The Government Grant System

Inhibitor of Truth and Innovation?

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Flush with success in creating an atom bomb, the U.S. federal government decided it should start funding nonmilitary scientific research. A government report entitled "Science, the Endless Frontier" provides the justification for doing this. It makes the case that "science is the responsibility of government because new scientific knowledge vitally affects our health, our jobs, and our national security" (Bush, 1945). Accordingly, the government established a Research Grants Office in January 1946 to award grants for research in the biomedical and physical sciences. It received 800 grant applications that year. The Research Grants Office is now known as the Center for Scientific Review (CSR), and it processes applications submitted to the National Institutes of Health (NIH) and other agencies in the U.S. Department of Health and Human Services (HHS). In 2005, CSR received 80,000 grant applications.

The System

Investigators seeking an NIH grant submit a 25-page Research Plan that begins with an abstract placed in a half-page box on the form. The Specific Aims of the project, preferably two to four, come next (recommended length, 1 page). The applicant must show that these objectives are attainable within a stated time frame. As one NIH center (the National Cancer Institute) advises in its online Guide for Grant Applications, "A small, focused project is generally better received than a diffuse, multifaceted project." The other components of the Research Plan are Background and Significance (3 pages); Preliminary Studies the applicant has done (6–8 pages); Research Design and Methods (about 15 pages); and, if applicable, Human Subjects and Vertebrate Animals

considerations. The investigator must also submit a detailed budget for the project on a separate form.

The Center for Scientific Review "triages" applications it receives. A cursory appraisal eliminates one-third of the applications from any further consideration, and it selects the remaining two-thirds for competitive peer review. CSR sends each application to a Study Section it deems best suited to evaluate it. Peers in Molecular Oncogenesis, Cognitive Neuroscience, Cell Structure and Function, Hematopoiesis, HIV/AIDS Vaccine, and 167 other Study Sections review grant applications. Each Study Section has 12–24 members who are recognized experts in that particular field. Members meet three times a year to review 25–100 grants at each meeting. Two members read an application and then discuss it with the other section members who collectively give it a priority score and percentile ranking (relative to the priority scores they assign to other applications). An advisory council then makes funding decisions on the basis of the Study Section's findings, "taking into consideration the [specific NIH] institute or center's scientific goals and public health needs" (Scarpa, 2006). CSR's slogan is "Advancing Health through Peer Review."

With a budget of $28 billion, the director of NIH reports that it currently funds 22 percent of all the grant applications it reviews (Zerhouni, 2006). Among these, multi-year R01 grants are the mainstay of research by medical school faculties. And in 2005, the NIH funded only one in eleven (9.1%) of the unsolicited R01 research grant applications it reviewed (Mandel and Vesell, 2006). In 1998 the NIH funded 31 percent of its grant applications, and since 2003, grant appropriations have lagged behind inflation (Zerhouni, 2006). The National Science Foundation awards $6 Billion in grants each year. This independent federal agency funds 28 percent of the 40,000 annual grant proposals it receives.

Twenty-six federal granting agencies now manage 1,000 grant programs. Even clinical trials of drugs, vaccines, and devices, where industry may profit from the outcome, have come under the purview of government. Zarin and colleagues (2005) reviewed ClinicalTrials.gov records and found that the federal government currently funds 9,796 (51%) of the 19,355 interventional trials being conducted. Industry sponsors 4,734 (24%); and universities, foundations, and other organizations, 4,825 (25%). Under the current system scientists are expected to spend time drafting, writing, and refining unsolicited R01 grant applications, despite a less than one in ten chance of success.

Ethics of Writing Grant Proposals

Ethics in science and society "describe appropriate behavior according to contemporary standards" (Friedman, 1996). Two standards that scientists fol-

low for writing grant proposals are 1) Keep it safe and survive, and 2) Don't lie if you don't have to. Pollack (2005) addresses the first ethic, noting that the paramount motivational factor for scientists today is the competition to survive. A scientist's most pressing need, which supersedes the scientific pursuit of truth, is to get her grant funded — to pay her salary and that of her staff, to pay department bills, and to obtain academic promotion. The safest way to generate grants is to avoid any dissent from orthodoxy. Grant-review study sections whose members' expertise and status are tied to the prevailing view do not welcome any challenge to it. A scientist who writes a grant proposal that dissents from the ruling paradigm will be left without a grant. Speaking for his fellow scientists Pollack writes, "We have evolved into a culture of obedient sycophants, bowing politely to the high priests of orthodoxy."

