

NON-ZERO-SUM GAME RESEARCH STRATEGIES IN TIMES OF FLAT FEDERAL RESEARCH BUDGETS

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Sustaining momentum in any endeavor requires clear understanding of how we arrived where we are and the ingredients necessary to propel us to our goal. To sustain the rate and rise of the academic research enterprise we must know the key elements in our growth and how these elements are likely to change in the future. What I would like to do is take a brief look back over the last decade of academic research in the United States, with particular focus on the growth of the life sciences. Then I will try to answer three questions:

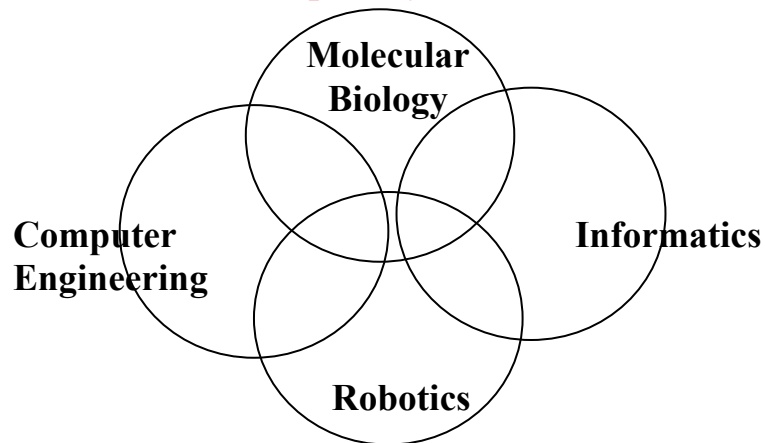
1. Over the past decade, what have been the drivers for funding academic research?
2. What will be major drivers for the direction of federal research funding in the future?
3. What strategies must we employ to remain competitive?

There is no question that the dawn of the Human Genome Project in 1990 has been one of the most important investments by the federal government in life sciences. Efforts coordinated between the National Institutes of Health and the Department of Energy resulted in the completion and publication of the human genome in 2003. In addition to the human genome, mapping the genome of other species and phyla such as the mouse, rat, maize and soy (and other genome projects) resulted in an overall investment of nearly \$2.7 billion in contracts and grants related to mapping these genomes. The genome project was the catalyst for our nation's and the world's current multi-billion dollar biotechnology industry. It is the basis for many of the regional "life sciences" initiatives across the country. Those universities positioned to contribute to the genome project were awarded substantial contracts from the Department of Energy (DOE), the National Institutes of Health (NIH) and the National Science Foundation (NSF).

Fundamentally, the advances in university research programs due to the genome project are founded in not only the fields of molecular biology and chemistry, but also other fields such as computer engineering and robotics. Without the underlying enabling technologies such as the invention of PCR and the automated DNA sequencer, the completion of the genome projects would have never been realized. Further, the emergence of bioinformatics, resulting

from the marriage of biology and computer sciences, is one of the most robust and fastest growing fields in science. Thus, one of the principal drivers for the unprecedented growth of life sciences research in academia has been the embracing of interdisciplinary approaches needed for invention and discovery. Universities that were positioned to build teams of biologists, engineers and computer scientists, and engage in non-zero-sum game strategies to achieve maximum gain for each team member, were the ones who benefited the most from the federal investments in the genome project.

Genome Project: An Ideal Model for Multidisciplinary Teamwork



A second major driver in the past decade for the growth in academic biomedical research has been the congressional goal of doubling the NIH budget. Since 1999, the five-year increase in NIH spending resulted in a \$27.2 billion budget in 2003, surpassed in recent years only by spending on homeland security. Importantly, over half of the total budget at NIH has gone to academia resulting in NIH being the largest single source of funds for academic research. Many universities benefited from this doubling. And, while “the rich did get richer,” there were many smaller universities that appreciated large increases in national rankings and percent increases in NIH funding from 1998-2003. Universities that benefited from these unprecedented federal investments in life sciences and engineering positioned themselves early on to set their sails appropriately and make significant advancements in their research expenditures.

Over the past decade, what have been the drivers for funding academic research?

- Many if not the majority of these landmark events in science were a direct consequence of interdisciplinary teamwork.
- Non-zero-sum game strategies were employed.

- We must acknowledge that revolutionary advancements in science and medicine and, by default, breakthrough advances in individual research programs require working together, both across campus and across institutions.

