inorganic growth initiatives will fit our strategic direction, with high priority being given to the Big 3 businesses.

Looking forward, we further identify transformative technologies to be pivotal enablers for our growth and innovation ambition. Therefore, we will look into novel technologies beyond our core products and markets while keeping in strategic proximity to our business sectors to leverage our existing assets and capabilities.

Our Group Science & Technology Office is leading the implementation of our combined strategy for innovation and “Data & Digital,” fostering innovation in as well as across our business sectors through seeding and integrating transformative technology trends while harnessing the power of cutting-edge data and digital capacities. To enable our businesses and accelerate innovation through data we are deploying a company-wide harmonized Data and Analytics Operating Model and Ecosystem. This allows us to derive actionable insights from data, support informed decision-making, and scale related activities across the company to solve business challenges with machine learning and artificial intelligence. Data culture is foundational for our digital transformation. Through dedicated data upskilling activities, we are strengthening the ability of our workforce to identify, understand, create, model, analyze, interpret, communicate, and argue with data.

Business strategies

Life Science

Our Life Science business sector is a global leader in the ~€ 200 billion ex Covid life sciences industry. We continue to consistently deliver profitable growth in this market that is growing ~5 to 7% CAGR. While our strategy has not changed – strengthen our core business and expand in high-growth segments – our priorities now reflect changes in the external environment, with an even sharper focus on our strategy, further enabled by digitalization, innovation, and enhanced capabilities. In February 2022, we announced a new organizational structure focusing on the customer and portfolio, across three distinct business units: Process Solutions dedicated to consumables and instruments, Life Science Services delivering pharmaceutical testing, manufacturing, and development services, and Science and Lab Solutions unifying offerings for the research and applied markets.

Process Solutions is focused on innovation in process development, building a robust supply network, and expanding capacity to capture accelerating market growth. Customers and governments increasingly view bioprocess consumables as a strategic resource and prefer regional suppliers. Our plan calls for a shift from manufacturing centers of excellence to increasingly in-region, for-region production. We will continue to invest heavily in new capacity for key portfolios including single-use, filtration and cell culture media. This will improve customer service levels and increase our resilience. In addition, innovation remains critical. Our deep expertise in monoclonal antibodies (mAbs) and proteins provides a launchpad to offer fit-for-purpose products for the efficient manufacturing of novel modalities, such as viral vectors, and mRNA and cell therapies, which are all growing rapidly.

Science and Lab Solutions unites our strong positions across diverse lab and testing segments, including academia, pharmaceutical R&D and diagnostics, among others. This exposure provides exceptional resilience and predictable, profitable growth. Our strategic focus here is to ensure our long-term competitiveness as customer needs evolve. We are poised to continue our legacy of innovation for the lab, adding digital features and greener alternatives to our expansive product portfolio, and enhancing omnichannel engagement, by providing a seamless customer experience through all purchasing channels, from our sales representatives to our leading eCommerce platform.

We have already unified our service offerings under the Life Science Services business to build our presence in the attractive and growing contract testing, development, and manufacturing organization (CTDMO) segment. Here we have a strong foundation, with more than 25 years of CDMO expertise, a global footprint, and capabilities across the value chain. Our vision is to move from an emerging, multi-modality CDMO and CTO to a full-service and focused, multi-modality CTDMO. To enable this in the near term, we will focus on streamlined sales and a robust customer pipeline, ultimately increasing global scale and reach.

Across Life Science, we are also raising our ambition in the Asia-Pacific (APAC) region. As noted, our plans include establishing additional in-region, for-region infrastructure. At the same time, we will enhance our support level across the APAC region, sharing our technological expertise with customers to become a true partner in this fast-growing market.

Our Life Science business sector is poised to deliver sustained growth in a dynamic market through supply regionalization, a differentiated customer experience, and accelerated innovation – all aimed at shaping the future and fulfilling our purpose to impact life and health with science.

Healthcare

Global megatrends such as growing and aging populations as well as better access to healthcare continue to drive the need for our products. At the same time, the Covid-19 pandemic has accelerated many anticipated industry trends within the healthcare sector such as changes in market dynamics, ongoing healthcare reform, and increased digitalization. In recent months, the macroeconomic and geopolitical external environment has become more volatile, considering, for example, rising inflation or the war in Ukraine. To meet these demands and respond appropriately to the dynamics of our markets, we have significantly transformed our Healthcare business sector in recent years with the objective of delivering focused leadership and sustaining above-market growth through a diversified portfolio that is resilient to long-term volatility.

Following our successes over the past years, we continue to drive pipeline projects with the aim of bringing groundbreaking medicines to patients, maximizing our existing portfolio, and continuing our expansion in growth markets. We are resolute in our ambition to become a global specialty innovator, with a high-growth future in Oncology, Neurology and Immunology, and Fertility – areas where significant unmet medical needs exist and where we can bring meaningful value to patients. We build this ambition on top of a strong foundation and will continue to grow Cardiovascular, Metabolism & Endocrinology sustainably and profitably. We pursue this ambition with a focused leadership approach, concentrating investments on decorrelated opportunities in our pipeline and across therapeutic areas, regions, and payer types.

The first pillar of our strategy is to reinforce our global footprint, bringing the innovation of our pipeline to patients and growing our presence – in the United States and in China, for example. The emerging markets and China are expected to be the largest growth drivers for many of our established products in the future. Managing the balance between delivering innovative new medicines with first-in-class and/or best-in class potential while leveraging our strengths in other markets and ensuring the profitable growth of the existing business will be one of the strategic imperatives. Numerous examples in our existing business offer significant opportunities to bring value to patients, and considering their growth potential, maximizing their business potential will remain important.

The second pillar of our strategy is the focus on specialty medicine franchises. Here, we expect the oncology, neurology, immunology, and fertility markets to remain highly attractive in terms of size, growth prospects, and profitability. Within each specialty franchise, our approach is to develop deep internal expertise and insight, from internal research to commercialization, augmented by external talent sourcing and strategic partnering. In order to optimize the value and focus of our pipeline, we continuously monitor and assess the potential of our pipeline candidates, based on clinical data, strategic fit and financial criteria, to determine the best way forward.

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

Electronics

Within the last years, the Electronics business sector has transformed into an innovation leader within the electronics industry targeting the most critical materials segments of the semiconductor wafer processing as well as OLED and LC display panels. Our diversified portfolio delivers profitable growth and stable attractive cash flows. We partner with key thought leaders around the world to enable the next generation of electronic devices.

The acceleration of digitization, and its visualization, is fueled by an exponential growth of data and a lasting need for electronics, especially semiconductor chips across all industrial sectors. Highly impactful technology trends like artificial intelligence (AI), 5G networks, big data, and Internet of Things (IoT) require more powerful chips and advanced OLED display platforms. In the mid and long term, this growth is expected to continue through the next decade, as semiconductors have become a critical component in many industries. Unprecedented investments, in the hundreds of billions of euros, are being announced for new chip manufacturing capacity across the world. To produce ever more powerful and energy-efficient chips, innovation in novel materials is essential.

