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REPORT

LAB LEADER, MARKET ASCENDER: CHINA'S RISE IN BIOTECHNOLOGY

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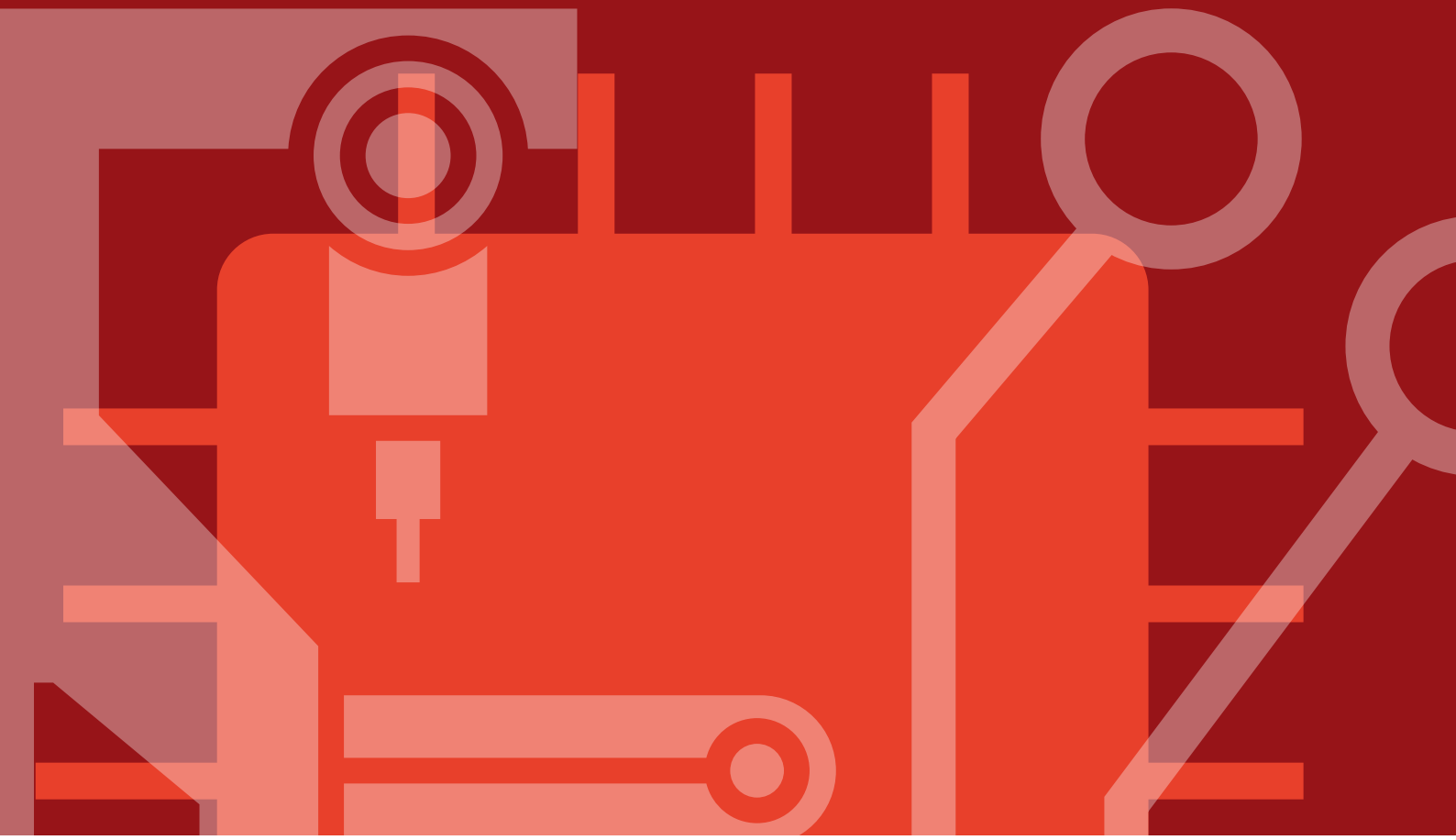

China Tech Observatory

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Mercator Institute for China Studies

China Tech Observatory

ABOUT THE CHINA TECH OBSERVATORY

The China Tech Observatory (CTO) of Mercator Institute for China Studies (MERICS) is funded by the German Ministry for Education and Research (BMBF). The three-year research project takes stock of China's progress in developing and using globally critical technology. It provides information and analysis to help decision-makers in government, business and other areas to better understand China's aims and efforts in future technologies.

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KEY FINDINGS

- Biotechnology has been a priority sector for China for two decades and is now promoted as a leading technology of the "new-quality productive forces". Public funding for research in the field has been consistent and generous, totaling at least CNY 20 billion (EUR 2.6 billion) in 2023. Judged by leading publications and Patent Cooperation Treaty (PCT) patents, China's innovation capabilities have surpassed Europe in most biotech areas, and the US in some.

- China's research and innovation capabilities in biotechnology are ahead of its domestic demand in healthcare, chemicals, energy, agriculture and other downstream markets.

- China's biotech sector needs access to overseas markets and investors, especially for its most advanced products. If this access is increasingly limited, China's biotech sector is at risk of confinement to the lower and middle ranges of the supply chain. Currently, China's main strengths are in areas where cost effectiveness is key, particularly in manufacturing active pharmaceutical ingredients, in providing contract research and in generating so-called me-too and me-better versions of existing treatments.

- European and American pharma firms have been investing heavily in Chinese biotech companies. This illustrates the growing innovativeness of China's biotech sector, which benefits from a range of government incentives.

- The potential benefits to public health, the environment and Europe's economy from collaboration should be harnessed where possible. The rapid development of testing kits, treatments and vaccines during the Covid-19 pandemic also underscores that collaboration with China, however difficult, leads to better outcomes for patients. There is more room for global collaboration than in some other areas of critical technology.

- Europe needs to match the strategic intent and policy support China offers its biotech sector, by both strengthening the environment for local capital investments and ensuring that collaboration serves EU interests.