What will be major drivers for the direction of federal research funding in the future?

Unfortunately, for the near future, federal research funding budgets are expected to be flat for FY05 and probably FY06. And since most of academic extramural research funding is generated from federal grants and contracts, it is realistic to expect the rate of growth to be less during this time of flat budgets. But given that dose of reality, we all still want to achieve the maximum growth possible for each of our universities and, in a zero-sum game environment, there will be winners and there will be losers.

Or can we engage in a non-zero-sum game? Is there a position of cooperation and true interdisciplinary/intercampus partnerships that will achieve maximum gain for each team or institution?

We do have some hints, at least from the NIH, about how this agency is planning on investing extramural funding for the future. As stated in the NIH Roadmap, the research teams of the future will require cooperation and collaboration across disparate disciplines: "The scale and complexity of today's biomedical research problems increasingly demands that scientists move beyond the confines of their own discipline and explore new organizational models for team science."

Areas in which NIH plans on investing in the future include:

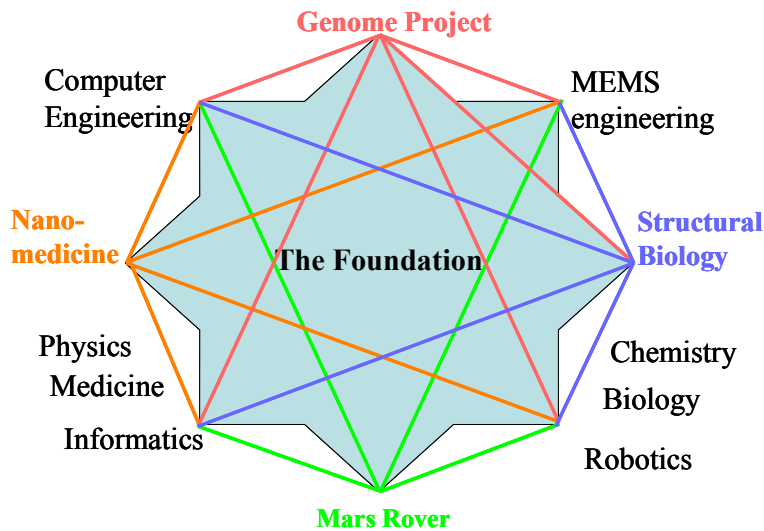
- High-Risk Research
- Interdisciplinary Research
- Public-Private Partnerships
- Building Blocks, Biological Pathways, and Networks
- Molecular Libraries & Molecular Imaging
- Structural Biology
- Bioinformatics and Computational Biology
- Nanomedicine

Another area of future federal investment will be in the National Nanotechnology Initiative to be supported by NSF, DOE and NIH. The FY 2005 request in nanoscience by NSF is about \$305 million, a \$56 million increase over the FY 2004 request. The DOE FY 2005 request in nanotechnology is \$211 million, an increase of \$8 million over FY 2004. Finally, the NIH FY 2005 request in nanomedicine is \$89 million, \$9 million over the FY 2004 appropriation.

What strategies must we employ to remain competitive?

Sustaining the momentum and gains achieved over the last 15 years will require a change in our university research culture. The classic university “stove-piped” approach to scientific discovery and advancement of new knowledge is no longer adequate to meet the rapidly evolving world needs in science, engineering and medicine. Federal agencies funding basic and applied research are looking at interdisciplinary teams to develop new fields of investigation such as Systems Biology, Nanomedicine and Bioinformatics. These teams will also need to work closely with their social science colleagues as we look to apply these new technologies within a complex and diverse society. Thus, we must find new ways to encourage, reward and institutionalize interdisciplinary and intercampus research collaborations.

The diagram below illustrates four examples of research and engineering that will continue to lead the evolution and revolution of scientific discovery for humankind in this century: the Genome Project, Structural Biology, the Mars Rover Project and Nanomedicine. Each of these areas is grounded in interdisciplinary, non-zero-sum game collaborations between areas of research such as computer engineering, MEMS, physics, medicine, chemistry, biology, robotics and informatics.



Our future success as academic research institutions will boil down to a willingness to accept and embrace change and must be entered into with strong leadership and leaders. Will there be barriers to the successful implementation of a non-zero-sum game strategy? Absolutely. It is imperative that we overcome these barriers and work creatively to foster change.