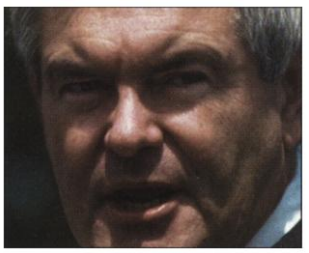
POLICY FORUM: SCIENCE PRIORITIES

An Opportunities-Based Science Budget

Newt Gingrich

As a nation, the United States must take a new approach to the federal investment in scientific research and development. The current approach of arguing for percentage increases does not communicate the sense of urgency and required for a safe and prosperous future. Although I have strongly supported increased science funding, current proposals will not increase them enough. We need a science budget for the next generation based on opportunities in science rather than on bureaucratic and political infighting in Washington. Five major increases in federal funding for scientific research need to be considered:

1. There should be an increase in peer-reviewed money allocations to enable more high-quality proposals to get full funding. The scale of shortfall was highlighted in remarks by Rita Colwell, the Director of the National Science Foundation (NSF), who stated that funding existing first-class research proposals plus other needed initiatives would require more than double the $4.4 billion currently appropriated (*1*). Yet this only describes the shortfall within the current system. The psychology of a budget-constrained science community minimizes proposals of appropriate large-scale research projects.



2. We must begin to fund a new generation of large projects that could create great breakthroughs. The Defense Advanced Research Projects Agency invested millions of dollars without peer review, which made possible the creation of the Internet. In astronomy, the terabytes of data that will be produced daily ought to be captured in an open, Internet-based, archived, virtual observatory. The current plans will capture only a tiny percentage of the data. In weather and climatology, we are drifting toward spending trillions of dollars under the Kyoto Global Warming protocol. Yet we fail to increase the current budget by <0.1% as much for a worldwide climatology project that would include space-based and land-based ocean and atmospheric monitoring on a scale that is technically possible with modern systems. The National Oceanic and Atmospheric Administration is so strapped for money to keep its current systems operating that it legitimately shies away from this grandiose scale of investment in knowledge and research, which actually should be the minimum investment.

3. Money needs to be available for highly innovative, "out of the box" science. Peer review is ultimately a culturally conservative and risk-avoidance model. Each institution's director should have a small amount of discretionary money, possibly 3 to 5% of their budget, to spend on outliers. The history of plate tectonics should remind all of us that accepted wisdom can be wrong.

4. We need a new commitment to integrate the hobbies and funnel the interests of amateur scientists into real discovery. Significant recent findings by amateur scientists include animal tracks in New Mexico older than dinosaurs, and discovering supernovae in distant galaxies (*2*). It is important to remember that Darwin the amateur beetle collector nurtured Darwin the evolutionary theorist. There is plenty to be discovered and explored by amateurs, and the Internet combined with new instrumentation can harness and focus the work that amateurs already do.

Shawn Carlson recognized the untapped resource of amateur scientists and in 1994 founded the Society for Amateur Scientists (*3*). He and others guide amateur scientists in their research and enlist their help in gathering data for professional scientists. The society's Web site sends out calls for assistance on projects at universities and laboratories around the country. The potential is massive but the funds are lacking.

The Ames Research Center hosts a program that is another excellent example of amateurs, in this case, students, helping professionals with research. NASA funds a collaborative project between Ames and the nonprofit Marine Sciences Institute, a science education organization that runs educational cruises for teachers and students in the San Francisco Bay area (*4*). The program's director, Lynn Rothschild, has utilized the samples and physical data (temperature, UV radiation, water clarity, etc.) collected by students on the cruise to help her identify UV-absorbing pigments in plankton and to measure DNA damage experienced by plankton in the Bay at different times of the year. Students are being immersed in research and given part-ownership in scientific data. This program not only nurtures the next generation of scientists but has allowed Ames to provide useful data that would otherwise have an economically prohibitive price tag. We need federal funding to support more programs like this one.

5. We must have new approaches to learning that combine the discovery process, virtual reality, and a 24-hour/7-day-a-week Internet-based opportunity for the committed learner. In particular, we need an immersion approach to virtual learning about the quantum world, which is so counterintuitive to our daily experience of the classical Newtonian world.

This investment will also require a dramatic overhaul of science and math education. This is a national security issue of the first order. Barely half of our computer science graduate students working in the United States were born in the United States, in large part because our own high schools are not graduating enough students with math and science capabilities (*5*). While we benefit from being an educational beacon for the world, it should alarm us that our own society is not producing enough math and science students for us to remain a world leader.

There are four effective actions scientists can take to advance the ideas discussed in this paper. First, discuss the idea of an opportunities-based budget with your professional societies and encourage them to publicize and advocate the concept systemically. Second, visit your congressman and senators. Do not underestimate the importance of passionately presenting your concerns to Congress. If you are not comfortable going alone, pull together a group of scientists. Third, write op-ed articles and letters to the editor in your local papers. Last, give speeches at your local civic clubs to encourage them to advocate an opportunities-based science budget. It all starts with the scientific community organizing around these issues and telling their story with conviction and passion.

Newt Gingrich is a Senior Fellow at the American Enterprise Institute and a former Speaker of the House. A longer version of this article and other articles and speeches on science funding can be found at www.newt.org.

CREDIT: AP PHOTO/JOHN BAZEMORE

References

1. R. Colwell, presentation to the National Science Board, Arlington, VA, 4 May 2000 (open session).
2. F. M. Mims III, *Science* **284**, 55 (1999).
3. Society for Amateur Scientists, www.sas.org.
4. Marine Science Institute www.sfbaymsi.org/index.htm
5. www.nsf.gov/sbe.srs/seind00/c3/tt03-22.htm