BEIJING'S BIOTECH RISE AMID GROWING TECH RIVALRY

Biotech, the use of biological systems and organisms to develop products or processes for medical, industrial, energy or agricultural applications, is widely recognized as a strategic technology because of its potential to transform humanity's control over nature. Governments worldwide are racing to secure their positions in the field. In 2022, China for the first time issued a five-year plan for the bioeconomy with broad goals for 2025 in biopharma, bio-agriculture, bio-manufacturing and bio-security.[1] The main objective is to overcome technological challenges and achieve independence in science and technology.[2]

Beijing's aspiration to reduce its dependence on foreign links reflects the increasingly contested nature of cooperation in the biotech sector. The European Commission has proposed actions to boost biotechnology and biomanufacturing, raising the possibility of a European Biotech Act.[3] Former European Central Bank President Mario Draghi's influential report on EU competitiveness includes pharma (which partly overlaps with biotech) among the ten sectors that Europe should invest in.[4] In the US, biotech is firmly framed as part of its rivalry with China. The Biosecure Act, first presented in May 2024, seeks to ban government procurement from Chinese firms such as BGI Genomics, Wuxi Apptec, and Wuxi Biologics.[5]

This government-led pursuit of biotech dominance threatens to reverse the trend of expanding cross-border collaborations. A survey of 124 US biotech firms in May 2024 found that 79 percent engage with China-based contract manufacturers.[6] Cutting such ties could prove to be highly disruptive, slowing innovation on all sides.

This report explores the goals, trends and international ties of China's biotech sector, to help inform Europe's own strategy on biotechnology. Europe already has a strong foundation, with several firms among the world's leaders.[7] Both strengthening domestic capabilities and finding the right balance between engagement and risk mitigation with China will be crucial for Europe's long-term success.

Exhibit 1

Biopharma is by far the largest segment in China's biotech industry

SECTOR	INDUSTRY SCALE IN CHINA IN MILLION CNY	DESCRIPTION	CHINESE FIRMS
Biopharma	110	Pharmaceuticals derived from biological sources, including vaccines, monoclonal antibodies, gene therapies, and cell-based treatments	BeiGene , Jiangsu Hengrui, Legend Biotech, Innovent, Bloomage
Bioagriculture and Food	15	The application of biotechnology in farming and food processing industries, including biopesticides, biofertilizers, genetically modified crops, animal feed, and plant-based proteins	Sinochem, Da Bei Nong, Longping, Si-Gene, Cabio Biotech
Platforms and Services	13	Support through contract research, development and manufacturing services, as well as bioinformatics, the analysis of genetic and other biological data	WuXi Biologics, WuXi AppTec, BGI Genomics, Novogene, Berry Genomics
Biochemicals and Materials	7	Chemicals and materials like plastics produced using biological processes, such as fermentation or enzymatic reactions, instead of petrochemical synthesis	Meihua Group, Fufeng Group, Vland Biotech, Bluepha, Layn Natural Ingredients
Biofuels and Eco-biotech	5	Ethanol, biodiesel, sustainable aviation fuel and other fuels derived from renewable biological sources like plants, algae, and waste biomass, as well as biotech for soil remediation	Sinopec, Cofco, SDIC Biotech

Source: Tianjin Institute of Industrial Biotechnology

CHINA HAS INVESTED SIGNIFICANTLY IN BIOTECH R&D

Beijing has consistently promoted the biotech sector since the mid-2000s, dedicating significant resources to China's research capabilities. Although it is now one of the leading publishers of high-quality scientific research, this advantage has contributed little to industrial build-up. Policymakers are working to create greater synergies between the academic and corporate worlds, hoping to generate improved returns on their investments.

China's biotech policy ambitions have expanded over time

A fixture of China's industrial policy of the last two decades, biotechnology has recently emerged as one of Beijing's top priority sectors.[8] In 2024, China's government work report mentioned "innovative drugs" for the first time and biomanufacturing was cited as a key

economic growth engine.[9] It features prominently as part of the "new-quality productive forces," a political term that since mid-2024 frames Beijing's innovation and industrial policy goals.[10]

Exhibit 2

Building a strong biotechnology sector is a longstanding ambition of China's leadership

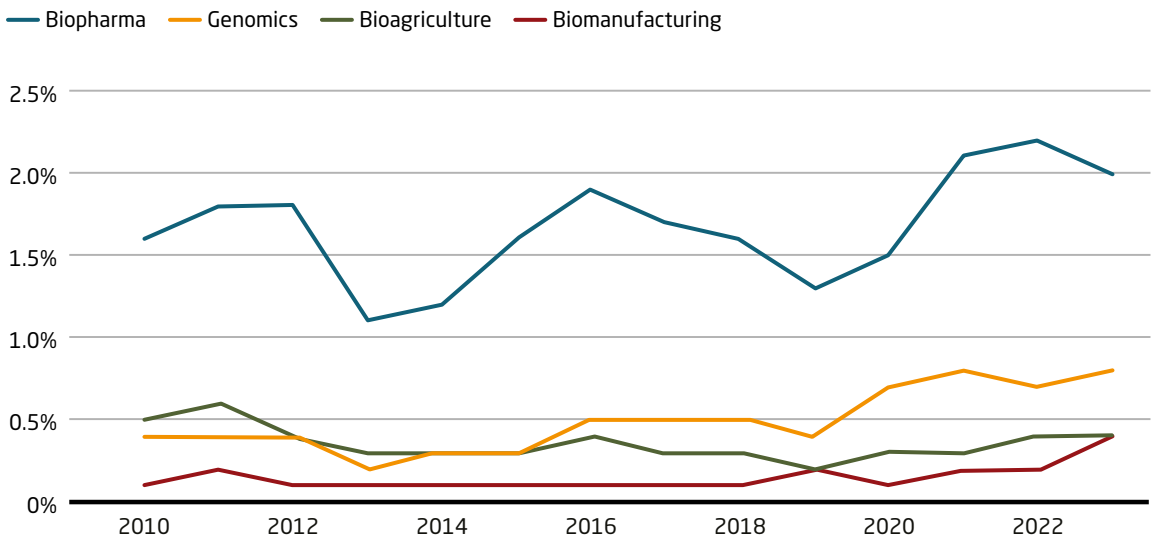
Mentions of biotechnology in top level industrial policy documents

