Philanthropy Is Key To Rapid Life Science Innovation

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ABSTRACT

The over-dependence on federal government funding for biomedical research that has become the norm in the past few decades is actually stifling new discoveries and thwarting the research advantage held by U.S. science, which was designed and launched by philanthropists. Recent federal research blockades and funding limitations highlight the need to return to philanthropy if U.S. science is to move forward rapidly and maintain it's global eminence. Tax codes, historically supportive of charitable giving, need to be broadened to encourage both individuals and corporations to donate ample resources to life science discovery efforts.

"What endures from philanthropy is not how hard we try, or how clever we may be, or even how much we care… what is remembered is how we have been able to improve lives…"

Judith Rodin, Rockefeller Institute, 2007

INTRODUCTION

Because of their potential to cure currently incurable diseases, it was headline news when President George W. Bush limited federal research funds for studies of human embryonic stem cells seven years ago. The lack of federal research dollars has been cited as the single biggest reason research has not moved forward fast enough in the ten years since human embryonic stem cells (hESCs) were discovered to begin to yield therapies for diseases such as Parkinson's, spinal cord injury, heart failure, diabetes, arthritis and AIDS.

This was not, however, the first political restriction imposed on the use of federal funds for biomedical research. Research on contraception has always been politically limited, and total restrictions on federal funds for studies of fertilized human eggs were imposed during the Reagan administration and continued during the Clinton administration by the Dickey-Wicker amendment.[1,2,3] It is these restrictions that the current Bush administration has not lifted to allow federal funding for all human embryonic stem cell lines.

The political restrictions on federal funding for stem cell research highlight the problems inherent in an over-dependence on federal funding agencies to support novel biomedical research. A profound dependence on federal dollars for biomedical research has emerged during the past four decades, the growth period for the National Institutes of Health. In 1965, the budget for the National Institutes of Health was approximately 0.5 billion dollars(1); this year it is approximately 26 billion.[4]

HISTORY OF U. S. RESEARCH FUNDING

Established in 1887 as the Laboratory of Hygiene, it was renamed the National Institutes of Health in 1930. But, when President Franklin Delano Roosevelt responded to the growing polio health crisis in 1938, he did so by establishing the National Foundation for Infantile Paralysis (NFIP) as a public charity, rather than by expanding the budget and the role of the NIH.[5] This demonstrates that era's dependence upon private citizens, rather than the federal government, to solve problems. Indeed, throughout the next two decades, both treatment and vaccine research were funded by public contributions to the NFIP, including funding for the Salk Institute itself, built on land deeded by the citizens of San Diego in 1959.[6] The NFIP was renamed the March of Dimes in the early 1970's and has continued to provide support to the Salk Institute. "It was a pioneer for scientific research in San Diego and continues to be a primary catalyst for the city's biotechnology industry with an estimated annual economic impact of 199 million."[6] In 1985, Rotary International, a philanthropic organization headquartered in Evanston Ill, took up the challenge of eradicating polio world-wide. A combination of volunteer efforts and fund-raising, including $100 million in matching funds from the Bill and Melinda Gates

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Table 1
Health Research Investment in the U.S (billions of dollars).

Year	Total Health Research Expenses	Industry	Federal	State	Other	Gross Domestic Product	Total Hlth Res (% of GDP)	NIH Budget	NIH (% of GDP)
1985[1]	13.1	38%	52%	nr	10%	3,998	0.3	5.4	0.13
2005[2,3]	111.4	55%	33%	3%	9%	12,400	0.9	28.6	0.23

1. U. S. Funding for Biomedical Research, Pew Charitable Trusts, 1988
2. World Bank,
3. Research!America

Foundation, has reduced the global polio case load from 350 thousand in 1985 to only 2 thousand in 2007.[7]

Polio research is just one example of important advances in biomedicine funded by philanthropists and public fund raising in the U.S. Other important examples include projects funded by the Rockefeller Foundation, the Howard Hughes Medical Institute, and the Pew Charitable Trusts. From the late 1800s to the end of World War II, the Rockefeller Foundation "…led the development of strategies which maximize the effect of philanthropic funding of research."[1] Originally focused on public health control of communicable diseases, the Rockefeller trustees implemented sweeping reforms of medical school education in the U.S., including the establishment of curriculum guidelines and the importance of institutional-based funding mechanisms for medical research. During the 1930s, Rockefeller research funds shifted away from broad institutional support toward funding individual researchers, including those European scientists relocated to the U.S. in the late 1930s.