Applicants following the ethic of "keep it safe and survive" propose research that will please the reader-peers and avoid projects that might displease them. An NIH pamphlet on grant applications reinforces such behavior by stating, "The author of a project proposal must learn all he can about those who will read his proposal and keep those readers constantly in mind when he writes" (Ling, 2004a).

With regard to the second ethic, Albert Szent-Györgyi said, "I always tried to live up to Leo Szilard's commandment, 'Don't lie if you don't have to.' I had to. I filled up pages with words and plans I know I would not follow. When I go home from my laboratory in the late afternoon, I often do not know what I am going to do the next day. I expect to think that up during the night. How could I tell them what I would do a year hence?" (qtd. in Moss, 1988, p. 217). This long-time cancer researcher, discoverer of vitamin C, and Nobel laureate was unable, despite multiple attempts, to obtain a government grant. Friedman (1996) describes a variant of this ethic where an investigator applies for a grant to do a study that he has already completed. With this grant awarded and money in hand he publishes the study and uses the funds on a different project. The misrepresentation enables the investigator to remain one project ahead of his funding. Apparently enough seasoned investigators do this that the academic community views the practice as sound "grantsmanship."

Apollonian Research

When the peer review grant system was established in 1946, people assumed that scientific progress occurs in an evolutionary, incremental, and cumulative fashion. Having a panel of experts judge the worth of each research proposal seeking funds seemed then to be the best way to allocate federal tax dollars for research. This system assumes that a majority of specialists in a given field will know where truth lies and how best to get there and find it (Ling,

2004b). But as Hall (1954) and Kuhn (1962) later showed, periodic upheavals and revolutions in science disrupt an otherwise steady growth of scientific knowledge. Long-cherished ideas are replaced wholesale by new ones that lead science in a different direction.

The grant system fosters an Apollonian approach to research. The investigator does not question the foundation concepts of biomedical and physical scientific knowledge. He sticks to the widely held belief that the trunks and limbs of the trees of knowledge, in, for example, cell physiology and on AIDS, are solid. The Apollonian researcher focuses on the peripheral branches and twigs and develops established lines of knowledge to perfection. He sees clearly what course his research should take and writes grants that his peers are willing to fund. Forced by the existing grant system to follow such an approach, Pollack (2005) argues that scientists have defaulted into becoming a culture of believers without rethinking the fundamentals.

Intuitive geniuses, like Thomas Edison, Louis Pasteur, Ernest Rutherford, and Albert Einstein, take a Dionysian, transformational approach to science. Their research relies on intuition and "accidental" discoveries. Szent-Györgyi describes intuition as "a sort of subconscious reasoning, only the end result of which becomes conscious." The Dionysian scientist knows the direction he wants to follow into the unknown, but "he has no idea what he is going to find there or how he is going to find it. Defining the unknown or writing down the subconscious is a contradiction *in absurdum*." And, citing Pasteur, who said, "A discovery is an accident finding a prepared mind," Szent-Györgyi notes that "accidental" discoveries are rarely true accidents (Moss, 1988, pp. 216–217).

Although it is the Dionysian method of research that produces transformative scientific breakthroughs, peers possessing the power to judge grants do not support this kind of research. They abuse the trust and power of government, which does not know science, to advance their own careers and, in some cases, protect their investments in companies that profit from the reigning paradigm. Knowing this, government might be more amenable to supporting potentially transformative, Dionysian research.

To make matters worse, this system is replacing other sources of funding that formerly supported Dionysian scientists. Ling (2004b) observes, "Oversupply of scientists, the rising cost of living and of research, the decline of private foundations and scientific niches which these foundations once sustained [have] completed the dismantling of the socio-economic environment which once protected revolutionary scientists and their young followers."

Unassailable Paradigms

Paradigms in the biomedical and climate sciences that have achieved the status of dogma are,

A) Cholesterol and saturated fats cause coronary artery disease.
B) Mutations in genes cause cancer.
C) Human activity is causing global warming through increased CO_2 emissions.
D) A virus called HIV (human immunodeficiency) causes AIDS (acquired immune deficiency syndrome).
E) The damaging effects of toxins are dose-dependent in a linear fashion down to zero. Even a tiny amount of a toxin, such as radiation or cigarette smoke, will harm some people.
F) The membrane-pump theory of cell physiology is based on the concept that cells are aqueous solutions enclosed by a cell membrane.

Scientists who question these state-sanctioned paradigms are denied grants and silenced (Moran 1998). But valid questions nevertheless have been raised about each of these established orthodoxies. The idea that cholesterol causes coronary heart disease is now close to being dogma, and investigators who question the lipid hypothesis need not apply for funding. But there is growing evidence that the hypothesis is wrong, as Ravnskov (2000) documents in *The Cholesterol Myths*. Aneuploidy (an abnormal number and balance of chromosomes), instead of mutation-produced oncogenes, may well prove to be the true cause of cancer (Bialy, 2004; Duesberg and Rasnick, 2000; Miller, 2006).