Policies	Biotechnology focus areas
2006: Medium- to Long-Term Plan for the Development of Science and Technology	Launches three biotech related megaprojects, in the fields of genetically modified organisms, drug development and vaccines
2010: Strategic emerging industries plan	Calls for the development of large varieties of innovative drugs such as biotechnology drugs, new vaccines and diagnostic reagents, chemical drugs, as well as bio-agriculture
2015: Made in China 2025 strategy	Highlights need to develop new target chemical drugs, antibody drugs, protein and polypeptide drugs with completely new structures, new vaccines
2016: 13th Five-Year Plan National Science and Technology Innovation Plan	Includes biotechnology among key areas to develop a modern industrial technology system, covering biomedical, biomanufacturing, and biosecurity technologies; announces new megaprojects related to genetically modified organisms, new drugs and the prevention of major infectious diseases
2016: Healthy China 2030 strategic plan	Emphasizes research into medical frontier technologies such as stem cells and regenerative medicine, new vaccines and biological treatments
2017: 13th Five-Year Plan Biotechnology Development Plan	Seeks to accelerate the creation and industrialization of new drugs, and expand the application of biotechnologies in the fields of prenatal care, food production and emissions reduction
2020: Biosecurity Law	Strengthens security management for biotech research, development, and application activities, as well as oversight of the collection, storage, use, and external provision of human genetic resources
2022: 14th Five-Year Plan for the Bioeconomy	Supports research into areas such as protein science, crop phenomics, medical imaging, biological drugs and biological materials
2024: Ethical Guidelines for Human Genome Editing	Sets a precedent for the regulation of genetic research. Guidelines provide an ethical framework, divide basic and special requirements and enforce prohibition of clinical research involving germline genome editing

Source: MERICS

Biotech policy in China has focused on healthcare and foundational tech

Share of national and provincial policies that mention related key terms



The relevant key terms for each segment are as follows: Biopharma - 生物制药, 生物医药, 生物药, Genomics - 基因组, 基因测序, 遗传资源, 遗传育种, Bioagriculture - 农业生物育种, 农业微生物, 转基因, Biomanufacturing - 生物制造, 合成生物.

Source: MERICS

Biotechnology has gradually gained more attention in China's policy making, including an industry-specific plan issued in 2022 (see Exhibit 2). While earlier plans focused on enhancing China's R&D capabilities in areas such as biomedicine and genetically modified organisms (GMOs), subsequent policies have sought to convert R&D findings into applications and promote industrial development. The scope of support has expanded beyond healthcare and agriculture to include industrial, energy and environmental applications.[11]

Policy guidance often calls for cutting-edge innovations and the promotion of "future industries" in areas such as gene sequencing, biomedical materials and brain-computer interfaces.[12] While these are expected to help transform a wide range of industries in the future, the government has not pushed for widespread adoption so far. For instance, national and provincial policies mention terms associated with genomics (in particular, genetic resources 遗传资源) about twice as often as those associated with biomanufacturing and bioagriculture, reflecting the government's efforts to control the collection and use of genetic information. Most of China's efforts and successes in biotechnology are in the earlier stages of the innovation chain, as outlined in the next sections.

China is a global powerhouse in biotech research

According to OECD data, China overtook the US and the EU to become the world's leading source of impactful publications in biotech in 2016. By 2022, it had about 3-4 times Europe's output.[13] China's universities and labs employed about 30 percent of top academic talent in the world during 2019-2023, more than the US (27 percent) or Europe (12 percent), according to the Australian Strategic Policy Institute's (ASPI) analysis of highly cited papers.[14]

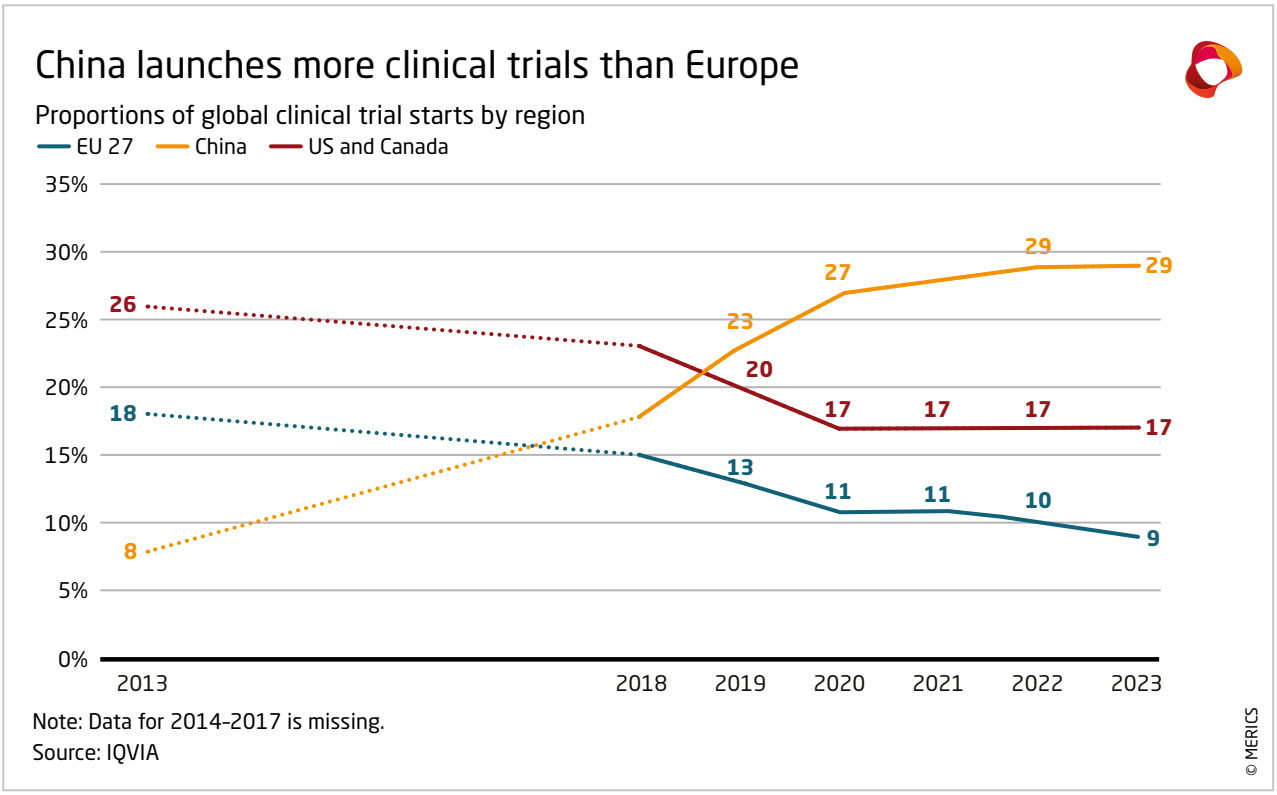
In 2023, China was the top country for most-cited papers in the fields of synthetic biology (accounting for 61 percent of global share), genomic sequencing and analysis (42 percent), novel antibiotics and antivirals (30 percent) and biological manufacturing (29 percent).[15]