To benefit from the strong electronics industry growth, our plan is to expand our capacities and our capabilities. We have announced investments of significantly more than € 3 billion into innovation and capacities by 2025 aligned to the businesses and regions we serve. These investments are an essential part of our sector’s Level Up growth program, which kicked off at the end of 2021.

We are progressing well in our Level Up program, which focuses on four, mutually reinforcing key priorities: Scale, Technology, Portfolio and Capabilities. With Scale and Technology, we support the ongoing capacity expansion that is happening globally in our focus industries, investing in our footprint in close proximity to our customers while boosting R&D and innovation. Under the priority area Portfolio, Electronics seeks to exploit attractive, external growth opportunities via acquisitions. Furthermore, Level Up is accelerating important internal initiatives under the Capabilities priority. Among other things, it is further leveraging data analytics capabilities and investing even further into the safety realm.

After substantial investments in expanding our production capacities in Surface Solutions, we remain confident to successfully implement its strategic transformation.

Sustainability strategy

Leveraging science and technology

For us, sustainable entrepreneurship and profitable growth go hand in hand. Only by creating value for society can we remain competitive and achieve human progress through our innovations and high-quality products. Responsible action is an integral part of our company culture. This also includes respecting the interests of our employees, customers, investors, and society. Safety and ethics matter just as much to us as business success. We mitigate ethical, economic, environmental, and social risks as far as possible. From the early stages of development through to disposal, we keep an eye on the entire life cycle of a product. We apply strict sustainability standards to our procurement activities. During product manufacture, we strive to keep the environmental impact as low as possible, which is why safe production techniques, high environmental standards and strict quality management are of course so important to us. And with our sustainable products, we also help the companies that we supply to achieve their sustainability goals.

Sustainability is an essential element of our enterprise strategy. We have set ourselves three strategic sustainability goals: In 2030, we will achieve progress for more than one billion people through sustainable science and technology. By 2030, we will integrate sustainability into all our value chains. By 2040, we will be climate neutral and reduce our resource consumption. With these goals, we are helping to achieve the UN Sustainable Development Goals (SDGs). In order to achieve our sustainability goals, we have defined seven focus areas: sustainable innovations and technologies for our customers, impact of our technologies and products on health and well-being, sustainability culture and values, sustainability and transparency in the supply chain, securing our social license to operate in all regions, climate change and emissions, and water and resource intensity.

Implementing the sustainability strategy

In 2022, we focused on creating the right conditions for achieving our sustainability goals. All three business sectors derived sustainability strategies from the overarching company strategy and started executing them.

On the basis of 14 key indicators, which we defined back in 2021, we record and assess our progress towards achieving our sustainability goals. In 2022, we implemented various digital working tools that we believe will allow us to gain greater transparency with regard to our achievements.

In the year under review, we specified that also when assessing potential acquisitions, we would always include sustainability aspects. This will be the case even more so in the future, also when it comes to capital allocation and investment decisions as well as research and development. To assess the potential impacts of our products throughout their entire life cycle, we use a scorecard developed in-house. We introduced this scorecard for all three of our business sectors in 2022. Moreover, we added a sustainability factor to tour Long-Term Incentive Plan (LTIP) in 2022. Details on how this sustainability factor is calculated can be found in the **Compensation Report**.

We are now in the process of transforming the company and are integrating sustainability into the innovation process and all parts of the value chain. It is our aim to decouple the growth of our businesses from negative environmental impacts.

More information on sustainability topics can be found in the **Non-Financial Statement**, which is also part of the management report.

Strategic finance and dividend policy

We pursue a conservative financial policy characterized by the following:

Financial flexibility and a conservative funding strategy

We ensure that we meet our obligations at all times and adhere to a conservative and proactive funding strategy that involves the use of various financial instruments. Our diversified and profitable businesses form the basis for our strong and sustainable cash flow generation capacity. Moreover, we have several funding resources in place. A formerly EUR 2.0 billion syndicated loan facility has been increased to an amount of EUR 2.5 billion in Q4 2022 and now in place until 2027 to cover unexpected cash needs. This credit line is a backup facility that should only be used in exceptional situations.

The Group also agreed upon several bilateral loan facilities. In addition, we have a commercial paper program with a volume of € 2 billion at our disposal. Within the scope of this program, we can issue short-term commercial paper with a maturity of up to one year.

Additionally, as a general rule, the bond market represents a key element. The most recent bond issuance took place in June 2022 (€ 1.0 billion euro bonds) and September 2020 (€ 1.0 billion hybrid bond). The use of various instruments provides a broad financing basis and addresses different investor groups.

Maintaining long-term and reliable business relations with a core group of banks

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

Strong investment-grade rating

The rating of our creditworthiness by external rating agencies is an important indicator of financial stability. A strong investment-grade rating is an important cornerstone of our financial policy, as it safeguards access to capital markets at attractive financial conditions.

On October 17, 2022, we received a rating upgrade by Scope Ratings from A- (positive outlook) to A (stable outlook). Also in October 2022, we received rating confirmations from Moody’s (A3, stable outlook) as well as from Standard & Poor’s (A, stable outlook).

