China's amassing of genomic data highlights global biotech race

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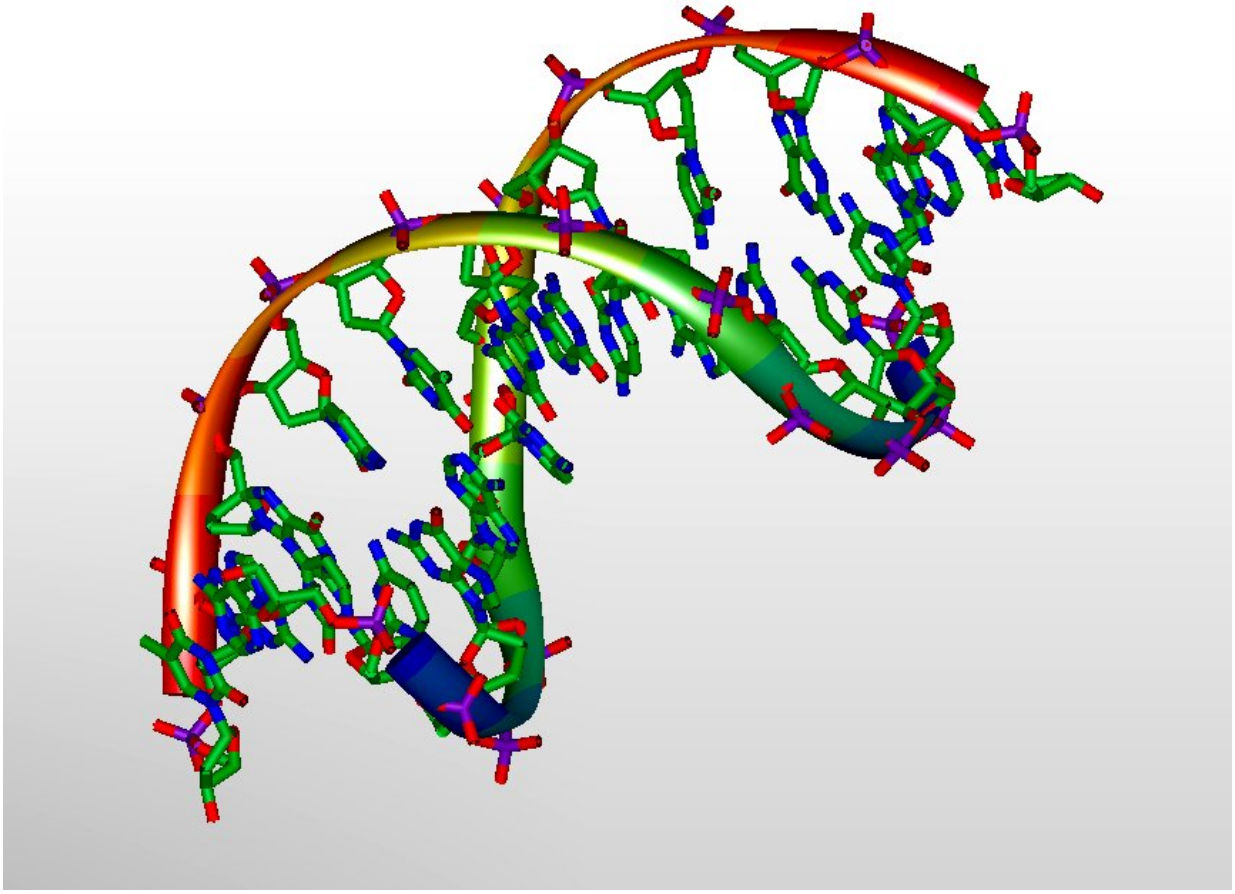

3D-model of DNA. Credit: Michael Ströck/Wikimedia/ GNU Free Documentation License

"Losing your DNA is not like losing your credit card."

That little-noticed warning from the top U.S. intelligence office came in February, alerting Americans of the risks of inadvertently handing over their genetic codes to China.

Unlike a misplaced credit card, lost DNA cannot be replaced, the Office of the Director of National Intelligence said in the bulletin, adding that Beijing, as part of its quest to become a global leader in biotech, is aggressively collecting large quantities of genomic data from around the world.

To meet the surging global demand for tests as the COVID-19 pandemic spread last year, one of the leading Chinese biotech firms, BGI, sold test kits to 180 countries and established labs in 18, the lead spy agency says, warning that the genetic data it was collecting could be flowing into Chinese databases.

Although there are no Chinese COVID-19 test labs or kits in the United States yet, China is seeking Americans' genetic data either by acquiring U.S. genomic sequencing companies or by buying a stake in popular genetic testing companies such as 23andMe. Beijing also has been partnering with U.S. hospital chains to provide cheap genomic sequencing services, according to the agency and a recent report by the U.S.-China Economic and Security Review Commission.

Left unchecked, China's advances in biotech could lead to drug discoveries capable of undermining the U.S. pharmaceutical industry, the agency said.