This output is the result of extensive public research funding, which is likely to have exceeded CNY 20 billion (EUR 2.6 billion) in 2023. Unknown but large amounts of funding go to science and technology megaprojects in brain science, seeds and health protection.[16] The National Natural Science Foundation of China (NSFC), which supports basic research, spent at least CNY 8.5 billion, or 34 percent of its budget, on life science and healthcare research.[17] The National Key R&D Projects likely spent around the same amount through calls for projects such as synthetic biology and biomacromolecules and microbiome.[18] Structural funding also supports public labs, with over a fifth of China's 540 State Key Labs focused on biology.[19]

China's large-scale collection of genetic data supports these research efforts. The 2020 Biosecurity Law labels human genetic and other biological information and material a national resource under state control.[20] This data is gathered through the National GeneBank, operated as a public-private partnership together with BGI Genomics.[21] The platform has capacity for 46 petabytes of data, and launched a whole genome database of Chinese ethnic minority populations in 2024.[22] It aims to support research in precision medicine, future agriculture, marine development and microbes.[23]

The government is also successfully promoting China as a location for clinical trials. Although getting official approval in China often still takes longer than in Europe (about 25 weeks compared to about 12 in Germany),[24] China's large public hospitals significantly reduce patient recruitment timelines and costs, making China attractive for multinational corporations. In 2023, 29 percent of new clinical trials involved China, while Europe was involved in only 16 percent, according to the European Federation of Pharmaceutical Industries and Association (EFPIA).[25]

Exhibit 4



Research commercialization relies on state support

Despite its strengths in the R&D space, China has made only modest advances in its industrial build-up. China made up about 4.8 percent of the global biotech market in 2024, whereas the US accounted for 35 percent and Europe 31 percent.[26] To address the gap between research output and commercial capabilities, the Chinese government is taking steps to promote technology transfer. These measures include incentives for labs and firms to co-innovate,[27] reforms to intellectual property ownership,[28] as well as preferential access to capital for state-selected small and medium-sized enterprises in high-tech sectors.[29]

The number of biotech PCT patents registered by China increased from 119 in 2010 to 1,918 in 2023, according to data compiled by the World Intellectual Property Organization (WIPO).[30] In comparison, in 2023, the EU27 and the US registered 1,369 and 3,721 PCT patents. respectively.

Beijing promotes the application of these patents and research commercialization, for example through innovation alliances like the Biotechnology Future Industry (Yangtze River Delta) Innovation Alliance. Launched in June 2024 at Nantong University, it brings together universities, labs, hospitals, (state-owned) firms and government officials in the wider Shanghai region.[31] Another instrument is government guidance funds. For instance, in 2023, the State Development and Investment Corporation (SDIC), China's largest investment holding company, was tasked to lead public investment in biomanufacturing.[32] Next to setting up several investment funds with provincial governments, SDIC launched the Biomanufacturing Innovation Academy in Tianjin in December 2024, with an CNY 6 billion investment and a mission to commercialize research in enzyme preparations, amino acids, nutritious food additives and functional sugars.[33]

Shanghai: A jewel in China's biotech crown

Shanghai stands out as China's most advanced biotech cluster. The city is home to 3,000 life-science companies that employ over 270,000 people and invested USD 15 billion in research and development in 2022. The local government has attracted firms through free leasing of land, tax rebates for international talent and support for equipment purchase. In August of 2024, a further USD 4 billion in subsidies was pledged for biomedicine companies conducting clinical trials in the city.[34] In late 2024, the Shanghai government announced it will work to turn the city into a "globally influential" center for medical AI before 2027.[35]

CHINA'S BIOTECH FIRMS BEGIN TO SHOW THEIR METTLE

Even though China's innovation capabilities appear to be running ahead of its domestic market, it has still managed to cultivate a cohort of successful biotechnology companies. These players have pursued varied development pathways, including:

- Producing highly innovative drug prototypes for sale to big pharma, in the case of China's biopharma startups
- Offering integrated contract research, development and manufacturing services, as WuXi Apptec and WuXi Biologics have done
- Transitioning from research-based to commercial operations, like BGI did with its sequencing services
- Pursuing gradual technological improvement and cost reductions, like in the case of MGI's DNA sequencer technology

These models show how Chinese firms can build on the strengths of China's biotech ecosystem to produce highly competitive products and services. Yet the limited size of China's domestic market also reveals some key weaknesses. Notably, China's standard industrial playbook focusing on scale and cost reduction does not yet apply in the biotech sector. In biopharma, quality standards take priority over cost savings, and in other areas traditional forms of manufacturing are still more cost effective. This chapter will look at the key catalysts and obstacles for industrial development in the biopharma, biomanufacturing and genomics segments.

China's innovation capabilities appear to be running ahead of its domestic market

Biopharma: China's innovation leaders rely on international integration

Regulatory reform paves way for China's rise in biopharma

China's enhanced innovation capabilities have led to a surge in interest from multinational biopharma firms in drugs developed in China. EU and US pharma firms have ramped up acquisitions and out-licensing deals in China, which grant them some or all of the rights to develop, promote and sell a treatment.[36] Estimates compiled by DealForma show that the total amount of upfront payments that Chinese firms receive as part of larger deals for their R&D-stage biotech assets has grown every year since 2018, to reach over USD 2.5 billion in 2024 (until November).[37] Since AstraZeneca acquired China's Gracell Biotechnology in December 2023, there have been ten other deals involving Western and Chinese firms potentially worth over USD 1 billion in total (see appendix).[38] Additionally, more pharmaceuticals developed in China are being approved for the US and European markets; in 2024, most notably the anti-cancer drugs Fruzaqla and Ryzneuta.[39]

