

China and the Future of Nanoscience

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China is soon to take the future of nanoscience and nanotechnology in its hands, given the country's massive investment in many fields relating to nanotechnology such as drug delivery, cancer research, tissue engineering, artificial intelligence, robotics, etc., coupled with the full support of the Chinese government. Nanotech has been recognized as a strategic industry in China's 13th Five-Year Plan, and the country is planning to compete on a global scale in this field.

Everything about [China](#)'s drive to become a leading innovator works on a giant scale. Ambitions are enormous, budgets are vast and the focus is widespread. And in many fields, it's beginning to close the gap with U.S. and European institutions. But it's in the study of materials on the scale of a billionth of a meter — nanoscience — that [China](#) is already fast overtaking its international rivals.

From cloning to cancer research, [China](#) is using nanoscience and nanotechnology innovation to drive some of the world's biggest breakthroughs. In July, an international team of researchers led by Chinese scientists developed a new form of synthetic, biodegradable nanoparticle. Capable of targeting, penetrating and altering cells by delivering the CRISPR/Cas9 gene-editing tool into a cell, the nanoparticle can be used in the treatment of some single-gene disorders, as well as other diseases including some forms of cancer.

In a separate project, scientists at [China](#)'s Nanjing University have used nanoparticles to target and destroy abnormal proteins known to cause breast cancer. Tests in mice showed the treatment reduced the size of tumors by half compared to the control group. At the University of Science and Technology of [China](#), a team of researchers claims to have given mice infrared night vision by injecting nanoparticles into their eyes.

And at the State Key Laboratory of Robotics in the northeast city of Shenyang, researchers have developed a laser that produces a tiny gas bubble. This bubble can be used as a tiny "robot" to manipulate and move materials on a nanoscale with microscopic precision. The

technology promises new possibilities in the field of artificial tissue creation and cloning. These innovations are backed up by a scale of research that's unmatched. In 2018, Chinese researchers were on their own responsible for 40 percent of all global scientific papers in the field, with the U.S. (15 percent) a distant second.

Nanotechnology supports biomedicine and quantum technology development and makes its way into everyday life through advancements in consumer electronics and artificial intelligence, all areas where [China](#) seeks global dominance. Being at the forefront of cutting-edge nano research greatly improves [China](#)'s prospects for success, especially in biomedicine, where it has long trailed rivals.

"Drug delivery, nanomedicine and tissue engineering are rapidly growing fields that rely on our ability to engineer nanoparticles and biomaterials targeted at specific cells, such as cancer cells, to enhance the therapeutic efficacy," says Dr. Omid Kavehei, deputy director of the University of Sydney Nano Institute.

[China](#)'s gains could help it win critical patents in advanced research in fields like cancer, where the U.S. has historically led.

Strong state support in nanoscience — as in tech fields such as artificial intelligence and robotics — is also a key advantage for [China](#). Bai Chunli, president of the Chinese Academy of Sciences (CAS), conceded publicly in August. The importance the government places on competitiveness in the field is underlined by its inclusion as a strategic industry in [China](#)'s 13th Five-Year Plan, ensuring state funding and legislative and regulatory support. Nanotech research is also a key component of the ambitious Made in [China](#) 2025 initiative aimed at turning [China](#) into a high-tech manufacturing powerhouse.

That's allowing [China](#) to find success in myriad areas of nanotechnology. A new nanomaterial invented by CAS scientists promises to eliminate millions of metric tons of liquid pollution and emissions from organic chemicals used in printing plates and ink. It is one of the headline acts for CAS as it drives to apply nanotechnology innovation to the development of consumer tech. So far, the project has landed \$780 million in investment.

In an October 2019 paper published by science journal Nano Energy, Dalian Institute of Chemical Physics announced the creation of a tiny lithium battery that is resilient to low

temperatures, capable of operating at 80 percent efficiency at temperatures of -40 degrees Celsius. While the battery presents huge potential for industries from electric cars to mobile devices, the ability of the battery to operate at extreme temperatures is particularly important to the future of space technology.

Industry experts point to the return of foreign-trained Chinese researchers to the Middle Kingdom, lured by the promise of readily available funding, as an important factor of [China's](#) progress. The next step is for [China](#) to become self-sufficient in developing talent. "Currently [China](#) still relies on collaborations with foreign institutions in most of the subfields of nanoscience and nanotechnology," says Shengfu Yang, nanochemistry professor at the University of Leicester. The nanoparticle that delivers the gene-editing tool into cells was developed in partnership with scientists at Tufts University in the [United States](#), for instance.

Enhancing innovation in the private sector will also help [China](#) kick on, says Zheng Xiao Guo, professor of chemistry and mechanical engineering at the University of Hong Kong. "State-funded institutions have played a far bigger role in nanotechnology innovations, and ... private institutions or enterprises in this area are not as strong," he says.

But the number of private companies driving nanotech product innovation is rapidly growing, Zheng concedes. Nanopolis, the world's largest nanotech industrial zone, located in the eastern city of Suzhou, houses several private multinationals and new Chinese startups across nanotech fields. [China](#) now also leads the globe in newly established nanotech companies. In 2018, Tencent founder Ma Huateng joined a number of high-profile businesspeople in financing the establishment of [China's](#) first private research institute, Westlake University, with nanotech a main focus for research.

Private-sector involvement opens new and unique pools of funding and talent, and the focus is on applicable research — even in a country like [China](#), where state-sponsored institutions still dominate, say experts.

That combination of a growing talent pool and a state-sponsored desire to become a global leader, with an expanding private-sector ecosystem, will be hard for other countries to match. [China's](#) big leap in small science is just starting.

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