PRESIDENT'S Column

An Opportunity for Change

Never waste either an opportunity or a crisis. Today, cell biologists are facing both.

21st Century Opportunities in Cell Biology

Engineers at the beginning of the 20th century grasped the opportunities that had emerged from centuries of basic discovery and knowledge in the mature sciences of chemistry, physics, and mathematics to create exponential progress in technology. These applied scientists took us from the first airplane flight in 1903 to travel to the moon, from the 1908 Model T to the Prius, and from the first transcontinental telephone call in 1915 to the World Wide Web.

Sandra Schmid

In contrast, cell biology was still in its infancy and experiencing a wondrous period of discovery. Starting in the late '30s and enabled by advances in electron microscopy and subcellular fractionation, subcellular components were just being discovered: the endoplasmic reticulum, mitochondria, and ribosomes in the '40s; microtubules in the '60s; and endosomes in the '70s. That DNA was the genetic material was not proven until 1944. What followed, at breakneck speed, were discoveries of its double helical, base-paired structure, of mRNA, tRNA, the genetic code, protein, and DNA sequencing. These culminated in 2001 with the completion of the Human Genome Project: the biological equivalent—some say—of landing a man on the moon.

As we enter the 21st century, cell biology has matured, having gained a strong foundation of skills and knowledge. We are equipped to ask increasingly sophisticated questions to reveal the complex and wondrous machinery and behavior of the cell. We are poised to experience our own exponential rate of progress. As cells are the fundamental unit of life, the outcomes of our research will ultimately contribute to improving human health and treating disease.

The Sustainability Crisis

The crisis that we face should be equally evident. Just as cell biology emerges, like a young adult, eager to exploit new knowledge and capabilities, investment in these future endeavors is shrinking. Faced with growing deficits, the U.S. and other countries are cutting the budgets of their research funding agencies. The U.S. Congress has proposed a $1.6 billion cut to the National Institutes of Health (NIH) budget. In this troubled economy, pharmaceutical companies are also slashing their research budgets and discontinuing programs. Moreover, these acute cuts are occurring as we are graduating more life science PhDs than ever.

Recent PhDs were attracted by the opportunities for discovery in this young field, and used to fuel our research enterprise. But with fewer opportunities for independent research, the careers of a large cadre of highly trained PhDs remain stalled in postdoctoral positions. Together, this convergence of events—the perceived need for government fiscal restraint, the economic downturn, and the overcapacity of trainees for current research-focused positions—constitutes a crisis.

Catalysts for Change

Change is a difficult process, with many barriers to overcome. Together, opportunity and crisis can be the forces of change. Opportunities provide positive incentives (the pull), while crises demonstrate that the status quo or business as usual is not sustainable (the push). The need for change in the scientific enterprise has long been discussed. Perhaps these unprecedented opportunities and crises will provide the catalysts to finally implement change.

Communicating Our Value

Many have suggested that scientists need to be more proactive in advocating for, and communicating the value of, research to the community. But the message will not resonate if it comes only from the head. We must also learn to speak with our hearts. Our passion and enthusiasm must be demonstrable. We need to

The American Society for Cell Biology

8120 Woodmont Avenue, Suite 750
Bethesda, MD 20814-2762, USA
Tel: 301-347-9300
Fax: 301-347-9310
ascbinfo@ascb.org, www.ascb.org

Joan R. Goldberg
Executive Director

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communicate the aesthetics of science: the joy of discovery, the beauty of subcellular structure, the marvel and sophistication of the cellular machinery. We also need to describe the risk and reward of exploration, the competitive nature of our profession, the triumphs we've had, and the need for perseverance in the face of frequent failures. A colleague of mine lamented that you'll seldom hear anyone proudly announce, "I know nothing about music," but people will frequently—often proudly—admit, "I don't know anything about science." Talk to your neighbors, friends, relatives, co-passengers, and to your representatives. Use anecdotes, metaphors, and draw on real experiences. Make science interesting and accessible.

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Managing Talent

Over a decade ago, the National Academies released its study on "Trends in the Early Careers of Life Scientists".[1] The report noted that, "The 42% increase in PhD production between 1987 and 1996 was not accompanied by a parallel increase in employment opportunities, and recent graduates have increasingly found themselves in a 'holding pattern.'" The authors concluded that, "Although the current abundance of PhDs is an advantage to established investigators, those responsible for graduate education in the life sciences should realize that further growth in the rate of PhD training could adversely affect the future of the research enterprise."