The human-caused global warming paradigm is most likely false (Soon *et al.*, 2001; Editorial, 2006). Two climate astrophysicists, Willie Soon and Sallie Baliunas, present evidence that shows the climate of the 20th century fell within the range experienced during the past 1,000 years. Compared with other centuries, it was not unusual (Soon and Baliunas, 2003). Unable to obtain grants from NASA (National Aeronautics and Space Administration), Soon (personal communication, August 31, 2006) observes that NASA funds programs mainly on social-political reasoning rather than science.

Duesberg (1996), Hodgkinson (2003), Lang (1993–2005), Liversidge (2001/2002), Maggiore (2000), and Miller (2006), among others, have questioned the germ theory of AIDS. All 30 diseases (which include an asymptomatic low T-cell count) in the syndrome called AIDS existed before HIV was discovered and still occur without antibodies to this virus being present. At a press conference in 1984 government officials announced that a newly discovered retrovirus, HIV, is the probable cause of AIDS, which at that time numbered 12 diseases (Duesberg, 1995, p. 5). Soon thereafter "HIV causes AIDS" achieved paradigm status. But, beginning with Peter Duesberg, Professor of Molecular and Cell Biology at the University of California, Berkeley, a growing number of scientists, physicians, investigative journalists, and HIV positive people have concluded that HIV/AIDS is a false paradigm. The NIH awarded Duesberg a long-term Outstanding Investigator Grant and a Fogarty fellowship to spend a year on the NIH campus studying cancer genes, and he

was nominated for a Nobel Prize. When Duesberg publicly rejected the HIV/AIDS paradigm the NIH and other funding agencies ceased awarding him grants. Government-appointed peer reviewers have rejected his last 24 grant applications. Peter Duesberg (personal communication, September 20, 2006) writes: "When I was the blue-eyed boy finding oncogenes and 'deadly' viruses, I was 100% fundable. Since I questioned the HIV-AIDS hypothesis of the NIH's Dr. Gallo, and then the cancer-oncogene hypothesis of Bishop-Varmus-Weinberg-Vogelstein etc. I became 100% unfundable. I was transformed from a virus- and cancer-chasing Angel to 'Lucifer.'"

Rather than being harmful, as predicted by the linear no threshold hypothesis, low doses of radiation are actually beneficial (Calabrese, 2005; Hiserodt, 2005). Its beneficial effect is based on hormesis, where radiation in small doses stimulates immune system defenses, prevents oxidative DNA damages, and suppresses cancer. The dose must exceed a certain threshold to stop having a stimulative and start having an inhibitory effect on the body and become toxic — and in high doses, fatal (Miller, 2004).

Research in cell physiology is based on the concept that the cell, the basic structural unit that makes up all living things, is an aqueous solution of chemicals enclosed within a cell membrane. Drug research adheres to the concept that a drug's action is mediated by fitting into a specific receptor site on the cell membrane. Ling (2001) and Pollack (2001), however, make a strong case that the membrane paradigm of cell physiology is wrong. They show that cell function does not depend on the integrity of the cell membrane, and membrane pumps and channels are not what they seem. These investigators hypothesize that the three main components of a living cell — proteins, water, and potassium ions — are structured together in a gel-like matrix, where the cell's water is organized into layers alongside proteins. Magnetic resonance imaging (MRI) is a product of this view of cell physiology, known as the association-induction hypothesis, which was first proposed by Gilbert Ling in 1962. For more than 45 years government granting agencies, guided by their "expert" peer-reviewers' verdicts, have refused to provide funds for this pioneering investigator to pursue research on this hypothesis, even after it brought about the important medical technology of MRI (Ling 2004b). Despite multiple attempts, Gerald Pollack (personal communication, September 13, 2006) also has been unable to obtain government grants to conduct research on this alternative hypothesis of cell physiology.

Peer review enforces state-sanctioned paradigms. Pollack (2005) likens it to a trial where the defendant judges the plaintiff. Grant review panels defending the orthodox view control the grant lifeline and can sentence a challenger to "no grant." Deprived of funds the plaintiff-challenger is forced to shut down her lab and withdraw. Conlan (1976) characterizes the peer-review grant system as an "incestuous 'buddy system' that stifles new ideas and scientific breakthroughs."