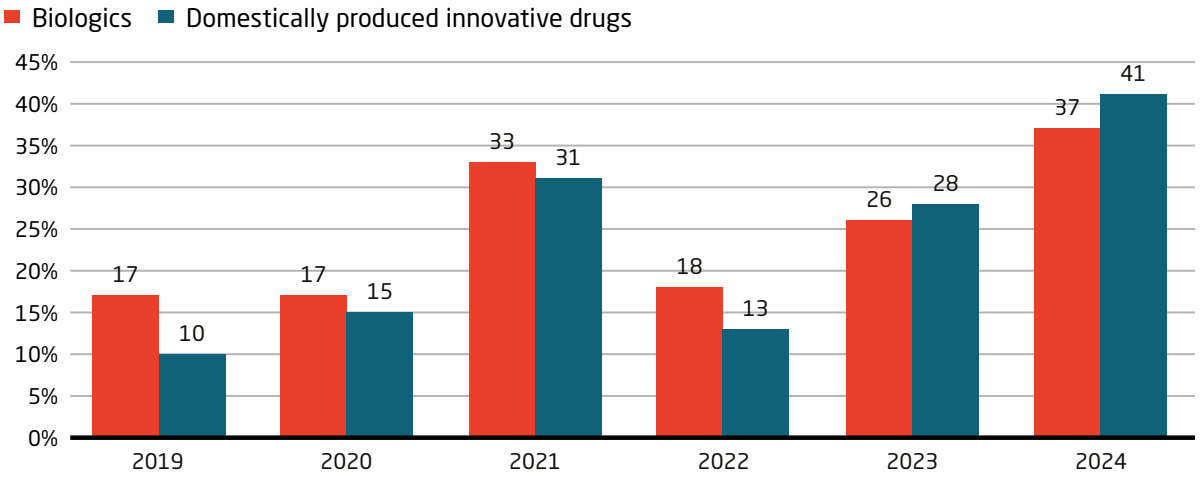
Reforms to China's drug review and approval system, coupled with the steady government support for R&D activities (see Chapter 2) provided the basis for China's growing capabilities in the biopharma sector. Two rounds of reforms were made in 2015 and 2017 to implement higher standards, streamline review procedures and expand the acceptance of overseas clinical trial data.[40] In 2017, the China Food and Drug Administration (the precursor to today's National Medical Products Administration, NMPA) joined the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH). Gradual implementation of ICH guidelines facilitated the integration of China's drug administration

system with international practices.[41] China's share of global commercial clinical drug trials has doubled since 2018 to reach 18 percent in 2023 (see Exhibit 4).[42] The number of generic drug varieties approved by authorities increased from 112 to 742 between 2018 and 2023, while approvals of innovative and biologic drugs have also grown in tandem (see Exhibit 5).[43]

Exhibit 5

Approvals of biopharma and innovative drugs are on the rise

Number of drugs approved for sale by the NMPA, by drug type



Note: the categories are not mutually exclusive. Some drugs may be both biologics and innovative drugs. Innovative drugs are those which present novel chemical structures or new therapeutic uses.

Source: PhIRDA, CCTV

China's most innovative firms depend on overseas partners and sales

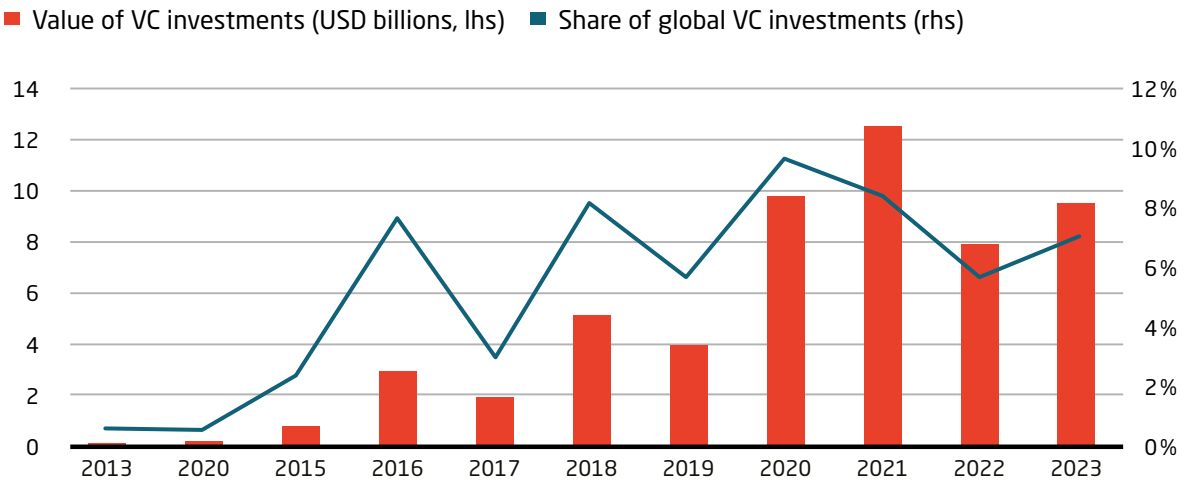
Although China has successfully built a pipeline of valuable biopharma products, the growing number of partnerships with multinational corporations (MNCs) reveals a key weakness in China's domestic market for biopharma products. To keep healthcare costs from ballooning along with its huge ageing population, China's government has rigorously restricted the cost of medication. It does so through a negotiated launch price, the National Reimbursable Drug List (NRDL), which is linked to China's public medical insurance schemes, and a complex, multi-tiered procurement system for public hospitals.[44] Average price reductions between 2019 and 2024 for new drugs added to the insurance list ranged from 50 to 65 percent.[45]

This approach limits the size of China's domestic market, constrains the profitability of firms within China, and dampens investor interest. In 2023, China represented only 7.5 percent of the global pharma sales market, while Europe accounted for 23 percent and the US and Canada 53 percent.[46] Venture capital investments in the sector have been declining since 2021, prompting Chinese media to talk of an investment winter. Although the stock of the 300 leading companies on the Shanghai and Shenzhen exchanges rose about 15 percent in 2024, those in the pharma and biology sector fell 13 percent.[47] The outcome is that Chinese firms lack the financial power to compete at the frontier of innovative drugs. On average, top Chinese biopharma firms invest a smaller percentage of their revenue in R&D (10 percent) than their Western competitors (about 20 percent).[48]