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Howard Hughes envisioned a medical institute as early as 1925 that "…shall be devoted to the search for and development of the highest scientific methods for the prevention and treatment of diseases." Incorporated as a medical research organization (MRO), the Howard Hughes Medical Research Institute must support research at institutions associated with a hospital. It began by supporting six research fellows in 1951, thus allowing them to "…pursue long term projects of high significance—projects that could not fit within the confines of a standard grant proposal." The sole owner of the Hughes Aircraft Company, the HHMI realized an endowment of 5 billion dollars in 1985 when the aircraft company was sold.[8]

The Pew Charitable Trust was originally founded in 1948 by Joseph and Mary Pew, founders of Sun Oil Company.[1] By 1979, a total of 7 individual charitable funds had been established by the Pew family, dedicated to promoting public good in a variety of ways, including biomedical research, especially research activities "…which neither industry, government, or individual citizens might elect to support." The Pew Scholars Program in the Biomedical Sciences provides "…assured support, during their early years, for junior members of the faculty as they establish their research." The scholars program was established following extensive investigation into unfulfilled needs in biomedical science. Dr. Craig Mello, Nobel Laureate in 2006, was a pew scholar.

The success of biomedical research in controlling communicable diseases and improving medical education and treatment became obvious by the 1950s. The successes encouraged federal politicians to approve increased funding for the NIH. By 1985, the NIH budget had grown to over 5 billion (Table 1), providing more than half the estimated total health research spending of $13 billion that year. The balance was paid for by industry and philanthropy.

The ensuing 20 years saw a nearly ten-fold increase to $111 billion in health research spending with an inversion of the balance between federal dollars (33%) and industry (55%). Philanthropy kept pace at about 9%, maintaining its mission to fund novel, out-of-the mainstream research, including contraceptive research, not attractive to industry, and too controversial for the federal government. During these 20 years, investment by states in health research also became more visible, amounting to approximately 3% of the total by 2005.

DECADES OF FEDERAL FUNDING DEPENDENCE

For the past thirty years, biomedical research outside the pharmaceutical industry has largely been funded by the NIH through competition by scientists for federal grant awards. NIH-funded scientists are sought after by institutions of higher education and research because NIH funds come with substantial overhead allocations to the institution, on the order of an additional 70% of the cost of the research is added to the institution's total award. Scientists whose research is not successful at attracting NIH funds usually do not have secure positions in institutions of

higher education, a fact that has seriously eroded the numbers of U.S. citizens entering academic careers in sciences that are dependent upon NIH research funds. Many students in the sciences are foreign-born and plan to return to their home countries upon completing their training in the U.S. A substantial percentage of biomedical research is conducted by scientists-in-training who must work hard to accomplish sufficient research within a time frame that makes them attractive candidates for the ever-shrinking academic faculty positions at U.S. institutions of higher education and research. It is essential for their career development that they demonstrate their ability to obtain federal funding to support their research efforts within academic departments.

Indeed, the current dependence of major biomedical teaching and research institutions on federal research dollars is so deep that should NIH support suddenly disappear, the infrastructure of biomedical teaching and research in the U.S. would collapse. The current level of operational dependence by the nation's institutions of higher education and research was never the mission or the intent of the NIH. This situation obviously pits biomedical research budgets against federal defense and infrastructure obligations. Tough choices.

Moreover, the power of the notion that approval by federal funding agency review bodies is a "gold standard" for new projects has spread to other entities, such as state agencies established to support economic development. An example is the Massachusetts Technology Collaborative, a state-funded agency founded originally to support the computer technology industry, and currently supporting other technologies such as alternative energy sources. One of their main operating models is to provide funds for projects that fare well during federal review. Thus, those projects deemed meritorious by a federal review body are preferentially matched with state funds.

