The Convergence of AI and Genomics to Grow as Chinese and US National Security Priority

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Key Judgements

- The growth of artificial intelligence (AI) is causing rapid technological disruption to the genomics, pharmaceutical and biotechnology industries as AI models and AI-enabled platforms are becoming crucial for the development and deployment of drugs and other related technologies.
- The emerging importance of AI in these industries is increasing the commercial and national security importance of the datasets underpinning them, including genomic data.
- The Chinese government will continue to strongly support its biotechnology and genomics industries, utilizing state resources to give Chinese companies an advantage against international competitors and giving them greater access to centrally-controlled and populated datasets to exploit.
- China's ascent in AI and biotechnology risks enabling Chinese companies to have a commercial edge against Western rivals and potentially damaging Western national security if China weaponizes such technologies.

Increasing Competition

Growing strategic competition between China and the West – particularly the United States – will increasingly play out in the biotechnology and pharmaceutical industries, and when coupled with AI's ability to process large datasets, will increase the strategic importance of genomic data, biometric information and other types of health data. Already, Western policymakers are recognizing the growing importance of protecting these datasets, most recently evidenced by the Department of Justice's April 2025 rule prohibiting data transactions involving the transfer or access to bulk genomic data to US adversaries, principally China. In June, the US Food and Drug Administration halted clinical trials sending living human cells to China and other adversarial countries due to the Justice Department's new rule. For its part, China has long used a myriad of tactics, including both legal – commercial health data deals and legitimate access to international health databases – and illegal – data theft and cyberattacks – methods to acquire genomic and other health data. At the same time, China has emerged as a near-peer to the United States in AI development and deployment, particularly in the hard sciences.

AI Competition and the Convergence of AI and Health Data

The AI race has emerged as the most important part of technology competition between the United States and China, and China is increasingly closing the gap with the United States and may

eventually surpass it in some areas. The United States is leveraging its long-standing dominance in the software and hardware design industries to create the world's leaders in AI development, including more commercially- and consumer-oriented products and companies, like OpenAI's ChatGPT and Anthropic's Claude platforms, but the same strengths are being applied to genomic and healthcare data by large biotechnological and pharmaceutical companies, AI-focused genomic companies, universities and even large technology companies. Nonetheless, on the software and AI research side of the equation, China is closing in on the United States, if not on equal footing.

According to Epoch, an AI research consultancy tracking AI models released worldwide, US organizations released 51 notable AI models in 2024, compared to just 21 by Chinese organizations. As of mid-October, both US and Chinese organizations have released 31 notable AI models each this year. Moreover, Chinese organizations have also closed the qualitative gap in performance on many major benchmarks to achieve near parity. China has been able to close the model development and performance gap despite Western restrictions on China's access to higher performance AI accelerators, such as the most advanced chips that Nvidia builds, and the world's most advanced semiconductor manufacturing equipment needed to build such processors.

AI and Genomics

AI is already revolutionizing the genomics and broader healthcare industry due to its unparalleled ability to efficiently sift through the vast amounts of data that are found in genomic and other similar datasets. AI can be used throughout the development and testing process for developing drugs, including discovery and validation, molecule design and optimization, and clinical trials. In one example of how successful AI can be, a 2024 study found that the Phase I success rate of AI-developed drug trials was around 80-90%, far above the typical 40% using traditional methods of drug development. Organizations have developed several large genomic and drug-development focused foundational models for applications like predicting the structure of proteins and encoding functional information of proteins for drug development, particularly in de novo design of creating novel molecules and proteins for drugs, where proponents anticipate that billions of dollars in research and development can be saved through higher success rates and optimization.

Research and development of foundational biotechnology, drug development and genomic AI models are being developed by both startup companies as well as large companies. For example, French startup Bioptimus, which was founded by a former lead researcher at Google Brain is developing a universal AI foundation model for biology and its M-optimus model is taking into account a diverse set of patient data, including biomolecular, cellular, tissue, organ and patient information for drug discovery and diagnostics. Meanwhile, Nvidia has developed its BioNeMo Framework for open-source machine learning to develop biopharma models and Google's DeepMind has developed AlphaGenome, a DNA sequencing model that is available via its API suite of AI models. While Chinese entities have not publicly released as many AI models as US counterparts in these areas, Chinese researchers have published several papers on the matter and, in September, China's leading biotechnology firm BGI Genomics launched its 133111i Multi-omics Precision Health Management System, an AI-powered system designed to integrate big data for disease prevention and health management, utilizing vast amounts of different datasets.