Exhibit 6

Despite sustained growth, China's share of global VC investment remains small

Venture capital investment in biotechnology in China

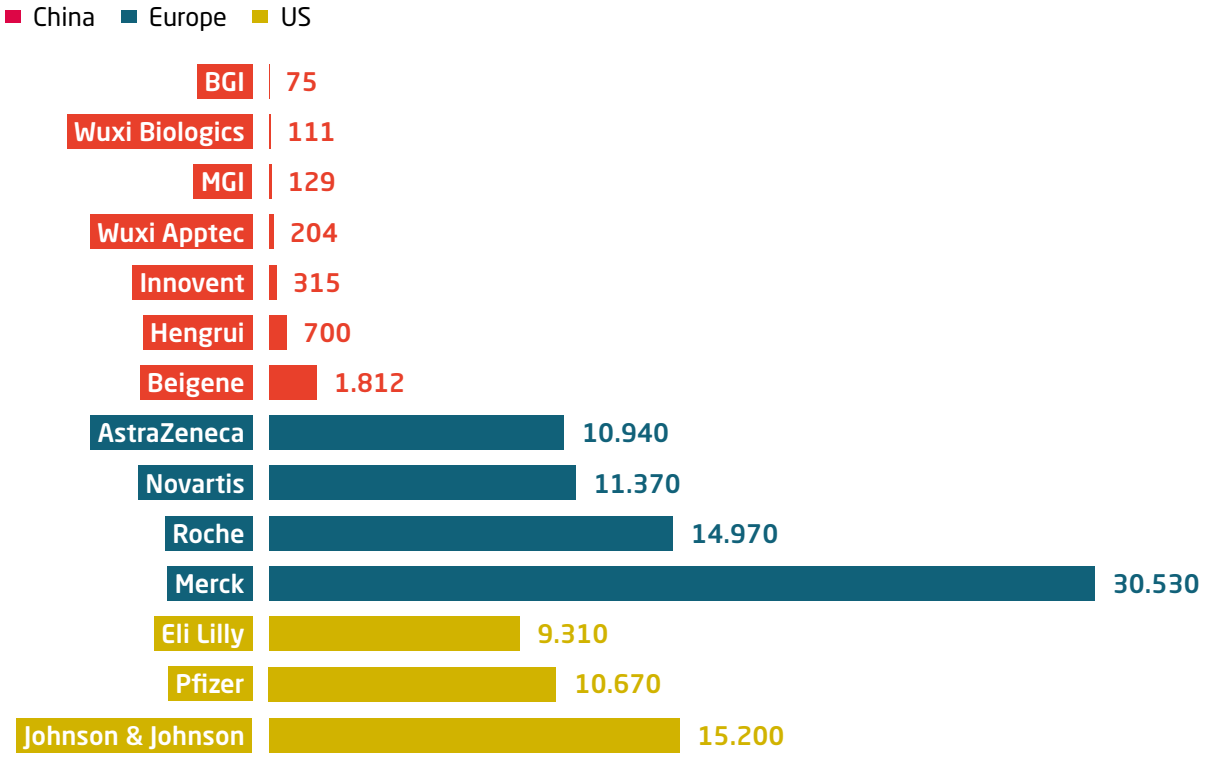


Source: Crunchbase, Stocklytics

Exhibit 7

China's biotech leaders have limited R&D budgets

Comparison of leading biotech firms in China and globally (in million USD)



Sources: MERICS, Fierce Biotech

With few prospects at home, Chinese biopharma firms working in advanced areas such as antibody-drug conjugates (ADC), cell therapies and innovative antibodies, which tend to result in high costs per patient, are focused on the North American and European markets. MNCs are stepping in to front the enormous costs involved in clinical trials and help navigate regulations across countries. For example, Chinese firm Legend Biotech developed its bone marrow cancer treatment – Carvykti – in collaboration with the US firm Johnson & Johnson, who invested USD 350 million in 2017 and another USD 200 million in the following years for meeting milestones.[49] Based on sales reaching USD 900 million in 2024, the drug is expected to generate USD 1.9 billion in 2025 and to peak at about USD 5 billion per year.[50]

Chinese biopharma firms working in advanced areas focus on North America and Europe

The way forward: Officials weigh improvements to the system

The drawbacks of China's focus on cost reduction, not only for industrial development but also public health, are a matter of ongoing debate within China. "Don't give me subsidies, give me a market," an anonymous industry insider told Caixin in November 2024.[51] Improve the pricing policy and capital and talent will flock to the sector, added Xiaobin Wu, the president and COO of Beigene.[52] Authorities are considering new rules for the pricing of innovative drugs and their inclusion in the public medical insurance scheme to help boost the profitability of local drug developers.[53] Yet the specifics of proposed reform measures are hotly contested. If they are approved and implemented, they will likely be incremental changes at best and not significantly change the investment climate.

There are also broader concerns about the efficacy of some drugs provided through the central procurement system. Many doctors suspect companies are cutting corners to meet the drastic price reductions demanded by authorities. In January 2025, the National Healthcare Security Administration began to investigate potential quality risks after members of Shanghai's political advisory body and doctors flagged issues with some generic drugs such as laxatives, blood pressure medicine and anesthetic drugs.[54]

While some adjustments are possible, an overhaul to the current system appears unlikely given the broader priorities of the central government.[55] The percentage of GDP that China spends on healthcare has already increased steadily as the population ages.[56] Beijing wants to avoid this rising further and is pursuing an anti-corruption campaign in the healthcare sector to cut down on inefficient spending.[57]

Biomanufacturing: Modest progress to date masks huge future potential

China's biomanufacturing sector could benefit from several industrial sectors where China makes up a large share of global production and demand. For example, China accounts for 40 percent of the global market in chemicals.[58] Biomanufacturing offers an opportunity to leverage biological systems, such as microorganisms and enzymes, to produce chemicals and materials using renewable resources.[59] Up to 60 percent of chemical inputs could be replaced with more sustainable substitutes this way.[60]

China's 2022 14th Five-Year Plan for the Bioeconomy calls for raising the relative importance of the sector in China's overall manufacturing layout.[61] Government funding and guidance is supporting researchers and startups to push technological boundaries and beginning to deliver results. China produces over three fifths of high impact academic papers in synthetic biology.[62]

However, the commercialization of these technologies is still in its early stages. In 2023, the biomanufacturing industry only represented 2.4 percent of China's manufacturing industry in terms of added value, whereas this figure was 11 percent in the US and 6.2 percent in Europe.[63] China's share of the global biomanufacturing market is small, at 11 percent, compared to the US and Europe, which held 36 percent and 31 percent.[64]

The key factor holding back the scaling of biomanufacturing is cost. This is particularly true in China, since its competitiveness in chemicals is based on its cost advantage. For many chemical precursors, biomanufacturing is two or three times as expensive.[65] However, this gap is progressively smaller for food, specialty chemicals and biopharma use, mainly due to the smaller scales and stricter quality requirements that drive up the cost for all production methods. As a result, the bulk of the biomanufacturing market value in China is focused on healthcare outputs (73 percent), followed by agriculture (10 percent), energy (9 percent) and chemicals (5 percent).[66]

China's shift toward bio-based materials across a range of industries will progress gradually over the next couple of decades. Yet the current investments in research capabilities suggest that they are positioning themselves to take a central role in future innovation.[67] One expert argued that China leads in synthetic biology, and that collaboration is crucial for Europe. Another noted that Chinese researchers have much better access to company-based fermentation facilities than their European counterparts.