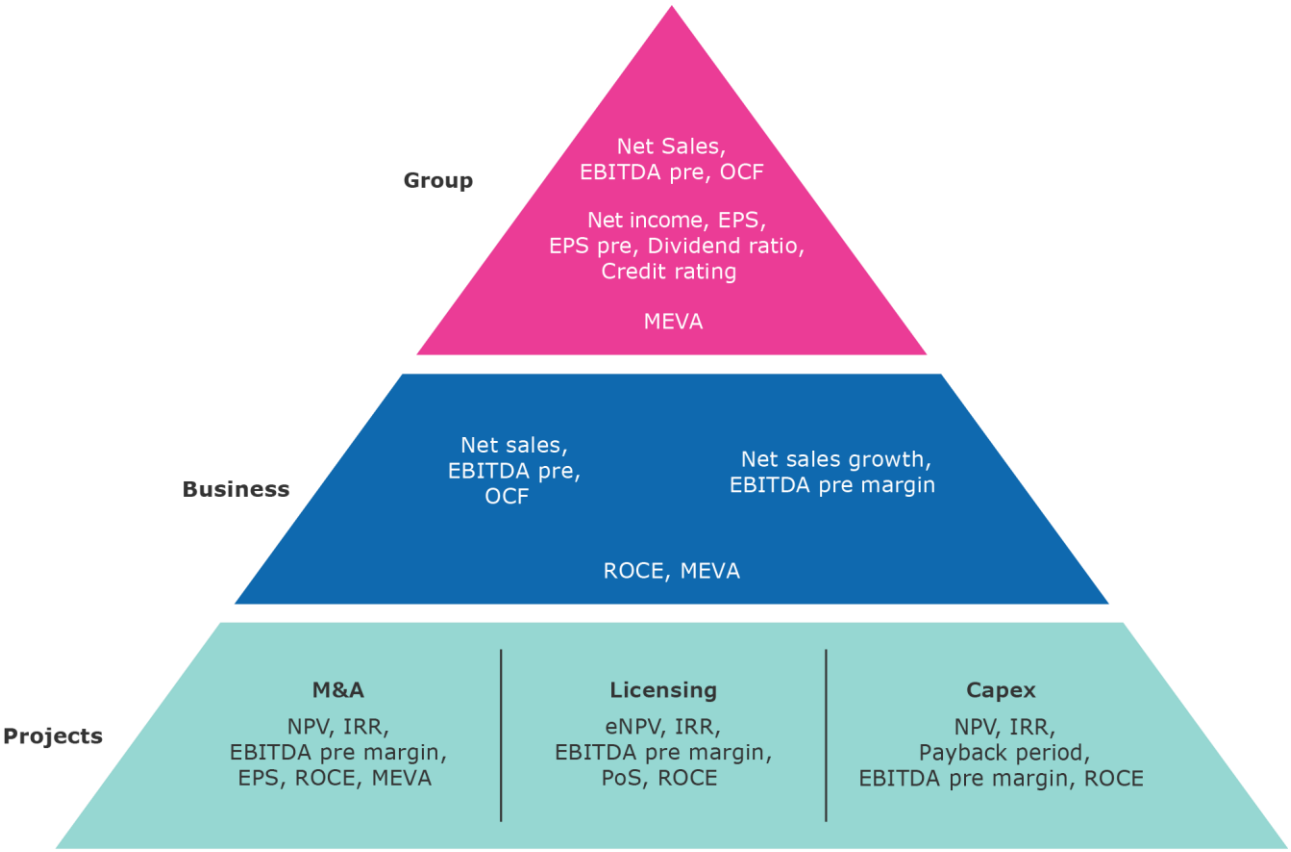
Sustainable dividend policy

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

Internal Management System

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

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



Abbreviations
EBITDA pre [1] = Earnings before interest, income tax, depreciation and amortization as well as adjustments.
EPS = Earnings per share.
MEVA [1] = Value added of the Group.
OCF [1] = Operating cash flow.
ROCE [1] = Return on capital employed.
NPV [1] = Net present value.
IRR [1] = Internal rate of return.
eNPV [1] = Expected net present value.
PoS [1] = Probability of success.
M&A = Mergers and acquisitions.

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

Key performance indicators of the Group and its businesses

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

Net sales

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

Group

Net sales

			Change	
€ million	**2022**	2021	€ million	%
Net sales	**22,232**	**19,687**	**2,546**	**12.9%**

EBITDA pre

EBITDA pre is the main performance indicator measuring ongoing operational profitability and is used internally and externally. To permit a better understanding of the underlying operational performance, the operating result is adjusted to exclude depreciation and amortization, impairment losses and reversals of impairment losses, as well as adjustments. These adjustments are restricted to the following categories: integration expenses, IT expenses for selected projects, restructuring expenses, gains/losses on the divestment of businesses, acquisition expenses, and other adjustments. The classification of specific income and expenses as adjustments follows clear rules and is subject to strict governance at the Group level. Within the scope of internal performance management, EBITDA pre allows for necessary changes or restructuring without penalizing the performance of the operating business. The following table shows the composition of EBITDA pre in fiscal 2022 compared with the previous year. The IFRS figures have been modified to reflect the elimination of adjustments included in the respective functional costs.

Group

Reconciliation EBITDA pre[1]

	2022			2021[2]			Change
€ million	IFRS	Elimination of adjustments	pre[1]	IFRS	Elimination of adjustments	pre[1]	pre[1]
Net sales	**22,232**	**–**	**22,232**	**19,687**	**–**	**19,687**	**12.9%**
Cost of sales	-8,527	32	-8,496	-7,351	25	-7,326	16.0%
Gross profit	**13,705**	**32**	**13,737**	**12,335**	**25**	**12,361**	**11.1%**
Marketing and selling expenses	-4,714	32	-4,681	-4,304	17	-4,287	9.2%
Administration expenses[2]	-1,306	115	-1,191	-1,227	83	-1,144	4.1%
Research and development costs[2]	-2,521	75	-2,446	-2,426	8	-2,418	1.2%
Impairment losses and reversal of impairment losses on financial assets (net)	-6	–	-6	1	–	1	>100.0%
Other operating income and expenses[2]	-685	323	-361	-202	76	-125	>100.0%
Operating result (EBIT)[1]	**4,474**			**4,179**			
Depreciation/amortization/ impairment losses/ reversals of impairment losses	2,030	-232	1,798	1,767	-53	1,715	4.9%
EBITDA[3]	**6,504**			**5,946**			
Restructuring expenses	198	-198	–	79	-79	–	
Integration expenses/IT expenses	88	-88	–	81	-81	–	
Gains (-)/losses (+) on the divestment of businesses	-38	38	–	-3	3	–	
Acquisition-related adjustments	29	-29	–	-18	18	–	
Other adjustments	68	-68	–	19	-19	–	
EBITDA pre[1]	**6,849**	**–**	**6,849**	**6,103**	**–**	**6,103**	**12.2%**
thereof: organic growth[1]							6.1%
thereof: exchange rate effects							6.4%
thereof: acquisitions/divestments							-0.3%

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

[2] Adjustment of prior-year figures due to restructuring within Corporate and Other.

[3] 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.

Operating cash flow (OCF)

Operating cash flow results from our current business activities and describes the cash generated from operating activities. It is influenced mainly by EBITDA pre, income tax, the financial result and changes in net working capital.

Group

Operating cash flow

			Change	
€ million	**2022**	2021	€ million	%
EBITDA pre[1]	**6,849**	**6,103**	**746**	**12.2%**
Adjustments[1]	-345	-157	-188	>100.0%
Finance result[2]	-187	-255	68	-26.7%
Income tax[2]	-948	-859	-89	10.4%
Changes in working capital[1]	-917	-349	-568	>100.0%
thereof: Changes in inventories[3]	-604	-472	-133	28.1%
thereof: Changes in trade accounts receivable[3]	-413	-310	-103	33.2%
thereof: Changes in trade accounts payable/refund liabilities[3]	101	433	-332	-76.8%
Changes in provisions[3]	113	196	-83	-42.6%
Changes in other assets and liabilities[3]	-279	-121	-158	>100.0%
Neutralization of gains/losses on disposal of fixed assets and other disposals[3]	-48	-24	-25	>100.0%
Other non-cash income and expenses[3,4]	21	81	-60	-73.9%
Operating cash flow	**4,259**	**4,616**	**-356**	**-7.7%**

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

[2] According to Consolidated Income Statement.

[3] According to the Consolidated Cash Flow Statement.

[4] Adjustment of prior-year figures due to reclassification of the presentation of impairment losses/reversals of impairment losses on financial assets from "Depreciation/amortization/impairment losses/reversals of impairment losses" to "Other non-cash income and expenses".