Change, indeed, is difficult. The doubling of the NIH budget from 1998–2003 removed the sense of urgency that had accompanied this call to action, and instead the number of postdocs and graduate trainees continued to increase over the subsequent decade. Perhaps the present crisis will firmly establish that our current practices are not sustainable and provide the needed impetus for change. Are we training too many PhDs? This question is debatable as an increasingly educated population must be beneficial to society. However, we are undoubtedly training too many experimentalists for independent research, either in academia or industry. In addition to their technical skills, our PhD graduates emerge with many core competencies, including the abilities to think strategically and analytically, to be skeptical, to ask and answer important questions, to communicate effectively, to plan and organize, to persevere. When combined with passion and commitment, these skills will ensure a high level of success in virtually any field. Perhaps a postdoctoral period, aimed exclusively at training the independent research scientist, should no longer be the default next career step. Are we counseling our students, helping them to match their skills with their passions, and advancing them along the best career paths in an effective and timely manner? Single career path PhD training is no longer tenable, and by not matching expectations with possibilities we are demotivating too many talented and capable students in the process.

The need for change in the scientific enterprise has long been discussed. Perhaps these unprecedented opportunities and crises will provide the catalysts to finally implement change.

How should training change to ensure that today's PhDs gain exposure and the skills they need to pursue other viable and exciting careers? Some institutions already do this well, while many ASCB Annual Meeting sessions spotlight a variety of options. However, NIH training grants discount the value of nonacademic endpoints. The National Institute of General Medical Science's new training plan is grappling with this question.

Measuring Productivity

Growth in either research funding levels or the job market is unlikely to satisfy the current rate of influx of PhD or postdoctoral trainees. We must therefore ask how the scientific enterprise can be more efficient and increase its productivity with fewer trainees and resources. In today's economy, competitive businesses are striving to do more with less. When measuring productivity, equal weight is given to both increasing production and decreasing expenditures (costs and personnel). Science, on the other hand, does not typically give the denominator equal weight when measuring

productivity. Increasing productivity requires careful planning, focused efforts, and decreased waste. Scientists often argue that creativity requires a certain amount of chaos: but how much?

The Pareto Principle, also known as the 80:20 rule for cause and effect, states that, on average, 80% of effects result from only 20% of causes. Put another way, on average 80% of input (think costs, time, personnel) results in only 20% of output (think discoveries, publications). I've seen this principle in action in many research labs, including my own. A small improvement in these odds, for example to 70:30, would correspond to an almost two-fold increase in productivity.

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Can we increase efficiency and decrease waste, while preserving intellectual freedom and a creative environment? Are there structures that leave room for serendipitous discovery? Each of us is different, and we must seek and implement our own solutions. A smaller lab, more frequent contact and strategic discussions with my postdocs, the establishment of collaborations to acquire new expertise, and the hiring of skilled, permanent scientific staff have substantially increased my own lab's productivity. Are there changes you might implement?

A Call to Action

Now is the time to communicate the excitement, opportunities, and potential value of our research, as well as the need for continued investment to our neighbors and politicians. While this may ease the current funding crisis, it will not alleviate it. Thus, the paradox of fewer opportunities for funding and career progression during a time of increasing opportunities for discovery offers a challenge. What and how must we change to maintain momentum and the optimism necessary to sustain our rapid rate of progress? As our professional society, the ASCB should be a venue for raising these issues and for generating, sharing, and discussing solutions. I look forward to your thoughts. ■

Comments are welcome and should be sent to president@ascb.org.

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Reference

[1]Commission on Life Sciences (1998). Trends in the Early Careers of Life Scientists. Washington, DC: National Academy Press.

Did You Know...?

- The ASCB Annual Meeting offers a perfect venue for presenting research…but you don't need to have research to present in order to participate.
- Why should you mark your calendar for the 2011 ASCB Annual Meeting in Denver, December 3–7?
  - To hear the latest research *and* get an incomparable overview of cell biology
  - For career advice or to interview for a postdoc or academic/industry position
  - To improve your teaching
  - To learn about graduate programs
  - To enjoy multiple opportunities to network with peers and others
- It's not too early to plan to meet these important deadlines:
  - **July 21** Member-Organized Special Interest Subgroup Application
  - **July 28** Regular Abstract Submission (*for Minisymposium talk or poster consideration)*
  - **September 1** Travel Award and Childcare Award Application
  - **September 1** Regular Abstract Submission (*poster consideration only*)
  - **October 3** *Discounted* Early Meeting Registration
  - **October 13** Late Abstract Submission
- Visit the ASCB website—www.ascb.org/meetings—for further details in May! ■