Exhibit 8

China produces many of the world's fermented biochemicals

But it trails in the most advanced area: enzyme preparations

Product	Production (million tonnes in 2023)	Global market share (by volume)
Amino acids	6.2	68%
Vitamins	4.3	75%
Enzyme preparations	1.9	2%
Yeast	0.5	18%
Starch sugars	19.2	
Citric acids	1.7	76%
Poyol	5.0	58%

Source: Huajing Industry Research Institute 华经产业研究院

Genomics: China's champion in equipment chips away at US dominance

Through BGI Group, China's government has successfully nurtured a national champion and begun to chip away at its dependence on foreign technology in the field of genomics. The company was originally founded in 1999 as a non-governmental research institute and spin-out from the Chinese Academy of Sciences. From 2007 onwards, it began to commercialize its services, which today range from DNA sequencing to precision medicine solutions. The company produces its own genetic sequencers, mass spectrometers and medical imaging systems through its subsidiary MGI.

Close government ties and access to foreign technology have provided the tailwind for BGI's growth to date. The company has been responsible for the construction and operation of the government-funded China National GeneBank since its establishment. It developed its genetic sequencing services using third-party reagents and sequencers provided by the US firm – and global market leader – Illumina. Most famously, it bought 128 devices from Illumina in 2010 using a CNY 10 billion loan from the China Development Bank.[68] BGI has also established a wide network of overseas research centers and expanded through acquisitions, including the US firm Complete Genomics in 2013.

More and more customers in China are now opting for local genetic sequencing equipment. The domestic market share of BGI's subsidiary MGI in DNA sequencers grew to 47 percent in 2024.[69] Meanwhile, Illumina's market share in China dropped from 59 percent to 26.5 percent between 2020 and 2024. Moreover, China added Illumina to its Unreliable Entities List in February 2025, banning it from exporting to China.[70] This illustrates how China is using its domestic market to nurture a national champion, following the playbook of mobile phones and new energy vehicles.[71]

The EU, China and the US have all recognized the strategic value of the biotech sector

However, MGI is yet to make major inroads into the global market for genomics equipment. In 2024, Illumina still accounted for about 90 percent of the US and European markets for DNA sequencers.[72] In 2023, MGI generated CNY 2.91 billion (EUR 380 million) in revenue, just a fraction of Illumina's intake in the same year (EUR 4.17 billion).[73]

Corporate and geopolitical tensions mean BGI and its subsidiaries now face an uphill battle against foreign genomics companies. Relations between BGI and Illumina have been fraught ever since they became direct competitors after BGI acquired Complete Genomics and expanded into the manufacturing of sequencers.[74] BGI's global reputation has also suffered from scrutiny over its handling of sensitive data, its ties with the Chinese government and the People's Liberation Army, and its collection of genetic data on ethnic minorities in Xinjiang.[75]

EUROPEAN ENGAGEMENT WITH CHINA DRAWS SCRUTINY

The European Union, China and the United States have all recognized the strategic value of the biotech sector as well as the associated risks. Each has adopted its own approach to managing these challenges. Distinguishing between the different factors of concern, we can assess the likely level of disruption to Europe's ongoing engagement with China.

Securing the supply of critical medicines has been a central focus of the EU's biotech initiatives to date. The offshoring of production over many years has led to the build-up of dependencies on China and India to produce active pharmaceutical ingredients (APIs), chemical raw materials and certain medicines.[76] For instance, in 2021, China accounted for

about 79% of all EU antibiotic API imports by volume.[77] Shortages of widely used essential medicines have become more frequent over recent years and were exacerbated during the Covid-19 pandemic.[78]

The European Commission is seeking to address the situation through the Critical Medicines Alliance (launched in October 2023) and the proposed Critical Medicines Act, which aim to promote diversification and more local manufacturing.[79] While, if successful, these efforts would decrease imports from China, they will likely remain narrow in scope and have limited impact on Europe's overall biotech ties to China.

In China health data is treated as a national resource

China's regulation of biodata and cross-border data flows has expanded over recent years and is already causing headaches for some collaborations. Europe's approach to health data regulation prioritizes the ownership and rights of individuals, whereas in China health data is treated as a national resource. The EU has strict requirements for transferring personal data outside the EU, including health data. China's regulations on cross-border data transfers are still evolving and have so far been limited to qualified green channels in selected industries.[80] Stricter data localization requirements in China and the EU's emphasis on data protection limit the ability to share health data freely between partners and may slow down collaborative research efforts. The different approaches pose a hurdle for cooperation in fields such as personal medicine, but not an insurmountable barrier.[81] Ultimately, biotech companies and research institutions will face increased costs and administrative burdens to ensure compliance with both EU and Chinese data regulations.

Managing the degree of market access is another key policy consideration, with diverging assessments of the associated economic and national security risks across the EU, China, and the US. Current discussions in Europe focus on openness and the need to make the European market more attractive for firms to conduct clinical trials and market innovative products.[82] China's focus on cultivating home-grown players – to the detriment of foreign firms – will put downward pressure on EU-China corporate ties. Surveys among European companies in China consistently rank the pharmaceutical sector among the most challenging for market access.[83] The Chinese government is taking only small steps to expand market access. For instance, new measures released in September 2024 allow foreign enterprises to develop and manufacture cell and gene therapies (CGT) in four free trade zones and sell them nationwide.84 While many pharma MNCs saw their sales in China increase substantially between 2016-2021, sales for most firms peaked in 2021 and their share of revenue derived from China is still relatively small (in the order of 10-15 percent) due to the market size constraints (see section 3.1).[85]

Innovative drug development is an outlier, where ties may even increase. European biopharma companies are turning to China as patents on key treatments approach expiry by 2030.[86] This is driving an uptick in:

- Licensing deals: In late 2024, AstraZeneca, GSK, and Merck announced significant deals with Chinese firms (see Appendix).[87]
- Acquisitions: AstraZeneca's takeover of Gracell Biotechnologies, a company that develops cell therapies, for USD 1.2 billion and BioNTech's planned acquisition of Biotheus, a developer of cancer drugs, for USD 800 million, were announced in 2023 and 2024 respectively.[88]

- R&D operations: Boehringer Ingelheim expanded its footprint in 2020 with a EUR 445 million investment in its China External Innovation Hub, and in 2023 it pledged an additional EUR 508 million to expand its R&D operations in China.[89]

- Scouting: Roche and Bayer have set up incubators in China that allow them to nurture and eventually acquire high-potential therapies.[90]

The US could disrupt this trend. If proposed legislation such as the Biosecure Act is passed, then European firms would also be required to find alternative supply chains and possibly R&D partners, so they can continue to market their products in the United States. While the bill has bipartisan support, President Donald Trump's position on the act is not clear and could lead to it being watered down or indefinitely sidelined.