Investments and value management

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

Net present value (NPV)

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

Internal rate of return (IRR)

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

Return on capital employed (ROCE)

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

Payback period

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

Value added of the Group (MEVA)

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

Capital market-related parameters

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

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

Reconciliation net income to net income pre[1]

			Change	
€ million	**2022**	2021	€ million	in %
Net income	**3,326**	**3,055**	**271**	**8.9%**
Non-controlling interest	14	10	3	31.1%
Income tax	948	859	89	10.4%
Amortization of acquired intangible assets	830	803	27	3.4%
Adjustments[1]	345	210	135	64.4%
Income tax on the basis of the underlying tax rate[1]	-1,310	-1,135	-174	15.3%
Non-controlling interests to be adjusted	-14	-10	-3	31.1%
Net income pre[1]	**4,371**	**3,791**	**579**	**15.3%**
Earnings per share pre[1] in €	**10.05**	**8.72**	**1.33**	**15.3%**

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

Credit rating

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

Dividend ratio

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

Other relevant/non-financial performance measures

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

Innovation

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

Sustained employee development

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

Research and Development

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

Around 7,700 employees (2021: approximately 8,300) worked in research and development and corresponding support functions in 2022. They dealt with innovations to address long-term health and technology trends in both established and growth markets.

Expenditures for R&D amounted to € 2.5 billion in 2022 (2021: € 2.4 billion).

The organizational setup of our R&D activities reflects our structure with three business sectors. In the Life Science business sector, our research activities focus on developing innovative technologies for laboratory and life science applications in government and academic labs, the biopharmaceutical industry, and the industrial sector. We continue to focus on digitized and automated labware, DNA purification for downstream applications, and emerging chemical synthesis, as well as software for our BioContinuum™ Platform to accelerate Biopharma 4.0. In addition, our teams remain dedicated to delivering advancements in our core portfolios, such as filtration, pure lab water, and diagnostic solutions. With our Healthcare business sector's R&D pipeline, we aspire to make a positive difference for patients – always with the goal to help create, improve, and prolong lives. Our main research areas include oncology, immuno-oncology, and immunology including multiple sclerosis. The main focus of our Electronics business sector's research is on the development of innovative materials and technologies required for the manufacturing of ever smaller, faster and more powerful processors and memory chips. In addition, Electronics develops novel materials for next-generation displays and functional and decorative effect pigments for use in the automotive and cosmetics industries and other industrial applications.

We are deeply convinced that science shouldn't be conducted in siloes. We believe a modern, multi-disciplinary approach to science will power the next wave of human progress. We call this approach bioconvergence because it leverages synergies across digital and material science as well as biotechnology. Success depends on the ability to combine a broad mix of competencies and technologies across several disciplines to create novel market solutions. As a diversified science and technology company with leading positions across life science, healthcare and electronics, we are in the sweet spot to pioneer this new era. Our goal is to harness synergies not only within our business sectors, but across them to make innovation much faster, more efficient, and far more impactful.

Examples of these opportunities that we are developing at the intersection of our business sectors and converging technologies include:

- We continue to build our automated design-make-test-analyze platform. This will contribute significantly to revolutionize drug discovery by accelerating discovery of new and better drug candidates and in turn expedite timelines for new therapies to reach patients.
- We are utilizing our capabilities across the group in messenger ribonucleic acid (mRNA) synthesis, lipid nanoparticle (LNP) synthesis and formulation and targeted delivery, and AI to enable the development of "smarter" LNPs that can more effectively target different tissue types including difficult-to-reach biological targets in various disease areas.
- We develop digital twins in smart manufacturing to optimize time, cost, quality, and sustainability. As virtual models designed to accurately reflect a physical object or organism, they can help to improve the time, cost, quality, and sustainability of manufacturing, process optimization, and product development. Examples include making pharma supply chains more traceable and trustful. We developed a model and together with a partner achieved proof-of-concept for pharma primary packaging. Here, authorized stakeholders within the supply chain get immediate access to quality and process data of products at item level.

High-quality, interoperable data combined with analytics and AI offer unprecedented potential for new digital business models adjacent to our current product offering and unlock additional growth opportunities. Examples include Syntropy and Athinia™, which are partnerships with Palantir.

Syntropy represents a data integration and analytics environment wherein healthcare organizations can contextualize and analyze infinitely diverse data types securely across their entire ecosystem, enabling experts to collaborate in the fight against cancer and many other diseases. In addition to existing partnerships with, for example, Mitre, MD Anderson Cancer Center of the University of Texas in Houston, USA, and the University of California, Irvine, USA, Syntropy partnered with another large NCI-designated academic medical center in the US on a pilot in 2022.

Athinia™, launched in December 2021, is targeting the semiconductor industry. It is the only industry-wide collaborative data ecosystem where multiple companies leverage AI to solve critical challenges by utilizing data to improve supply chain transparency, quality, and reliability of materials, and speed up time to market. In July 2022, Micron Technology, a global leader in innovative memory and storage solutions, was announced as a first customer. Together, both parties aim to create a pioneering data collaboration ecosystem that will help lead a continued journey of digital transformation with Micron's critical suppliers.

Research and Development Costs

			Change	
€ million	**2022**	2021	€ million	%
Life Science	399	351	48	13.8%
Healthcare	1,694	1,712	-18	-1.0%
Electronics	308	278	30	11.0%
Corporate and Other[1]	119	85	34	39.6%
Total	**2,521**	**2,426**	**95**	**3.9%**

[1] Adjustment of prior-year figure due to a change in functional allocation between administration expenses, research and development costs as well as other operating expenses.

The ratio of research expenditure to Group sales was 11.3% (2021: 12.3%). The decline is due to the positive sales development.

Life Science*

Across our three business units of Process Solutions, Life Science Services, and Science and Lab Solutions, our R&D teams, composed of approximately 2,000 employees, continue to bring expertise and a diversified and relevant portfolio of products and services to our customers around the world. In 2022, our Life Science business sector focused on delivering breakthrough innovations for our academic, biopharmaceutical, and industrial customers.

As such, we launched more than 27,000 products in 2022, including those launched through our "faucet program" for antibodies, reference materials, chemicals, and nanomaterials.

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

Process Solutions

In August, we launched the VirusExpress® 293 Adeno-Associated Virus (AAV) Production Platform, making us one of the first Contract Development and Manufacturing Organizations (CDMOs) and technology developers to provide a complete viral vector manufacturing offering including AAV, Lentiviral, CDMO, Contract Testing, and process development. This new platform enables biopharmaceutical companies to increase the speed of clinical manufacturing while reducing process development time and costs. It is an extension of our VirusExpress® offering, which can reduce process development time by up to 40%, based on our experience as a CDMO. We also launched Pellicon® capsule manifolds for single-use tangential flow filtration (TFF) production in August. Uniquely designed for faster installation and safer handling of filtration areas, Pellicon® Capsule manifolds offer ease-of-use for scale-up from clinical to small-volume production of biomolecules.

Science and Lab Solutions

We expanded our ZooMAb® recombinant monoclonal antibodies product portfolio with 72 new products and added 23 new products to the ColorWheel® flow cytometry antibodies and dyes portfolio. In April, ZooMAb® recombinant antibodies earned an accountability, consistency, and transparency (ACT) label from My Green Lab, a non-profit focused on promoting sustainability in science. ZooMAb is the first-ever antibody to receive the ACT label designation and received the lowest environmental impact factor (EIF) scores in the chemicals and reagents category. In addition to these factors, the manufacturing facility where the antibodies are produced has implemented energy, water, and waste reduction measures, produces renewable energy from a wind farm, and has an environmental management system program that is International Organization for Standardization 14001 certified.