National Security Concerns of Genomic Data

The datasets that underpin these AI revolutions in genomics and biotechnology are emerging as among the most strategic sets of data a country can possess for national security, commercial competitiveness and public health reasons. In order for these biopharma and genomic AI models to be trained, fine-tuned and developed, they need access to a wide range of genomic, patient, biomolecular and other data. Moreover, countries need to have access to data that comes from not only a large population, but also from a number of different ancestries if they want to develop drugs or perform gene-editing across a large set of humans.

For a country like China, which has few domestic ways to collect genomic and other related data from people of European ancestry, accessing overseas databases is crucial in closing the gap, whether it be for legitimate purposes, like trying to develop a commercial drug to export overseas, or nefarious purposes. Even for Western companies, having a diversified set of data is crucial commercially to compete with Chinese and Asian companies in non-Western markets with non-Western ancestries. From a national security perspective, however, genomic data when coupled with AI also has the ability to be more easily weaponized by adversaries. In 2021, two doctors at US firm Collaboration Pharmaceuticals found that their AI-enabled de novo molecule generator could be abused to create toxic molecules and thousands of both known and unknown toxic chemical warfare agents, demonstrating how countries could exploit these systems to develop bio and chemical weapons, including ones that are designed to target specific population groups based on genomic information, such as only affecting an adversary's population.

China's Growing Focus on Genomics and Life Science Research and Development

Over the next five years, the Chinese government will implement an aggressive state-led and coordinated effort to boost its life science, biotechnology and genomic capabilities as a pillar of its national strategy. While it has not been publicly released, China's 15th Five-Year Plan, which was approved by the Communist Party's central committee at its Oct. 20-23 plenum and will likely be revealed in the coming days, as well as its successor(s) to the Made in China 2025 Initiative, are likely to set the development of these areas as a top priority for China in the coming years and to detail their integration with AI and greater state support via "self-reliance" mandates.

In recent years, China's plans have already become increasingly ambitious regarding biotechnology and life sciences, including in the 14th Five-Year Plan, which among other things set a goal to expand investment into biotechnology by 10% annually and become the world's leader in biotechnology by 2035. President Xi Jinping has repeatedly mentioned biotechnology and life sciences as a focus area for his administration, including it as a part of China's "new productive forces" industries to modernize the Chinese economy.

For decades, China has also placed biotechnology and genomics into its broader concept of Military-Civil Fusion, integrating the development of the technology with the People's Liberation Army's own development – a relationship that has only led to more concern by Western governments due to China's collection of information that could be used against the West or China's minority groups.

In order to fulfill Xi's vision, the Chinese government and companies have rapidly built out their genomics and biotechnology industry over the past 15 years. Today, the sheer scale of China's research and development is staggering, with China now being home to more than 100 biotechnology research parks. Chinese researchers are also publishing more highly cited research papers on biotechnology than US counterparts, demonstrating that on the basic science and research part of the industry, China, like in AI, is catching up to the United States, reinforcing Western concern about China's rise. Commercially, a number of Chinese companies have emerged as globally competitive in recent years, including aforementioned BGI Genomics; WuXi AppTec, the largest provider of contract drug research and manufacturing services company in Asia; and BeiGene, a cancer drug development company. China's share of pharmaceutical licensing deals exceeding $50 million in upfront payments grew from just 2% in 2015 – and remained below 5% from 2015-19 – to 31% in 2024, according to DealForma, and in 2024 its share of global drug development rose to 30%, placing it second behind the United States. In fact, in a report published in 2025 tracking competition in different critical domains, Harvard researchers singled out biotechnology, especially for drug development, as the most likely area for China to overtake the United States.

Chinese Biotech Innovation Strategy

One of the reasons why China has been successful in quickly closing the gap with the United States has been the close relationship between the government and R&D, and this cooperation will only be enhanced as AI becomes more crucial for genomics and biotechnology. China's government has been able to strongly centralize data collection, database management and more easily allow researchers and developers to access Chinese genomic and other health data, putting it in a strong position to leverage AI and other tools to process that information. This strategy contrasts with the West, where data generated by the private sector and those available in the centralized databases have more controlled access due to privacy and other related restrictions. The Chinese convergence between the private sector and government interests is perhaps most closely demonstrated by China National GeneBank, China's first national-level gene storage bank, which is operated by BGI Group. For its own sovereignty purposes, China has also sought to increase control over its genomic and other health data with its 2020 Biosecurity Law, which places a range of restrictions on foreign entities accessing, storing and processing Chinese human genetic resources.