These considerations highlight the influence of federal politics on new research ideas, from state economic development to institutions of higher education and research. The recapture of federal funds for local projects has become an essential measure of success.

PROBLEMS INHERENT IN FEDERAL SUPPORT FOR RESEARCH

Over dependence upon federal funds for innovative biomedical research, such as embryonic stem cell research, carries several problems: 1) the deep influence of federal politics on biomedical creativity, 2) the inability to craft long range plans, and 3) the cost of federal dollars.

1) The executive branch of the federal government changes every four to eight years. This turnover is positive in most socio-political aspects, but it does not allow consideration for the pace of new scientific discoveries. Pharmaceutical industries estimate it takes one or two decades years to bring a single drug to therapeutic use.[9] The time necessary to fully develop a new area of biomedical science is clearly longer, emphasizing the need to develop long-range funding plans, independent of federal politics.

2) NIH grant awards vary in length from 2 years to 5 years, with many being awarded for 3 years. If not renewed, the assembled research team is fired until renewal funding can be obtained. Although there is merit in the competition for funds, the disassembly of a skilled research team is clearly counterproductive. Important therapeutic discoveries obviously require longer than five years. The benefits to society of long-range funding for promising scientists was recognized by philanthropies such as Howard Hughes Medical Institute and Pew Charitable Trusts nearly half a century ago. The need remains urgent today. These considerations support the concept that federal dollars should be considered supplements to a research program, rather than the backbone of the program.

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3) Each federal dollar awarded a research project costs the taxpayers more than each philanthropic dollar contributed. Exactly how much more is difficult to pin down, but review of the Office of Management and Budget's figures, and the National Institutes of Health budget, suggest each research $1.00 awarded to an institution costs the taxpayer on the order of $1.25. When coupled with institutional overhead, each dollar awarded directly to the research project costs the taxpayer $1.50 to $1.75. State-funded biomedical research also costs the taxpayer more than the research award itself, how much more depends on the state.

ADVANTAGES OF PHILANTHROPY-FUNDED RESEARCH

In contrast, because of the federal government's long-standing recognition that citizens have the right to directly support charitable projects of their choosing, and may therefore deduct the contribution from their gross income, a dollar awarded directly to research conducted by a non-profit institution may cost the taxpayer as little as $0.70, depending upon income level and tax bracket. Institutional overhead allotted to philanthropic sources is substantially lower than NIH guidelines, on the order of 25% of direct costs.

Moreover, not only are government dollars more expensive to taxpayers than philanthropic dollars, the focus of government funded research is to further "sure bets." To its

credit, the National Institutes of Health does seek to encourage innovative basic research, but it cannot support "risky-but-potentially-high-impact" research at the expense of the "sure bet." An example of this is the lack of federal review board enthusiasm for the controversial, but potentially high impact research of this year's Nobel Laureate, Dr. Mario Cappecchi. His nobel prize winning work, a cornerstone to the ability to manipulate specific genes in mice which has led to major advances in understanding many human diseases, was considered very risky and actually rejected by an NIH review committee.[10] Fortunately, Dr. Cappecchi became a Howard Hughes Investigator at the University of Utah and no longer had to pursue federal funding.

The relatively short-term nature of federal government awards, coupled with the "publish-or-perish" pressure that forces researchers to embark on problems with immediate answers, rather than those problems whose solutions will require several years to complete, further limits research starts. Examples are ridding the planet of malaria, AIDS and tuberculosis, all highly complex biological and environmental problems for which studies guaranteed for decades, rather than five years, are needed.

These considerations highlight the powerful impact of philanthropy on biomedical research. Ideally, biomedical research projects would proceed under the guidance of dedicated visionaries, with ample philanthropic resources for a minimum of 20 years. This paradigm would be in the best interests of everyone. Biomedical research would not be competing with education, healthcare, infrastructure, global threats and conflicts that are the purview of governments.