Also in April, we launched our ReadyStream® system, a novel solution that prepares and instantly dispenses culture media for microbiological food testing. The ReadyStream® system eliminates five time-consuming steps in the testing process, allowing for more streamlined, cost-saving food and beverage testing. ReadyStream is designed to save testing technicians time, resources, and lab space.

In November, we launched AIDDISON™, an AI-powered drug discovery software designed to accelerate drug discovery. The integrated platform allows rapid screening for novel molecules with machine learning models to predict pharmacokinetic profiles and design de novo molecules. This is another step in our journey to digitize the life science industry, allowing medicinal and computational chemists to optimize their in-silico small molecule drug discovery research.

Recognized for award-winning innovation

In 2022, Life Science was recognized by numerous industry organizations for excellence in innovation.

In April, the Process Solutions business unit received the award for the Best New Product/Service for the Bio4C® Software Suite featured in our M Lab™ Collaboration Centers from Interphex and in October, the Best Bioprocessing Supplier Award was given at the Taiwan Biopharma Excellence Awards.

In the fall, Life Science Services was recognized with four different awards, including the Overall Best Cell & Gene Therapy Supplier Award at the Asia Pacific Cell & Gene Therapy Excellence Awards in September; and one award in October, for the ChetoSensar™ platform, given by Pharma Manufacturing's Innovation Awards.

Science and Lab Solutions received two awards. In March, we received the CiteAb Carbohydrate Supplier of the Year award, recognized as the provider with the most citations related to carbohydrates, an important sector within the biochemicals market. In August, our 3-D printable inks were recognized with the R&D 100 award for Multifunctional, 3D-Printable Inks for Energy Products in 2022, as a result of our partnership with Dr. Marcus Worsley from Lawrence Livermore National Laboratory.

Healthcare*

With our Healthcare research, we aspire to make a positive difference for patients – always with the purpose to help create, improve, and prolong lives.

In November 2022, we announced that we aim to launch one new product or indication every 1.5 years on average, bolstered by external innovation. Our companywide focused leadership approach to pipeline enrichment builds on our established expertise in the underlying biology of our core therapeutic areas of oncology, neurology and immunology as well as technological capabilities. By building on our existing strengths and maximizing synergies within our in-house discovered pipeline and with external assets, we will secure sustainable R&D productivity that leads to innovative medicines for patients in need.

Oncology

Oncology is a core focus area in our R&D portfolio, as we aim to deliver transformative treatments. Translational research is embedded into the whole R&D process, with several projects addressing unmet needs in hard-to-treat cancers through innovative treatment approaches and novel combinations. In 2022, we achieved several milestones across our oncology pipeline.

We continue to deliver on our commitment to bring new standards of care for multiple tumor types to as many patients as possible worldwide, with new regulatory approvals of our marketed therapies in additional countries around the world in 2022.

Bavencio® (avelumab), an anti-PD-L1 antibody we are co-developing and co-commercializing with Pfizer Inc., United States, is now approved as a first-line maintenance treatment for locally advanced or metastatic urothelial carcinoma (UC) in adult patients whose disease has not progressed following platinum-based chemotherapy in 63 countries. Bavencio® was first approved for this indication in the United States by the U.S. Food and Drug Administration (FDA) in June 2020. It is also approved as a monotherapy for the treatment of metastatic Merkel cell carcinoma in 63 countries and for the treatment of advanced renal cell carcinoma in combination with axitinib in 60 countries.

In February 2022, the European Commission approved Tepmetko® (tepotinib), our in-house-developed oral MET inhibitor, as monotherapy for the treatment of adult patients with advanced non-small cell lung cancer (NSCLC) harboring alterations leading to mesenchymal-epithelial transition factor gene exon 14 (*MET*ex14) skipping, who require systemic therapy following prior treatment with immunotherapy and/or platinum-based chemotherapy. Tepotinib is now available in several countries globally.

As part of our efforts to bring our medicines to as many patients as possible who may benefit from them, we are assessing these medicines in new settings as well, while also progressing promising molecules from our pipeline. In 2022, we initiated the Phase II JAVELIN Bladder Medley study in 2022. This randomized umbrella study is evaluating whether optimization of first-line maintenance treatment by adding a novel therapy to avelumab could improve outcomes for patients with advanced urothelial carcinoma whose disease did not progress with first-line platinum-containing chemotherapy. JAVELIN Bladder Medley is assessing avelumab monotherapy versus the combination of avelumab with the company's investigational anti-TIGIT antibody M6223; avelumab in combination with Nektar Therapeutics' interleukin-15 (IL-15) receptor agonist, NKTR-255; or avelumab in combination with Gilead Sciences' Trodelvy® (sacituzumab govitecan-hziy).

With the Phase III development program for the potentially first-in-class IAP (Inhibitor of Apoptosis Protein) inhibitor xevinapant, we are building on our long-standing leadership in the treatment of squamous cell carcinoma of the head and neck (SCCHN). We opened the second Phase III clinical trial, XRay Vision (NCT05386550), a randomized, double-blind, placebo-controlled study to evaluate the efficacy and safety of xevinapant versus placebo in combination with adjuvant, post-operative radiotherapy in patients with resected locally advanced (LA) SCCHN who are at high risk for relapse and are ineligible for cisplatin, in 2022.

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

Recruitment continues to progress in the international, randomized, double-blind, placebo-controlled, Phase III TrilynX study (NCT04459715) to evaluate the efficacy and safety of xevinapant versus placebo when added to definitive chemoradiotherapy in patients with unresected LA SCCHN.

In 2022, we also have made progress on our ambition to deliver the next generation of innovative medicines for cancer, with two compounds from our pipeline advancing into clinical trials, with Phase I studies underway for our anti-CEACAM5 antibody-drug conjugate (ADC), M9140, and our A2aR_A2bR antagonist, M1069, in advanced solid tumors. M9140, which is the first ADC to enter clinical development that is based on our proprietary technology, showed a convincing preclinical profile with high antitumor potency in multiple models and a suitable safety profile.

We shared new data analyses for our marketed and investigational oncology medicines throughout the year at major congresses.

At the 2022 American Society of Clinical Oncology (ASCO) annual Genitourinary Cancers Symposium, February 17-19, we presented results of an exploratory analysis from the Phase III JAVELIN Bladder 100 trial with 19 additional months of follow-up data from the initial primary analysis. This analysis reinforced the original results and showed that Bavencio® plus best supportive care (BSC) in the first-line maintenance setting prolonged median overall survival by 8.8 months versus BSC alone for patients with locally advanced or metastatic UC whose tumors had not progressed on a platinum-based chemotherapy.