Increasing Western Prioritization

Western governments' concerns about the convergence of China's biotechnology and AI industries will only rise over the next few years. In addition to the new rules adopted by the Justice Department and FDA earlier this year, the National Security Commission on Emerging Biotechnology published an action plan for the United States to maintain dominance in biotechnology in April 2025, clearly placing competition with China at the forefront of importance. The commission called for the United States to not only expand its own government-led biotechnology strategy and incentivize the public sector to expand its own activities, but also for the United States to take steps to slow China's rise in biotechnology, such as by implementing outbound investment restrictions on biotechnology, reducing China's access to bulk biological data from the United States and imposing country-wide export controls for goods supporting China's biotechnology industry, including biotechnological goods, biological data, human capital and related IP.

Congress is also making progress on a revamped Biosecure Act and could pass it by the end of the year. The US Senate on Oct. 9 approved a measure to include a revamped version of the Biosecure Act in the National Defense Authorization Act (NDAA), the annual must-pass piece of legislation that will likely pass by the end of December. The modified version of the bill still attempts to block federal contracts from benefiting Chinese biotechnology companies, but instead of naming a list of specific Chinese companies affected, it refers to the Pentagon's list of Chinese Military Companies as companies to be restricted. Notably, BGI Group is listed on the Pentagon's list, but WuXi AppTec, which has facilities in the United States, is not included on the list Pentagon's list and was originally included as a target in the 2024 version of the Biosecure Act that failed to pass over concerns about due process for affected companies. The bill also allows for additional companies to be listed in a process controlled by the Office of Management of Budget but provides them with an ability to argue against being listed. The new bill still needs to be added to the House version of the NDAA but given that the House passed the previous version of the Biosecure Act with a two-thirds majority vote in 2024, it is likely that the updated version will be approved. To learn more about the Biosecure Act, please read the Health-ISAC and CyberCX analysis here.

More Safeguards May Mean Increased Value

Growing US and other Western restrictions on China's access to genomic and other healthcare information as well as technology underpinning the biotech and pharmaceutical industries will only drive Chinese threat actors to try to acquire the information using other means. Chinese cyber threat actors have carried out a number of cyberattacks designed to collect information from Western healthcare providers, biotechnology firms and pharmaceutical research and development centers. With AI enabling China to process even more vast amounts of information, China will have a greater appetite to process this information for nefarious purposes if it chooses and is less likely to run into resource constraints of using the data that it steals.

China is also likely to retaliate against Western biotechnology firms over restrictions the West adopts. China placed Illumina, the world's leading producer of gene-sequencing machines, on its list of Unreliable Entities in March amid growing restrictions on each other, enabling China to place broad restrictions on Illumina, including restrictions on the company's access to Chinese goods. With China becoming more willing to place restrictions on rare earth exports in connection to technology and trade tensions with the West, China is only likely to expand such restrictions on life science companies and exports of similar goods in the future.

Health Sector Impact

The existing AI race between the United States and China introduces a significant national security risk that exacerbates the concerns over the use of AI in the health industry. Genomic data is considered a strategic national resource, leading to a competitive dynamic over its acquisition. China has been seeking to acquire large and diverse datasets through commercial partnerships, but also through cyber intrusions. This poses a new risk for the health sector, as Beijing may continue to sponsor attacks on Western industries to further national economic plans. On the other hand, regulatory impositions by both China and the US threaten to fragment global research initiatives, leading to potential shortages of diverse datasets needed to train AI models and slower global advancements in health.

As AI tools become easily available and highly exploited in state-sponsored programs, concerns for ethical compliance and dual-use concerns emerge. The application of AI to process highly sensitive human data creates significant privacy risks as they could be used to reveal a person's identity or health issues from seemingly anonymized data, making them targets for extortion campaigns. Another severe threat is the dual-use potential for developing advanced weapons. AI-powered drug discovery tools can be repurposed to develop toxic compounds and, thus, facilitate the creation of chemical and biological weapons. This alarming potential requires strict global frameworks to ensure that AI's capabilities are not extended exclusively for malicious use.

Artificial intelligence will continue to play a critical role in the innovation of the biotechnology industry and the health sector as a whole. Members are encouraged to engage with artificial intelligence as an innovative tool for automation and innovation, including in the cyber defense landscape. However, careful considerations are called for; privacy and ethical compliance must be ensured at all times. To mitigate the risks associated with the use AI to acquire and manipulate sensitive data, members are advised to implement the following key measures:

- **Data security:** Members are encouraged to encrypt all genomic datasets and make sure data sent to AI models is stored securely.
- **Human oversight and accountability:** require human oversight for all critical AI decisions, particularly those directly related to patient contact and treatment, to ensure both accountability and accuracy.