Philanthropists also have the right to decide the nature of the biomedical research and what community will be the locale, thus freeing the research from the political pressures of government, and the economic pressures of for-profit entities, such as pharmaceutical companies. Three examples of relatively new institutions that have made a major contribution to their areas of focus are The Torrey Pines Insitute for Molecular Studies, The Aaron Diamond AIDS Foundation, and the New York Stem Cell Institute.

The Torrey Pines Institute for Molecular Studies was founded in 1988 as a "…small, agile research institute focused on quickly producing results." Early success in high through-put peptide screening methods established the TPIMS as a world leader in drug discovery. With both philanthropic and government funding, it has now attracted almost 100 scientists conducting research into a variety of tough medical problems such as multiple sclerosis and AIDS.

The Aaron Diamond AIDS Research Center was also established in 1988 as an entirely new research resource to fill the reluctance of the federal government to fund AIDS research. Founded by philanthropist Irene Diamond, it not only provided the resources for AIDS research fundamental to current drug therapies, it prompted the federal government to also expand its own support for AIDS research.

In response to both the promise of stem cell research, and the political environment limiting federal government support, Susan Solomon and Mary Elizabeth Bunzel founded the New York Stem Cell Foundation in 2003. Its mission is three parts: setting priorities for stem cell research, demonstrating the critical role for philanthropy to jumpstart promising science, and educating the general public in both the science and the need for private support. According to the founders, the need for, and the value of, the NYSCF will continue, independent of the views of the federal government.

Like all scientific discovery, biomedical research advances unpredictably. A finding must be repeated and confirmed independently by at least one other investigative team. New high through-put discovery techniques have launched a new era in biomedical research. The task of scientists is to interpret the facts at hand in all perspectives in order to design research avenues to answer the next question. Disease-oriented research applies the best basic research avenues to the medical problem, a task akin to an entrepreneurial business decision. Who should fund such research? If only 10% of biomedical research avenues will produce therapies, who should fund such risky work?

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TAX CODES ENCOURAGE PHILANTHROPY-FUNDED RESEARCH

Tax incentives for charitable giving have been provided by the U. S. tax code since its inception in 1917. Hence, philanthropists have the opportunity to be the "angel investors" for biomedical research by funding the risky projects, and those requiring a stable, sustained commitment, in return for lower tax obligations. With philanthropic nurturing, discoveries made can more quickly be translated into testable therapeutic approaches. The challenge to philanthropists is deciding what "angel investments" are the most promising—funding established institutions or new start-ups. Established institutions have the advantage of depth of scientific resources, but the disadvantages of high overhead, less agile response times and rigid intellectual property rules. Start-up research institutions have the advantage of investigative focus, lower overhead, rapid response time, nimble intellectual property agreements needed to translate discoveries to clinical use, and the locale of choice by the philanthropist, but may need ties to larger institutions to fulfill scientific depth and manpower needs. These considerations suggest the most robust bio-

medical research communities will be those with both large, established teaching institutions and small, focused research institutes.

New life science research institutions can re-vitalize communities facing economic challenges with environmentally low-impact jobs for both highly-skilled and moderately skilled workers. Many politicians, community, and business leaders throughout the country have realized the value of following the lead of the citizens of San Diego who donated land to the Salk Institute half a century ago. They are wooing philanthropists to invest in life science centers within their communities, such as St. Lucie, Florida, where a branch of the Torrey Pines Institute for Molecular Studies is opening this year, and Loudouin County, Virginia, where the first free-standing research institute built by Howard Hughes Medical Institute was established in 2004. Such far-thinking communities not only promote local economic development, but also ensure their citizens have access to front-line biomedical advances.

SUMMARY

The bottom line: tax codes, both federal and state, should encourage philanthropy from individuals and corporations. Communities should provide incentives to promote local philanthropic development. Philanthropic "angel investing" can provide the necessary funding for biomedical research, free from federal, state and institutional politics, to not only save lives and improve health, but also lower health care costs and promote global business opportunities —a big win for everyone..

ENDNOTES

1. U. S. Funding for Biomedical Research, Pew Charitable Trusts, 1988
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