In June, 30 abstracts featuring key data from our broad oncology clinical portfolio were presented at the ASCO Annual Meeting. Highlights included:

New analyses of long-term data from the Phase III JAVELIN Bladder 100 study of Bavencio® as first-line maintenance treatment in advanced UC, including data from subgroups defined by best response to first-line chemotherapy and in patients who did or did not receive second-line treatment after Bavencio® maintenance.

Data for the oral MET inhibitor Tepmetko®, including two poster presentations from the VISION trial reporting efficacy, safety and quality-of-life results of Tepmetko® in Asian patients with *MET*ex14 skipping NSCLC, and updated efficacy and safety results of Tepmetko® and exploratory biomarker analyses in patients with NSCLC with high-level *MET* amplification enrolled into Cohort B of the VISION trial based on liquid biopsy.

Abstracts from key investigator-sponsored studies exploring Erbitux® (cetuximab)-based combinations, including the Phase III FIRE-4 study of early switch-maintenance from Erbitux®/FOLFIRI to bevacizumab/5-FU and rechallenge in later lines for patients with RAS wild-type metastatic colorectal cancer (mCRC), and the Phase II AVETUXIRI study evaluating Bavencio® combined with Erbitux® and irinotecan for refractory microsatellite stable mCRC.

At the European Society of Medical Oncology (ESMO) Annual Meeting, held September 9-13, we shared 29 abstracts, including five late-breaking oral presentations and two additional mini-oral presentations, demonstrating the potential to make a transformative impact for patients with cancer.

For xevinapant, a late-breaking presentation of five-year results from the 96-patient Phase II study showed that adding xevinapant to chemoradiotherapy (CRT) markedly improved long-term efficacy outcomes in patients with unresected LA SCCHN, more than halving the risk of death over five years compared with placebo. This is the first randomized trial in decades to show significant improvement in overall survival in patients with LA SCCHN, reinforcing the transformative potential of xevinapant over standard of care in the curative setting.

- Initial results from the Phase II INSIGHT 2 trial of Tepmetko® plus osimertinib in the treatment of patients with EGFR-mutant NSCLC with *MET* amplification after progression on first-line treatment with osimertinib showed encouraging signs of clinical activity with this targeted, oral, chemotherapy-sparing regimen
- Data from DDRiver Solid Tumors 301, the first-in-human Phase I study of M1774, our potentially best-in-class potent and selective inhibitor of ataxia telangiectasia and Rad3-related (ATR), were featured in a mini-oral presentation. This research, which showed a favorable safety profile and pharmacologically relevant exposure in patients with advanced solid tumors, exemplify our commitment to advancing understanding of DNA damage response (DDR) inhibition mechanisms.
- For Bavencio®, translational data characterizing genomic biomarkers in peripheral blood from patients enrolled in the Phase III JAVELIN Bladder 100 trial were shared as a late-breaker]. Additional presentations included exploratory analyses from JAVELIN Bladder 100 that examined clinical outcomes in long-term responders with advanced UC treated with Bavencio® first-line maintenance for ≥12 months.
- Additional data for Tepmetko® included results from cohorts A and C in the Phase II VISION trial, which demonstrated robust and durable efficacy in treatment-naïve and previously treated patients with metastatic NSCLC with *MET*ex 14-skipping. In previously treated patients, efficacy was observed regardless of prior therapies including immunotherapy and/or platinum-based chemotherapy.

On June 3, we announced that, following an interim analysis of the ongoing global Phase II DDRiver SCLC 250 trial of berzosertib in combination with topotecan in patients with relapsed, platinum-resistant small cell lung cancer (SCLC), the decision has been made to discontinue the study due to low probability of meeting the pre-defined objective of this trial. The safety profile for berzosertib plus topotecan was consistent with that observed in other clinical trials to date. The ongoing development of our ATR inhibitor M1774 will build on learnings from the exploration of berzosertib, which has been studied in approximately 1,000 patients to date in multiple combinations, including with chemotherapy, radiotherapy, immunotherapy and PARP inhibitors across company- and investigator-sponsored studies.

To further support our focused research and development efforts in the area of DDR inhibition, in September 2022 we entered a collaboration agreement with licensing option with Nerviano Medical Sciences S.r.l. for the next-generation highly selective and brain-penetrant PARP1 (poly (ADP-ribose) polymerase) inhibitor NMS-293. NMS-293 has strong potential in combination with a wide variety of DNA-damaging agents, including systemic or targeted chemotherapy (ADCs) or with DDR inhibitors, in numerous tumor types. NMS-293 is in early clinical development for the treatment of patients with BRCA-mutated tumors as monotherapy and in combination with temozolomide in recurrent glioblastoma. The option to license this molecule provides us with the optionality to develop a next-generation PARP inhibitor in combination with our early pipeline of DDR inhibitors and DNA-damaging ADCs.

Neurology & Immunology

Multiple sclerosis (MS) is one of the world's most common neurological diseases. Despite the emergence of a number of therapies in the last two decades, there are still significant unmet needs for people living with MS. As a company we have more than 20 years of experience in MS research, and we remain committed to finding solutions for significant unmet medical needs for those living with the disease.

New data for our investigational treatment evobrutinib, along with Mavenclad® (cladribine tablets) have been presented across key congresses in 2022, including the European Committee for Treatment and Research in Multiple Sclerosis (ECTRIMS) Congress in October, the American Academy of Neurology (AAN) Annual Meeting in April and the Americas Committee for Treatment and Research in Multiple Sclerosis (ACTRIMS) Forum in February.

We presented a total of 39 abstracts at ECTRIMS including data that demonstrated long-term disease stability, showing annualized relapse rates (ARR) remained low and Expanded Disability Status Scale (EDSS) scores were stable for people living with RMS treated with evobrutinib in the longest-running and most extensive analysis of any BTK inhibitor in development for RMS. As well, we presented phase IV study highlights improvement in measures of Quality of Life in people living with RMS after two years of treatment with Mavenclad®.

At AAN, we presented new Phase II data which showed evobrutinib had sustained low annualized relapse rates (ARRs) and had no new safety signals at 2.5 years. As well, updated safety data continue to demonstrate people living with MS that were treated with Mavenclad® (cladribine tablets) for their MS who had confirmed or suspected Covid-19 experienced mild to moderate disease symptoms and no increased risk of serious outcomes.

At ACTRIMS, we presented new Mavenclad® data that showed favorable efficacy outcomes as compared to other oral DMTs, with a lower occurrence of further relapses or disability progression. Additional clinical trial data show people living with MS treated with Mavenclad® early after a first clinical demyelinating event had a lower occurrence of further relapses or disability progression as compared to placebo.

Fertility

At the 2022 European Society of Human Reproduction and Embryology (ESHRE) in July, we announced a clinical study for a new innovative smart fertility patient hormone monitoring solution. This is a non-invasive device that allows hormone monitoring from the comfort of a patient's home while enabling clinicians to monitor hormone levels remotely as well as to support their clinical decisions. Through this device, we hope to improve both the patient experience and the efficiency of clinic workflows by increasing convenience and flexibility. The first patient enrolled in August.

