America's 'Miracle Machine' is in desperate need of, well, a miracle

By Eric S. Lander and Eric E. Schmidt, May 5th

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An engaging first sentence catches the reader's attention.

For more than a half century, the United States has operated what might be called a "Miracle Machine." Powered by federal investment in science and technology, the machine regularly churns out breathtaking advances.

The opening paragraph expresses the primary focus of the op-ed: America's leadership in research has provided huge societal benefits and needs to continued federal support.

The Miracle Machine has transformed the way we live and work, strengthened national defense and revolutionized medicine. It has birthed entire industries — organized around computers, biotechnology, energy and communications — creating millions of jobs. It's the reason the United States is the global hub for the technologies of the future: self-driving cars, genome editing, artificial intelligence, cancer immunotherapy, quantum computers and more.

Our machine is the envy of the world. And yet, while other nations, such as China, are working furiously to develop their own Miracle Machines, we've been neglecting ours. Though historically a bipartisan priority, science and technology funding has steadily eroded over the past decade. One example among many: Adjusted for inflation, the budget for the National Institutes of Health, the federal medical research agency, has fallen since 2003 by nearly 25 percent.

Body paragraphs are short, each containing a singular point to develop the author's story.

In this op-ed, the authors use these paragraphs to relate the benefits of federally funded research to the values of voters who care about national defense, jobs, and US competitiveness.

If the Trump administration and Congress want to ensure that the United States remains the most powerful nation in the world, they should embrace and support our Miracle Machine. The spending bill that Congress passed this week represents a good step, but there's still a long way to go to recover lost ground and secure our leadership.

The Miracle Machine can be traced back to a report during the closing days of World War II called "Science: The Endless Frontier." The blueprint saw the power of bringing together two interlocking engines — the public sector and the private sector — to drive progress and innovation.

The United States has the most dynamic private sector in the world, with entrepreneurs, investors, big companies and capital markets all eager to license technologies and launch start-ups. But those ventures are often driven by technologies that come from basic research. Few companies

undertake such research because its fruits are typically too unpredictable, too far from commercialization and too early to be patentable.

That's where government comes in. While investing in basic research typically doesn't make sense for a business, it has been a winning strategy for our nation. For 60 years, the federal government has invested roughly a penny on each dollar in the federal budget into research at universities and research centers. In turn, these institutions have produced a torrent of discoveries and trained generations of scientific talent, fueling new companies and spawning new jobs.

For starters, investing in curiosity about the natural world has paid stunning dividends. Exploration of bacteria that thrive in geysers or salt flats led to breakthrough tools that can make millions of copies of DNA molecules, repair disease-causing mutations in living cells and use light pulses to fire nerve cells. Studies of fruit fly embryos led to drugs to treat skin cancer. Academic ideas inspired by neurons ultimately led to the artificial-intelligence revolution that is transforming industry today.

Building powerful tools without worrying about precisely how they'll be used has also turned out to be a great public investment strategy. Fundamental physics studies, funded by public investment, gave us high-energy particle accelerators, which are now a mainstay in pharmaceutical drug development, and atomic clocks, which enable the Global Positioning System that guides travelers to their destinations.

And we've witnessed firsthand that creating and sharing mountains of scientific data can drive both exploration and commercialization. The $4 billion NIH investment in the Human Genome Project, which one of us (Lander) co-led, dramatically accelerated the understanding of human disease — and unleashed roughly $1 trillion in economic activity. That's like $5 in a savings account growing to $1,250.

Finally, tackling novel engineering challenges has laid the foundation for new industries. In the late 1960s, federal grants to universities to explore message-passing among computers led directly to the Internet. A $4.5 million National Science Foundation grant to Stanford University in 1994, to explore the idea of digital libraries, helped contribute five years later to the creation of Google. Today, the U.S. taxes paid each year by the company and by its more than 40,000 domestic employees total in the billions — a good portion of the NSF's annual $7 billion budget.

Crucially, when scientific breakthroughs spawn new industries and jobs, those benefits occur right here in the United States — because companies want to remain close to the flow of new discoveries and experienced workers.

The closing paragraphs reiterate the main point that scientific research is beneficial but needs more support.

The final sentences ends with a memorable but bleak forecast if the government doesn't adequately fund federal research.

The Miracle Machine has been astoundingly successful. The problem is that too few people — in government or in the public — know how it works. As a result, we've been letting it fall into disrepair.

If we don't change course and invest in scientific research, we risk losing one of America's greatest advantages. To our lasting detriment, we may wake up to find the next generation of technologies, industries, medicines and armaments being pioneered elsewhere.