"No 23andMe genetic testing is performed in China or by any China-based or Chinese-owned entities,"Andy Kill, a spokesman for the company said in an email. "We do not share any individual level

customer data with any entity located in China, or any China-based or Chinese-owned entities."

Some lawmakers, national security experts and biotech researchers are concerned about the kinds of advances China is seeking to make in the world of life sciences even as most of the world's attention is focused on China's advances in military hardware and Beijing's role in ongoing cyberattacks and internet-based espionage.

"China has amassed the largest genomic holdings of anywhere in the world," Anna Puglisi, a senior fellow at the Georgetown University's Center for Security and Emerging Technology, told the Senate Intelligence Committee at a recent hearing. "Understanding what genes do, and so access to that kind of data, both their own and from other places in the world, gives them an advantage in figuring out" how to develop medicines.

Faced with an aging population and expected massive costs associated with future health care needs, China is focusing on precision medicine, or formulating medications tailored for people with specific genetic conditions.

Sens. Ron Wyden, D-Ore., and Marco Rubio, R-Fla., are among lawmakers alarmed at China's global genome grab and are pushing agencies to ensure that Americans' health data doesn't end up in Chinese hands.

Biological revolution

But the potential for advances in biotech to yield tailored medicines is only a small part of a much larger set of gains for any country that masters the coming revolution in biology, which experts say could rival or even exceed that of the digital age that yielded computers and the

internet.

"Advances in biological sciences, combined with the accelerating development of computing, data processing, and artificial intelligence, are fueling a new wave of innovation that could have significant impact in sectors across the economy, from healthcare and agriculture to consumer goods and energy," the McKinsey Global Institute said in a May 2020 report titled "Bio Revolution."

McKinsey collected examples of as many as 400 potential applications, more than half of them outside health care, and estimated that they could have "direct economic impact of up to $4 trillion a year over the next 10 to 20 years."

Synthetic biology, which refers to redesigning biological organisms to have new properties, could lead to as much as 60 percent of the world's physical inputs being made using biological means, including manufactured silk, leather and non-carbon-based plastics, the McKinsey report said.

Alarmed by China's aggressive ambitions to become the world leader in science and technology in the next decade, the Senate and House have individually passed bills that would provide nearly $80 billion to the National Science Foundation and to national labs overseen by the Department of Energy.

The measures would provide funding to the NSF and labs to focus on 10 critical areas, including biotech. None of the bills has passed both chambers.

Despite such legislation, policymakers and members of Congress are still more focused on competition in digital technologies—such as artificial intelligence and quantum computing, for example—than on the potential

for synthetic biology to transform the U.S. economy, according to experts.

Although the United States "basically invented the bio revolution," national investments are still focused on health care needs such as beating cancer or finding cures for other illnesses, and less on translating gains in biology into the broader economy, said Tara O'Toole, executive vice president at In-Q-Tel, a venture capital firm that focuses on investing in technologies relevant to U.S. intelligence agencies.

China, on the other hand, is rapidly building a government-funded, commercially oriented translation machine that aims to take the fruits of synthetic biology to transform agriculture, food production and other manufacturing on a global scale, O'Toole said.

'Carbon efficient'

Biotech experts often cite the example of Impossible Foods for how biology can revolutionize broad sectors of the economy. The California company's burgers and sausages are made using altered plant proteins that mimic the taste and feel of beef and pork without downsides of animal proteins, such as high cholesterol or factory farming of cows and pigs.

The plant-based alternatives "are just cheaper and more carbon-efficient" than the animal products, said Jason Kelly, co-founder of Gingko Bioworks, a Boston-based biotech company that programs biological cells to create new strains that are more cost-efficient in developing medicines, food and manufacturing.

Instead of trying to bring electronics manufacturing back to the United States from cheaper locations in East Asia, for example, the country could focus on building a new category of manufacturing using

genetically engineered plants that make products, Kelly said.

The vast farmlands of the Midwest could become a new kind of manufacturing facility growing engineered plants, Kelly said.

Scientists already have engineered mushrooms to make leather and programmed DNA to store data files—all of Shakespeare's sonnets and a snippet of Martin Luther King Jr.'s "I Have a Dream" speech have been encoded in DNA because it can store vastly more information for longer periods than a silicon chip can.

The use of mRNA vaccines against COVID-19 is another example of synthetic biology in action.

The importance of biotech for U.S. national and economic security is not lost on mathematician and geneticist Eric Lander, who is director of the Office of Science and Technology Policy and President Joe Biden's top science adviser.

In a recent op-ed in The Washington Post, Lander wrote that the United States should set a goal of developing an effective vaccine within 100 days of detecting any future pandemic and then be able to make enough doses to supply the world within 200 days.

The U.S. should aim to get rid of sterile needles and injections and deliver vaccines through skin patches, Lander wrote, adding that a global early-warning system ought to be in place to monitor and respond to biological threats.

"These goals are ambitious," Lander wrote. "But they're feasible," he said, citing the example of NASA's Apollo program that sent humans to the moon.