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# Will America Kill the Curiosity that Sent the Rover to Mars?

**The landing of the Mars Science Laboratory rover Curiosity on Mars marks a historic triumph for NASA, space exploration, and American innovation. But the endangered state of curiosity-driven basic research endangers America's capacity for future innovations.**

*NASA Mars Science Laboratory engineer Adam Steltzner reacts to the successful landing of the Curiosity rover on Mars as first images came into the Jet Propulsion Laboratory in Pasadena, Calif., Aug 5. Today, Curiosity shot its first lasers at a rock called 'Coronation.' Op-ed contributor and Nobel Laureate Ahmed Zewail says America's 'leadership is now threatened by decreased funding and increased bureaucracy' for science and technology research.*

*Bill Ingalls/NASA/AP/File*

Op-Ed by Ahmed H. Zewail

On Aug. 5, I was among a group of people who witnessed the rover landing on Mars in real time at NASA's Caltech-managed Jet Propulsion Laboratory in Pasadena. The excitement of this historic moment was overwhelming as we saw the one-ton, car-like Mars Science Laboratory (MSL) break through the Red Planet's atmosphere and slow its speed from 13,000 mph to zero. One glimpse of those first images more than 100 million miles away demonstrates America's leadership in innovation.

Appropriately named Curiosity, the Mars rover will, over the next two years, explore mysteries of our nearby planet. That is what science is all about – revealing the unknown. America's past investment in basic science and engineering is what led to such a triumph and undergirds its leadership in today's world. But this leadership is

now threatened by decreased funding and increased bureaucracy, and this change could transform America's position, economically and politically.

After World War II, scientific research in the United States 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 America winning the lion's share of Nobel Prizes. American universities were magnets for young scientists and engineers from around the globe. The truth is that neither did we then nor do we now know what the broad impact of research on society would be: Unpredictability is in the fabric of science discoveries.

In much of academia today, however, curiosity-driven research is no longer looked upon favorably. Research proposals must address "broad relevance to society" and provide "transformative solutions" even before research begins. Universities are increasingly pressured to raise funds for operational costs, and overhead is on the rise. Professors are writing more proposals, reducing the time available for creative thinking, and increasing numbers of academics are involved in commercial enterprises. Faculty tenure at many universities is driven by how much money the young faculty can raise.

These constraints and practices beg the question: Would a young Albert Einstein, Richard P. Feynman, or Linus Pauling be attracted to the profession today, and would he be able to pursue his inquiries into fundamental questions in today's environment?

In the US, industry participated uniquely in research and development, but this, too, has changed. One of the jewels of the research-oriented industrial entities was Bell Labs, where fundamental research was so advanced that it used to be said it was "the best university in America." Bell Labs had some of the world's leading scientists and engineers, and collectively they made pioneering contributions, from the invention of the transistor to the "Big Bang" origin of our universe.

The broad-based, curiosity-driven structure of Bell Labs is no longer in existence, and other industrial labs have, for the most part, redirected their resources into research areas relevant to their market products.

From my experience in academia, I found that the majority of young people seeking research-oriented professions are driven by the excitement of their curiosity and the prospect of a decent job, but in the current market, Ph.D.-level scientists are holding temporary positions or are unemployed.

The average age that a principle investigator receives his/her first NIH-R01 award (National Institutes of Health Research Project Grant) has increased to 42 years, and experience from multiple postdoctoral positions is often necessary for advancement

in academia. These drawbacks discourage younger generations from pursuing research careers.

What is clear is that progress in research requires the nurturing of creative scientists in an environment that encourages interactions between researchers and collaborations across different fields. But such interactions cannot and should not be orchestrated by weighty management, as creative minds and bureaucracies are inharmonious.

Today, officials in many developing countries are seeking mechanisms to reach the innovation level of the developed world, especially the US, but the core principles of innovation are often misunderstood. Regrettably, the same trend is creeping into developed countries.

One must then ask, is there a formula for "managing discovery making"? The answer is in the realization of and belief in the natural evolution of developments, from basic research to technology transfer, and then to societal benefits. For basic fundamental research to flourish, the nation must provide young people with a proper education in science, technology, engineering, and math (STEM).

Additionally, a renewed vision for investment in fundamental, curiosity-driven research is needed. It is not in the best interest of the US to reduce R&D funding in the indiscriminate, across-the-board cuts of the national budget. Legislators must not impede the best minds from around the world from coming to America. But at the same time, and perhaps more important, they must make the necessary changes to reignite young Americans' interest in science by exposure to it in the early years of schooling and through modern media.

In the 1950s, Nobel Laureate Robert Solow showed that new technologies create a large portion of economic growth, affecting nearly 75 percent of US growth output. The theory of quantum mechanics alone has had a major impact on the economy of the world market. Without it, revolutionary technologies would not have been realized. Think of the laser and the optical communication industry, MRI and the health industry, and the transistor and the IT market, not to mention the vast progress made in drug discovery, gene technology, and miniaturization.

In our daily use of the cell phone, the World Wide Web and Google's search engine, we should recall that basic research is the springboard of their development. As important, American influence in the world is spread largely through its "soft" power of science and technology, according to a Pew Research poll.

America was and still is able to make the necessary changes to maintain research institutions that are the envy of the world. At Caltech, I find it remarkable that an institution with less than 300 faculty members in all disciplines has been able to

produce from its faculty and graduates 35 Nobel laureates. The key to these achievements is the unique milieu for R&D envisaged by its "founding fathers" more than 100 years ago.

Since the Industrial Revolution, the West has dominated world politics and economics with the power of science. Yet it would be hubristic and naive to think that we now know what will be relevant tomorrow. Investing in science education and curiosity-driven research is investing in the future. For many decades, America had the right formula for achieving progress through such investments. Now, it is time to revisit this vision. If not, a transition may be in the making, with the sun of innovation rising in the East.

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