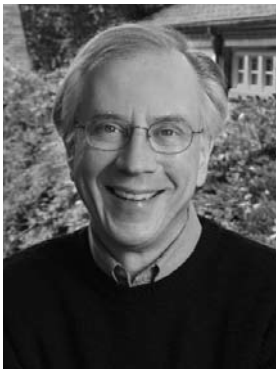
Strategies for Nurturing Science's Next Generation



Thomas R. Cech

Nobel laureate Thomas R. Cech is chair of the ARISE report panel and president of the Howard Hughes Medical Institute. He has been a Fellow of the American Academy since 1988.

"Woe be on woe . . . , frenzy of the mind distraught." Like the wailing chorus in a Sophoclean tragedy, today's academic research scientists are constantly bemoaning their funding fate.

No wonder – the NIH budget has declined in real dollars for five consecutive years, and the NSF's substantial budget increase committed by the America COMPETES Act has gone unfunded. But in addition to concerns about budget levels, we need to be concerned about how federal research funds are distributed. These latter issues provide the topic of a new study by a committee of the American Academy of Arts and Sciences. Our report is entitled *ARISE: Advancing Research in Science and Engineering*.

While numerous matters concerning mechanisms of federal funding of research are worthy of analysis, our committee chose to focus on two areas that are broadly acknowledged as being particularly endangered.

First is the difficulty assistant professors face in obtaining stable funding for their research. The nation invests 25 to 30 years in the education of these faculty, who then compete with perhaps a hundred other applicants to land a position; finally, when they should be in their laboratories making discoveries and in classrooms training the next generation, they are driven to their offices to become serial grant-writers. And their students and postdoctoral fellows, listening a bit too seriously to their mentors' travails, start pondering alternative careers.

The second issue: As research funds get tighter, review panels shy away from high-risk, high-reward research, and investigators adapt by proposing work that's safely in the "can-do" category. The clear danger is that potentially transformative research – that which has a chance to disrupt current complacency, connect disciplines in new ways or change the entire direction of a field, but at the same time incurs the very real possibility of failure – finds scant support.

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Our scientific leaders in Washington are well aware of these pressing issues, and they have taken action within their considerable constraints. At the NIH, first-time grant applications with scores just outside the funding line are frequently rescued. Potentially transformative research is supported through the Pioneer Awards at NIH, although to a very small extent, and NSF has developed plans to encourage such research.

Thus, some *ARISE* recommendations reinforce what agencies are already predisposed to do, and hopefully will give them additional fortitude for doing so. For example, the NIH is already considering shorter grant applications emphasizing potential impact and restricting the amount of methodological detail. And its Pioneer Awards program puts greater emphasis on previous inventiveness of the researcher who proposes bold new directions.

Other recommendations provide fresh ideas. Our meetings with early-career faculty revealed that obtaining a second major federal research grant, or a competitive renewal of the first grant, is often as much of a career bottleneck as the first grant. So we recommend that review panels be instructed to evaluate applications by career-stage-appropriate criteria, taking into account the time it takes to build a research team.

Implementing such recommendations takes money. From where will it come? The committee decided not to distract from its message about modes of funding by tackling budgetary issues; in short, we strongly believe that early-career faculty and potentially transformative research deserve priority independent of whether budgets are flat or increasing. Each agency should examine its entire portfolio (not just individual research grants, but also large projects and intramural programs) and redirect funds from areas that are underperforming.

The report's most radical recommendations are to universities, which are urged to take more responsibility for faculty salaries. This is not to say that recharging salaries to research grants is bad. To the contrary, American research universities and medical school faculties have been built on such federal support, to everyone's benefit. But medical schools have found that they can establish new programs with little institutional commitment: Soft-money faculty are hired and then write grants to obtain even 100 percent of their salaries, the stipends and tuition payments for graduate students, and indirect costs to help repay the debt on the research building, all without much institutional backup should they suffer a lapse in funding. That system weighs heavily on early-career faculty. When the risk of a grant not being funded means no salary and no job, it inhibits high-risk, high-reward grant applications. Rebalancing of responsibilities is needed, in small steps and with advance warning to avoid disrupting the system.

Indeed, in times of constricted budgets it is particularly important for academic scientists to ARISE and advocate some changes in the priorities of federal research funding. ■

Reprinted from *Science News*.

ARISE

Check List for Action

Recommendations to:

Federal Agencies

- Create Targeted Grant Programs for Early-Career Faculty
- Create Seed Funding Programs for Early-Career Faculty
- Pay Special Attention to Early-Career Faculty in Regular Grant Programs
- Develop Supportive Polices for Primary Caregivers
- Explore Targeted Grant Mechanisms and Policies to Foster Potentially Transformative Research
- Adopt Funding Mechanisms and Policies That Nurture Transformative Research in All Award Programs
- Strengthen Grant Review Processes
- Invest in Program Officers
- Establish New Programs Only if They Have Critical Mass
- Track Demographics on a Government-Wide Basis

Universities

- Actively Mentor Early-Career Scientists
- Create Seed Funding Programs for Early-Career Faculty
- Reconsider Promotion and Tenure Policies
- Address the Needs of Primary Caregivers and Childbearing Needs
- Accept Institutional Responsibility for a Greater Portion of Faculty Salaries
- In Building New Facilities, Shoulder a Larger Share of the Financial Cost

Private Foundations

- Spread the Wealth: Ensure a Greater Number of New Investigators by Capping the Number of Start-up and First Awards to a Single Individual

The *ARISE* report also received statements of support from:

Martin L. Leibowitz, Managing Director, Morgan Stanley; Chairman of the Board, Institute for Advanced Study

Richard H. Scheller, Executive Vice President, Research, Genentech

Debra W. Stewart, President, Council of Graduate Schools

Mark Fishman, President, Novartis Institutes for BioMedical Research

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Howard J. Silver, Executive Director, Consortium of Social Science Associations

Doug Comer, Director, Legal and Technology Policy, Intel Corporation; Chair, Task Force on the Future of American Innovation

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Alan Bernstein, Executive Director, Global HIV Vaccine Enterprise