Cardiovascular Metabolism & Endocrinology

The new formulation of Euthyrox® (levothyroxine) for the treatment of hypothyroidism obtained further regulatory approvals in 2022, resulting in a total of 91 countries where this incremental innovation is registered, allowing for more precise dosing.

Glucophage®, containing the active ingredient metformin, is the drug of choice for first-line treatment of type 2 diabetes available in more than 100 countries. It is also approved in 69 countries prediabetes when lifestyle intervention is not enough to control the condition. With a successful label extension of Glucophage® and Glucophage® XR in Europe during this year, our metformin products are the first ones that are authorized to be used, in the approved indications, during the pregnancy and around conception. The label update on the mechanism of action, also achieved for EU this year, gives credit to the still growing understanding and opportunities for metformin in the diabetes continuum.

Concor®/Concor Cor®, containing bisoprolol, is a beta-blocker for treating hypertension and cardiovascular diseases such as coronary heart diseases and chronic heart failure. In addition to Concor®/Concor Cor®, the Concor® family offers fixed-dose combinations such as Concor Plus®/Lodoz® (bisoprolol with hydrochlorothiazide) and Concor AM® (bisoprolol with amlodipine). In 2022, Concor® AM, our fixed-dose combination drug to treat hypertension, has been registered in 68 countries.

Ensuring the supply of our medicines to our patients

We are striving to ensure the supply of our high-quality medicines to patients around the world regardless of circumstances, while always observing the highest standards of health and safety for our people and partners.

Since the start of the Covid-19 pandemic, we have been continuously making every effort to proactively handle the situation and minimize the impact of the pandemic and also of any challenges from the external context on the supply of our medicines locally and globally. To this end, we are using three main levers: the thorough implementation of our business continuity plans across our network and their further development, the active management of our stocks, and the assessment of alternative transportation routes to reach our customers and patients.

In the context of the war in Ukraine, we have taken a number of measures to continue to supply to the best of our ability patients who rely on our medicines in the countries impacted, while ensuring the strictest compliance with international sanctions. These measures include constantly monitoring and updating our demand plans, building safety stocks locally, accelerating the shipment of goods from our European sites to the countries impacted and defining back-up air shipment routes in addition to truck transportation to ensure the highest flexibility at all times.

Building for the future

As part of our commitment to accelerate the discovery and availability of future medicines for patients in need, we marked the cornerstone laying for our Translational Science Center in July, and for our Launch and Technology Center in September, at our Darmstadt campus. They are both expected to be fully operational by the end of 2025 and are part of the € 1.5 billion investment package that we announced in March.

The Translational Science Center, which represents an investment of € 200 million, will be a 30,000 square meter, fully integrated, multi-use building including laboratories, a lecture hall, and office space allowing scientists from different disciplines to explore new avenues of research in fields ranging from identifying disease biomarkers to developing targeted therapies.

The Launch and Technology Center, which represents an investment of € 160 million, will offer 13,900 m^2 of space. It combines a highly technological environment with human-centered design, bridging research and commercial manufacturing, and ensuring that our next generation of pharmaceuticals are available for clinical trials, global launches and commercial supply on time, and in the right quality and quantity.

Biopharma Pipeline

As of: December 31, 2022

Therapeutic area **Compound**	**Indication**	**Status**
Neurology		
Evobrutinib (BTK inhibitor)	Relapsing multiple sclerosis	Phase III
Immunology		
Enpatoran (TLR7/8 antagonist)	Systemic lupus erythematosus/Cutaneous lupus erythematosus	Phase II
Oncology		
Xevinapant (IAP inhibitor)	Locally advanced squamous cell carcinoma of the head and neck – Unresected, cisplatin-eligible[1]	Phase III
Xevinapant (IAP inhibitor)	Locally advanced squamous cell carcinoma of the head and neck – Resected, cisplatin-ineligible	Phase III
Tepotinib (MET kinase inhibitor)	Non-small cell lung cancer, *EGFR* mutant, *MET* amplified[2]	Phase II
Avelumab (anti-PD-L1 mAb) + combinations	Locally Advanced or Metastatic Urothelial Carcinoma[3]	Phase II
M1774 (ATR inhibitor)	Solid tumors[4]	Phase Ib
M4076 (ATM inhibitor)	Solid tumors	Phase Ia
M1231 (Bispecific MUC1xEGFR Antibody drug conjugate)	Solid tumors	Phase Ia
M9140 (anti-CEACAM5 Antibody drug conjugate)	Solid tumors	Phase Ia
M6223 (anti-TIGIT mAb)	Solid tumors[5]	Phase Ib
M1069 (A2aR_A2bR antagonist)	Solid tumors	Phase Ia
Global Health		
Arpraziquantel (anthelmintic)	Pediatric schistosomiasis	Registration
M5717 (PeEF2 inhibitor)	Malaria	Phase I

Unless noted otherwise, clinical programs conducted in collaboration with external partners are not shown unless we have co-ownership of data. More information on the ongoing clinical trials can be found at **www.clinicaltrials.gov**. Pipeline products are under clinical investigation and have not been proven to be safe and effective. There is no guarantee any product will be approved in the sought-after indication.

[1] In combination with cisplatin and radiotherapy in unresected LA SCCHN patients eligible for cisplatin.

[2] In combination with osimertinib.

[3] Combinations include Sacituzumab Govitecan, NKTR-255 and M6223.

[4] Study as monotherapy and in combination with niraparib and M4076 ATMi

[5] Includes combinations other than avelumab

A2aR_A2bR: A2A and A2B adenosine receptors
ADC: Antibody Drug Conjugate
ATM: ATM serine/threonine kinase
ATR: Ataxia telangiectasia and Rad3-related protein
BTK: Bruton's tyrosine kinase
CEACAM5: Carcinoembryonic antigen-related cell adhesion molecule 5
EGFR: Epidermal growth factor receptor
IAP: Inhibitor of Apoptosis Proteins
mAb: Monoclonal antibody
MET: MET proto-oncogene, receptor tyrosine kinase
MUC1: Mucin 1, cell surface associated
Phase Ia: Dose finding
Phase Ib: Dose escalation/expansion and signal seeking
PD-L1: Programmed cell death ligand 1
PeEF2: Plasmodium eukaryotic elongation factor 2
TGFbeta: Transforming growth factor beta
TIGIT: T cell immunoreceptor with Ig and ITIM domains
TLR7/8: Toll-like receptors 7 and 8

Electronics*

Within our Electronics business sector, we are one of the leading players in most of our markets. As a science and technology company, we offer leading-edge products, services, and solutions that, in many cases, set us apart from the competition. Our business units are developing advanced materials for next-generation electronics. Our Chief Technology Office (CTO) is identifying trends and vetting technologies that are beyond the time horizon or scope of our business units. As a dedicated technology organization, the CTO is managing research partnerships, shaping our technology roadmaps, and managing our long-term R&D portfolio. We have also created a Technology Leadership Board to review and optimize our technology investment across the business sector. As an essential part of our Level Up growth program, we are investing significantly more than € 3 billion in innovation and capacity until the end of 2025. With these investments, we are also scaling up our research and development capabilities for next-generation semiconductor and display materials to further expand our position as a leading supplier to the electronics industry.