EU-China research collaboration will only become more challenging

EU-China research collaboration will only become more challenging in the context of intensifying geopolitical competition. As China has risen to become a major contributor to biotech research, ties between European and Chinese researchers have also grown.[91] Such partnerships are highly valued by European academics.[92] For instance, when it renewed its partnership with the Chinese Academy of Sciences (CAS) in May 2024, the Max Planck Institute highlighted joint research on regenerative biomedicine as one of the key outcomes to date.[93] At the same time, these partnerships are increasingly scrutinized by policymakers. In mid-2024, Copenhagen University and Aarhus University ended their long-standing cooperation with BGI, after Danish intelligence services pointed to the potential military and surveillance applications of joint projects.[94]

Caution among European policymakers about sharing knowledge with China will slow down joint research projects. International cooperation, via knowledge-sharing and industrial collaboration, is listed among the necessary steps required for the EU to seize opportunities in the Commission's communication on biotechnology and biomanufacturing released in March 2024.[95] China is notably absent from the list of key international partners outlined in the document. Yet cooperation on environmentally-focused areas of biotechnology will likely continue. Under Horizon Europe – the EU's key funding program for research and innovation – collaboration is ongoing under the Food, Agriculture and Biotechnology flagship initiative.[96]

MAINTAINING EUROPEAN COMPETITIVENESS THROUGH COLLABORATION

China has pursued a strategic and pragmatic agenda to advance its biotechnology ambitions. It has harmonized some of its regulations with international norms to attract clinical trials and foreign direct investment. It seeks to structurally favor national champions and other domestic firms by organizing loans and capital investments, promoting domestic supply-chain integration and adjusting centralized procurement, among other things.

In several biotechnology fields, China now contributes research and innovation that is more sophisticated than what its domestic demand in healthcare, chemicals, energy, agriculture and other downstream markets warrant. Unlike in other industries, where China's competitive advantage often stems from low-cost, "good enough" production, biotechnology demands higher standards. In the case of biopharma, government policy in fact constrains demand for innovative products.

Consequently, many of China's emerging biotech players to date have relied on foreign capital and markets. This set-up benefits European firms and citizens. Chinese state support

reduces the risk of drug discovery, the costs of clinical trials and the cost of prototyping and producing various bioplastics, amino acids or active pharmaceutical ingredients. Broadly speaking, it is in Europe's interest to continue this situation.

But some aspects of the current engagement are problematic for Europe. Supply-chain vulnerabilities loom large. Further outsourcing to China threatens to worsen medicine shortages, accelerate Europe's industrial decline, and erode its global competitiveness. Meanwhile, Chinese firms – along with the China-based operations of European firms – are steadily moving up the value chain. Chinese firms are aided by a skewed flow of data, and European research institutes are increasingly attuned to the ethical and dual-use risks of joint research.

Europe has an opportunity to build on the strong position it already holds in pharmaceuticals, life science and advanced chemicals to be a global leader in biotechnology. The challenge for policymakers is to reduce vulnerabilities and risks, while also maintaining or expanding engagement where it is safe to do so. Given China's pragmatic approach, there appears to be room for negotiation on issues such cross-border data regulations. The biotech boom is yet to fully materialize, and a carefully calibrated engagement with Beijing will be crucial for Europe to maximize its gains.

Europe needs to match China's strategic intent and policy support in biotech

In seeking solutions, Europe can learn from China's strategic and pragmatic approach. China pursues global collaboration where it needs foreign capital and technology and self-reliance where it can't or doesn't need access to foreign resources . While remaining open to Chinese talent, firms and investments, Europe should carefully conduct investment screening, secure the supply of critical goods and materials, and reconsider its data sharing regime to ensure collaboration serves EU interests.

Europe needs to match the strategic intent and policy support that China is offering its biotech sector. Biotech is a vast and diverse sector where Europe has significant strengths.[97] Europe can leverage its large market, strong IP protection and advantages in basic research. Like China, it needs to improve commercialization, and especially its environment for capital investments. In venture capital, the US is very far ahead of Europe, with Asia a close third.[98]

Planned laws in Europe will help to address some of these challenges.[99] The Critical Medicines Act seeks to reduce dependencies relating to critical medicines, such as antibiotics, insulin and painkillers, while the Biotech Act will facilitate the transition from the lab to production and marketing new innovations. The growing risk of disruption to globalized supply chains and innovation networks, or of Europe being relegated to a minor player in the biotech revolution, warrants ambitious action now.

Largest deals in biopharma with Chinese companies

Buyer	Seller	Field	Upfront (million USD)	Total value (million USD)	Date
AstraZeneca	Allorion Therapeutics	Oncology	40	1,100	Jan. 2025
AstraZeneca	CSPC Pharmaceutical Group	Cardiovascular	100	850	Oct. 2024
AstraZeneca	Novo Biosciences	Oncology	19	950	Apr. 2024
BioNtech	Biotheus	Oncology	800	950	Nov. 2024
BioNTech	MediLink	Oncology	25	1,800	Apr. 2024
BioNtech	DualityBio	Oncology		1,500	Apr. 2023
Candid Therapeutics	WuXi Biologics	Oncology	925	540	Jan. 2025
GSK	DualityBio	Oncology		1,300	Dec. 2024
GSK	Chimagen	Autoimmune	300	2,100	Nov. 2024
GSK	Hansoh Pharma	Oncology	185	1,500	Dec. 2023
Kailera Therapeutics	Jiangsu Hengrui	Endocrinology and diabetology	400		Oct. 2024
Merck	LaNova	Oncology	588	1,200	Nov. 2024
Merck	Curon	Oncology and autoimmune	700	1,700	Aug. 2024
Novartis	Argo biopharma	Cardiovascular	185	604	Jan. 2025
Novartis	Chengdu Baiyu	Oncology	70	3,300	Oct. 2024
Roche	MediLink Therapeutics	Oncology	50	4,200	Jan. 2025
Roche	Innovent Biologics	Oncology	80	1,000	Jan. 2025
Roche	Regor	Oncology	850	1,000	Sep. 2024
Takeda	Ascentage	Oncology	100	1,000	Jun. 2024

Sources: Bloomberg, MMM, Merck, Investerbiotech, Biospace, Labiotech, PRNewswire, Pharmamex, Takeda, Astrazeneca, Baiyu, GSK, Kailera, Wuxibiologics, BioNtech

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