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OP-ED

How curiosity begat Curiosity

Scientific breakthroughs come from investing in science education and basic research.

By Ahmed Zewail

On Aug. 5, I was among those who witnessed the rover Curiosity landing on Mars in real time at NASA's Caltech-managed Jet Propulsion Laboratory. The excitement was overwhelming: The one-ton Mars Science Laboratory broke through the Red Planet's atmosphere, slowed its speed from 13,000 mph to almost zero and touched down. One glimpse of those first images from more than 100 million miles away demonstrated America's leadership in innovation.

Curiosity — the rover and the concept — is what science is all about: the quest to reveal the unknown. America's past investment in basic science and engineering, and its skill at nurturing the quest, is what led to the Mars triumph, and it is what undergirds U.S. leadership in today's world. But now, decreases in science funding and increases in its bureaucracy threaten that leadership position.

After World War II, scientific research in the U.S. was well supported. In the 1960s, when I came to America, the sky was the limit, and this conducive atmosphere enabled many of us to pursue esoteric research that resulted in breakthroughs and Nobel prizes. American universities were magnets to young scientists and engineers from around the globe. The truth is that no one knew then what the effect of that research would be; no one could have predicted and promised all that resulted. After all, it is unpredictability that is the fabric of discovery.

In much of academia today, however, curiosity-driven research is no longer looked on favorably. Research proposals must specifically address the work's "broad relevance to society" and provide "transformative solutions" even before research begins. Professors are writing more proposals chasing less research money, which reduces the time available for creative thinking. And with universities facing rising costs generally, professors are more and more involved in commercial enterprises, which may not always push basic research forward. Even faculty tenure may be driven less by how good one is at science than how good one is at fundraising.

These constraints and practices raise the question: Would a young Albert Einstein, Richard Feynman or Linus Pauling be attracted to science today? Would they be able to pursue their inquiries into fundamental questions?

A generation ago, at the same time that government was supporting curiosity-based research, so was U.S. industry. One of the jewels was Bell Labs, where fundamental research was so advanced that it used to be said that it was "the best university in America." Bell Labs employed some of the world's leading scientists and engineers, and collectively they made pioneering contributions, from the discovery of the tiny transistor to the "big bang" origin of our universe.

The broad-based fundamental research at Bell Labs is no longer pursued, and other industrial labs have, for the most part, disappeared or redirected their resources into much more product-oriented research.

I teach at Caltech and oversee a research laboratory there. In general, I find that the majority of young people are excited by the prospects of research, but they soon discover that in the current market, many doctorate-level scientists are holding temporary positions or are unemployed. The average age at which principal investigators receive their first major government grant has risen, and experience from multiple postdoctoral positions is often necessary for advancement in academia. This slow track discourages young scientists from pursuing research careers.

So what is the formula for better "managing" discoveries? The answer is in the natural evolution of research and development, from curiosity-driven science to technology transfer and then to societal benefits.

We must nurture creative scientists in an environment that encourages interactions and collaborations across different fields, and support research free from weighty bureaucracies. The nation must provide young people with a proper and attractive education in science, technology, engineering and math. And the best minds from around the world should be encouraged, not discouraged, by public policy to join in this American endeavor. In sum, a renewed vision for investment in fundamental research is needed, especially in Washington, where further cuts across the board in science funding are being contemplated.

In the 1950s, Nobel laureate Robert Solow showed that new technologies create a large portion of economic growth, affecting nearly 75% of the growth output in the U.S. The theory of quantum mechanics alone has had a major impact. Without it, revolutionary technologies would not have been realized. Think of the laser, optical communications, MRI and discoveries in drug design, gene technology and miniaturization. At the same time, American influence in the world is bolstered largely through its "soft" power, and science and technology is an essential force of this influence, according to the Pew Research Center's Global Attitudes Project poll.

Since the Industrial Revolution, the West has dominated world politics and economics with the power of science. Since the mid-20th century, the United States has been at the center of that dominance, and more recently, China is pouring resources into R&D to reach first world status. The U.S. can still maintain research institutions, such as Caltech, that are the envy of the world, yet it would be hubristic and naive to think that this position is sustainable without investing in science education and basic research. We do not know now what will be relevant tomorrow.

American innovation and leadership put the rover Curiosity on Mars. Now is the time to recommit to the wise vision that made it happen — otherwise the sun of innovation will come from the east.

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