Semiconductor Solutions

We are addressing our customers' critical material needs through every step of the wafer manufacturing process. The outstanding capabilities and competencies of the businesses are diverse and will enable us to bring game-changing innovations for our customers into the market faster.

Our Thin Film Solutions business achieved significant progress in advancing critical PORs (Process of Record) and BKMs (Best Known Methods) for both logic and memory devices, by closely partnering with customers and OEMs: we continue to develop innovative solutions for Silicon containing films to address increasingly challenging problems, make progress in developing high-purity metal-containing precursor offerings enabled by newly engineered container delivery systems, and focus on developing new spin-on dielectric materials with improved gap fill and film characteristics for the most advanced semiconductor devices.

With our Specialty Gases, we continue to make progress with our new etch gas technology program, to develop new chemistries to enable more than 100-layer, single-stack etching for advanced memory devices such as V-NAND. We are also seeing good progress in our etch gas development work for new low-GWP (global warming potential) gases. In August 2022, we announced that we are joining forces with Micron, one of the largest semiconductor companies in the world, to develop low-GWP gas solutions used in the production of semiconductors.

Our Patterning Solutions business continues to heavily invest in pattern transfer technologies for advanced nodes. The proliferation of extreme ultraviolet lithography is gaining momentum in the industry, and our R&D programs for pattern collapse, underlayer, directed self-assembly (DSA) and image rectification are showing excellent progress with key customers. We have engaged in multiple joint development agreements with leading customers and are winning processes of record (PORs) for use of these advanced materials in high-volume chip manufacturing. We have embarked on a cross-business field program to drive the implementation of organometallic compounds into the photolithography segment. We are seeing strong interactions in hard masks and resist development with leading Asian customers leading to improved performance. As the need for heterogeneous integration drives advanced wafer packaging technologies, innovation in conventional lithography materials and formulated wet cleans is required. We are collaborating with leading companies to support this innovation and have won a new POR supporting hybrid bonding processes.

Our Planarization business is driving new product development across advanced oxide and metal segments by capitalizing on the proximity of our R&D lab to our leading customers in Asia and the United States. We are also leveraging data analytics in product development and quality control to speed up time to market for our customers while providing more predictive in-use performance for our customers. More recently, our Planarization Business focused on introducing industry-leading dielectric and tungsten slurries used in advanced node DRAM (Dynamic random-access memory) and NAND (flash memory named for the NAND logic gate)

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

applications. Also, the team has introduced new copper and copper barrier slurries in collaboration with key foundry and logic customers to enable advanced node logic, analog and multi-layer packaging applications.

Our Silicon Valley-based material innovation accelerator Intermolecular saw an increase in the amount of work done in its labs for quantum computing and neuromorphic computing companies. These companies benefit from the flexible device processing infrastructure and deep materials knowledge to quickly achieve tangible products in these emerging technology areas. For more than 15 years, Intermolecular has been exploring, testing, and developing advanced materials that are revolutionizing the next generation of electronics.

Display Solutions

Our display materials are enabling the fast-growing market of innovative displays for current and future applications such as foldable smartphones, rollable TVs, or AR/VR (Augmented Reality/Virtual Reality) devices. With liviFlex™-H, we are providing passivation solutions as protective film to free-form OLED display and are running customer qualifications at this moment. Furthermore, we are active in the development of innovative material solutions in close cooperation with customers and partners for next-generation displays, for example micro-LEDs, low k TFE (Thin Film Encapsulation), and AR/VR displays.

Our liquid crystal technology ultra-brightness fringe-field switching (UB-FFS) continues its successful growth, thanks to new product qualifications and rising demand in the liquid crystal displays (LCD) sector for mobile devices, especially mobile phones, tablet PCs and notebooks. The development of high-resolution 4K and 8K TV sets continues to pose a challenge, as the LCD backlight transmission and efficiency will be reduced due to higher pixel density. We are therefore actively working to expand our ultra-bright (UB) technology offering with our UBplus liquid crystal materials for the TV market. We are also introducing new mode Chiral-polymer stabilized vertical alignment (C-PS-VA) to boost up the transmittance of PS-VA technology. With such technologies, we increase the light transmission efficiency of applications for large-format TV sets and display panels by 10% to 15%. This contributes hugely to the reduction of power consumption and helps our customers and consumers to meet sustainability targets.

Deuteration is another key technology we are working on to realize next-generation OLED. Deuterated materials have the potential to more than double the lifetime of OLED stacks without compromising on efficiency and voltage. In general, we observe increased lifetime with higher deuteration degrees of the material. We are working with our customers to enable lifetime enhancement, focused on high purity, responsible consumption of raw materials and supply and process robustness.

Our LC-based technology licriOn™ enables extensive connectivity access, even in remote areas where fast internet connections are unavailable or unaffordable today. As part of our open innovation campaign, we completed the Ferroelectric Nematic Liquid Crystals (FNLCs) research challenge. These materials show very unique properties which could enable new, exciting applications like actuators, energy harvesting, memory, capacitors and supercapacitors. More than 50 researchers around the world submitted application ideas for this fascinating new material already predicted 100 years ago, but only recently were researchers able to confirm their existence – a discovery which doesn’t happen all too often.

Surface Solutions

In our Surface Solutions business, we focus on the empowerment of our customers to create surfaces that do what they need them to do – and look exactly the way they expect them to look. Thus, together with our customers, we not only develop product innovations but place more and more focus on new application technologies and process excellence to provide customized solutions for the individual challenges of our clients.

In our automotive pigments business, our pipeline consists of three pillars: product development, application engineering and effect visualization. We are actively working on the extension of our portfolio of Colorstream® multicolor-effect pigments with outstanding saturation in the bluish red color space as an ideal complementation of the existing Colorstream® Lava Red. We will also add a fine light silver Iriodin® pigment to our metallic stylings, offering a unique brightness and opacity.

With the development of a highly-viscous Durazane® polymer, we will extend the application field of anti-scratch and easy-to-clean coatings towards thicker films. With the development of a novel Durazane® formulation, we constantly extend the application field of durable anti-scratch, anti-graffiti and easy-to-clean coatings.

In addition, we push the boundaries of science and technology to lead our customers on the path to digitization of color evaluation processes. That is why we are implementing a digital setup that allows us to produce highly reliable color data as additional service for our customers.

In our Cosmetics business, we continue to put sustainability at the center of our efforts by focusing more and more on natural materials in our portfolio. Therefore, we will introduce additional cosmetic active materials from botanical sources with unique efficacy addressing anti-aging and anti-inflammatory claims. We also considered sustainability in the development of the first range of metal-free metal-look pigments for unique cosmetic effects based on proprietary and novel technology of pigment particle coating.

By broadening our portfolio of inorganic UV filters with two new products based on zinc oxide (ZnO_2), we will strengthen our position as one of the leading UV experts for light protection and tanning.

With the market introduction of additional specialty products for high-security applications, we will also extend our Securalic® portfolio offering our customers more reliable and highly discreet counterfeit detection.