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Promoting creativity and innovation

If the United States is losing its competitive edge in science and technology, how can we begin to reverse that trend?

The report by the US National Academy of Sciences, the National Academy of Engineering and the Institute of Medicine, entitled *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, points to the increase in research and development (R&D) in major developing countries; the rapid transmission of new technologies throughout the global economy; the increase in the number of doctoral students in China and India; the comparatively few US students entering science, technology, engineering and mathematics (STEM); and the rising return home of foreign graduate students who have trained in the United States. Among its recommendations, the report calls for increased federal investments in STEM research facilities and funding, graduate stipends and steps to increase the number of qualified STEM teachers down to the K–12 level.

These are all excellent recommendations that should be implemented immediately. But here is a pitch for one more recommendation that has been made before by others but is worth repeating: we should be spending more money funding high-risk, highly innovative projects.

Although agencies in Europe and the United States do fund some high-risk projects, three questions come to mind: are enough projects being funded, how are those projects being selected and is there enough money going into those projects?

According to the HINGE (High Innovation/Gain/Expectation Program) survey, 40 European funding agencies have specific programs that support novel or 'risky' research projects (http://www.nest-promise.net/hinge.html). The survey was carried out by the NEST-PROMISE (New and Emerging Science and Technologies—Promoting Research on Optimal Methodology and Impacts) project, whose aim is to promote high-risk, multidisciplinary research throughout Europe. The different agencies are providing funding of €1 million to €10 million ($1.6 million to $16 million) annually. Most interestingly, some agencies are trying out new ways of selecting projects. For example, one program called the 'Ideas Factory', part of the UK Engineering and Physical Sciences Research Council, is open to all disciplines on "focused topics that need a new dimension in thinking—not just the overlap between disciplines." For each topic, an interactive workshop called a 'sandpit' is held. The workshop consists of 20–30 selected researchers, joined by a group of stakeholders and international experts who act as referees in the process. The goals are defined during the sandpit, and the track record of the potential grantee is not an important criterion. This seems like a particularly innovative way of selecting a project, but the question of whether there is enough money going into the project and how long each project will be funded remains unanswered.

In the United States, the main funder of basic scientific research is the National Institutes of Health (NIH). In 2004, NIH began the Pioneer Award program (http://nihroadmap.nih.gov/pioneer/). It was designed to "identify and fund investigators of exceptionally creative abilities and diligence, for a sufficient term [5 years] to allow them to develop and test far-ranging ideas." Since it began, 9 awards were made in 2004, 13 awards were made in 2005 and 2006, and 12 awards were made in 2007. Each grant is for $500,000 in direct costs per year for 5 years. This seems like a reasonable amount of money, but are there really only a dozen grants worth funding?

Reviewers of the Pioneer grants suggest that the number and quality of the applications exceed the number actually granted. Ben Barres of Stanford University, who served on the 2005 team that reviewed Pioneer applications and met with finalists, said "NIH should do so much more of this…the Pioneer Awards make it so much fun to be a grant reviewer—five pages of some of the most creative science imaginable. Tell us the most high-risk, high-impact project you can think of, and we're going to enable you to do it…NIH should do everything this way. This is NIH at its best."

Jeffrey R. Balser of Vanderbilt Medical Center, a reviewer in both 2004 and 2005, said, "…the pool of talented individuals with imaginative, yet workable, breakthrough ideas is boundless." Balser continued, "Our challenge at the finalist stage last summer was not to look for deserving awardees, but rather to parse among a large group of extraordinarily compelling opportunities, and to affirm the real commitment of those in whom we would recommend you invest."

In September 2007, NIH launched the EUREKA program—a new funding initiative for innovative ideas (http://grants1.nih.gov/grants/guide/rfa-files/RFA-GM-08-002.html). The program wants applications from investigators who are "testing novel, unconventional hypotheses or are pursuing major methodological or technical challenges. The potential impact of the proposed research must be substantial, in terms of both the size of the scientific community affected and the magnitude of its impact on that community." How does EUREKA differ from the Pioneer Award? According to the Program director, Dr. Laurie Tompkins, who helped create EUREKA, "The Pioneer is trans-NIH; it's more money and more time. The emphasis there is on the person, not the project. [EUREKA] is about the size of a modest R01." A Pioneer awardee could also apply to EUREKA if he or she had a single idea, especially if it involves "a central hypothesis about a given field."

There are also the Grand Challenges Explorations funded by the Bill & Melinda Gates Foundation that helps scientists pursue innovative ideas for solving major global health problems such as infectious diseases and drug resistance (http://www.gcgh.org/explorations).

If these programs in Europe and the United States lead to even a few discoveries like those of Archimedes—who, when he stepped into his bath and realized he could calculate the volume and density of an object by submerging it in water, leaped out of the tub and dashed outside without clothes on crying, "*Eureka*! I have found it!"—the monies will have been well spent. ■