A Higher Degree of Difficulty

In previous issues, we noted the opportunities for chemical biologists in Japan and in Europe (*1–3*). While global opportunities for scientists are increasing, they are shrinking in the U.S. This shrinkage is apparent in new federal awards for all researchers as well as career opportunities for young researchers. Coupled with a perception that the regulatory environment for discovery is formidable (*e.g.*, human embryonic stem cell research), these new obstacles create a chilling effect on scientific progress.

In the U.S., sustainable progress in science has been under the financial stewardship of the federal government. U.S. leadership is in jeopardy. Because progress on new and challenging scientific problems requires a sustained effort, uncertainty in funding will have long-term as well as short-term consequences. Scientists know it. It is imperative that these consequences are appreciated within the funding agencies and the larger population. Without that understanding, the global playing field on which chemical biologists compete has a higher degree of difficulty.

Chemical biology may well be the interdisciplinary approach that will contribute substantively to solving problems facing human beings throughout the globe—affordable medicine, sustainable fuel, reduction in disease— but its scientists are just as susceptible as those in other fields to having their work sit unfunded in tight budgetary environments. Verbal support for translational, multidisciplinary, collaborative projects is commonly heard. But if the concept is truly embraced, it must be accompanied by recognition that scientists will go where the best opportunities are—that research leaders compete in a global marketplace not only with their results but in the workforce available to help generate new results.

The U.S. needs to look at what other countries are doing to foster research and to see how uncertainty in funding affects science. Europe is rebounding in funding after a previous dearth of opportunity. Germany, for example, has $2 million in new money available for each laboratory startup— exciting news after many years of low funding. It also has created a dilemma. The money is there, but will the talented researchers who left for better opportunities return? Researchers will ask themselves whether the current investments in science will be kept up over the coming years. The trust of the scientific community will need to be won back by European countries such as Germany; the U.S. should track carefully how difficult this will be.

Several Asian countries are investing in research. Certainly, they will become major drivers in science and in chemical biology in particular, despite facing the same problems outlined for Europe above. Singapore, whose schoolchildren lead the world in science and math assessments (*4*), is beginning a partnership between its Agency for Science, Technology, and Research and Japan's RIKEN research agency. The two agreed to exchange scientists, share research materials and information, and promote joint research, particularly in cancer drug targets, environmental pathogens, and neuroscience. Additional industrial investment in Singapore also has been made recently (*5*).

Scientists in Japan and India have created chemical biology associations. Japan announced that it will put 6 billion yen (U.S. $50.4 million) toward a new public chemical library. Indian universities are building multidisciplinary centers and funding them with 5.1

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billion rupees (U.S. $120 million) for the next 5 years (*6*). India also created a fund to encourage collaboration by industry with government and academia.

In China, the minister of science and technology announced that total R&D investment in China grew by 22% in 2006, totaling 300 billion yuan (U.S. $37.5 billion). This accounted for 1.4% of the country's gross domestic product (GDP). Historically, the U.S. investment in R&D has been a larger percentage of GDP than that of other countries, except Japan.

The dwindling investment in young researchers by the U.S. government is conspicuous. Principal investigators on National Institutes of Health (NIH) projects are forced to make difficult choices based not on talent but on financial stability by funding fewer researchers in their laboratories. Although the NIH budget was doubled between 1998 and 2003, it has since been stagnant. The result is an 8% decrease in purchasing power. Moreover, 8 out of 10 grant applications are unfunded. The effects on young scientists are devastating: the average age for a first-time R01 investigator grant recipient is approaching 40 years, and young scientists are discouraged from pursuing academic research careers because of this unfavorable climate. The short-term decisions on federal spending that direct the amount and emphasis of research funding in the U.S. are stifling the current generation of aspiring scientists. Despite these concerns, President George W. Bush would only modestly increase the 2008 budget of the National Science Foundation, the Department of Energy, and other agencies, and he proposes to cut the NIH. Thus, total federal support for basic and applied research would drop 2% in fiscal year 2008.


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A European Innovation report by the European Commission states that in 2006, Sweden, Switzerland, Finland, Denmark, Japan, and Germany are the innovation leaders, whereas the U.S., the U.K., Iceland, France, the Netherlands, Belgium, Austria, and Ireland are the innovation followers (European Innovation Scoreboard 2006: Comparative Analysis of Innovation Performance, www.proinno-europe.eu/doc/EIS2006_final.pdf). The report includes indicators and trends for the EU25 member states, two new E.U. members, Croatia, Turkey, Iceland, Norway, Switzerland, the U.S., and Japan. The U.S. and Japan are still ahead of the EU25 in terms of innovation performance, but the innovation gap between the EU25 and the U.S. is decreasing. Two of many factors underlying E.U. leadership are the growing number of science and engineering graduates and increased employment in medium- and high-tech industries.

How does each country define success in funding scientific endeavors? What will the result of uncertainty be on career opportunities in academia and industry, academic training programs, national competitiveness, and public health? What do we expect the result to be? All five of the 2006 Nobel Prizes for science went to U.S. scientists. The differences in investment are likely to change that trend as talent is recruited away from the U.S. or simply developed elsewhere.

The world is energized with scientific initiatives. The degree of difficulty is already high for U.S. scientists to maintain innovation and promote scientific achievement. The U.S. has the financial and human resources, but perhaps what is most required is leadership that appropriately values the benefits of science.

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