Science is self-correcting and, in time, errors are eliminated, or so we are taught. But now with a centralized bureaucracy controlling science, perhaps this rhetoric is "just wishful thinking" (Hillman, 1996, p.102). Freedom to dissent is an essential ingredient of societal health. Braben (2004) contends that suppressing challenges to established orthodoxy sets a society on a path to its doom.

Science in Service to the State

Over the last 60 years a new power structure, the state, has taken control of information. It uses federal tax money to fund and control research through the peer-review grant system. It forms mutually advantageous partnerships with industry and the academic community, which do its bidding. The state holds sway over education. And to round out its control of information, an increasingly powerful centralized government bureaucracy has persuaded the mainstream media to accept and espouse state-approved ideas. The Western tradition of information ethics dating from ancient Greece to the 20th century, characterized by freedom of speech and inquiry, has been co-opted by government. Knowledge advances by questioning accepted paradigms (Hillman, 1995). The state thwarts this and requires its tax-funded scientists to conform to the official establishment view on such things as global warming and HIV/AIDS. Government-sponsored scientific research reflects the biases, preferences, and priorities of its leaders (Moran, 1998). The state uses science to further its social and political purposes. Its actions follow Lang's First Law of Sociodynamics, where "The power structure does what they want, when they want; then they try to find reasons to justify it. If this does not work, they stonewall it (Lang, 1998, p. 797).

When inconvenient facts challenge paradigms the state promotes, it justifies them by consensus. If polar bear experts (Amstrup *et al.*, 1995) find that the bear population in Alaska is increasing, placing doubt on the government's stance on climate change, this finding is dismissed as being outside the consensus and ignored. *Science* magazine supports the prevailing view, stating, "There is a scientific consensus on the reality of anthropogenic climate change" that accounts for "most of the observed warming over the last 50 years" (Oreskes, 2004).

In 21st century America, consensus and computer models masquerade as science. They supplant experimental data. As Corcoran (2006) puts it, "Science has been stripped of its basis in experiment, knowledge, reason and the scientific method and made subject to the consensus created by politics and bureaucrats." Reduced to a belief system, a majority of scientists and groups like the Intergovernmental Panel on Climate Change can declare, without having to

provide scientific evidence, that they believe humans cause global warming. This alone makes the hypothesis become an established fact and received knowledge (Barnes, 1990). Peer review compounds the problem. It competes with objective evidence as proof of truth.

Computer models purporting to make sense of complex data, particularly with regard to climate change, have replaced the scientific goal of supplanting complicated hypotheses with simpler ones (Pollack, 2005). Researchers offer computer models as evidence for global warming. When unsound assumptions and faulty data render one model unreliable, other improved ones are constructed to justify the state's desire to promulgate this "truth," which it can use to exert greater control over the economy and technological progress.

AIDS research serves the interest of the state by focusing on HIV as an equal opportunity cause of AIDS. This infectious, egalitarian cause exempts the two primary AIDS risk groups, gay men and intravenous drug users, from any blame in acquiring the disease(s) owing to their behavioral choices. Duesberg, Koehnlein, and Rasnick (2003) hypothesize that AIDS is caused by three other things, singly or in combination, rather than HIV: 1) long-term, heavy-duty recreational drug use—cocaine, amphetamines, heroin, and nitrite inhalants; 2) antiretroviral drugs doctors prescribe to people who are HIV positive—DNA chain terminators, like AZT, and protease inhibitors; and 3) malnutrition and bad water, which is the cause of "AIDS" in Africa. HIV/AIDS has become a multibillion dollar enterprise on an international level. Government, industry, and medical vested interests protect the HIV/AIDS paradigm. The government-controlled peer review grant system is a key tool for protecting paradigms like this.

Grant Reform

Bauer (2004) proposes that there be mandatory funding of contrarian research, along with a science court set up to adjudicate technical controversies. In addition, science journalism needs to investigate established orthodoxies more vigorously. Pollack (2005) proposes several remedies to the competitive peer review grant system. Government should establish forums where the most significant challenge paradigms can compete openly with their orthodox counterparts in civilized debate. Open-minded "generalists" who have no stake in the outcome should adjudicate, like a jury does in law. Pools of money should be set aside to support multiple grants on selected schools of thought. Training grants that encourage curiosity and thinking outside the box should be made available. And the NIH should provide lifetime support for a select cohort of Dionysian scientists.

The peer review grant system stifles innovation and protects reigning para-

digms, right or wrong. The 60-year experiment of "Advancing Health through Peer Review," the NIH Center for Scientific Review's slogan, has failed. It needs to be dismantled. Tax-funded research would be better conducted and more productive, if government allocated funds directly to universities and foundations to use as they see fit for advancement of the biomedical and physical sciences.

One alternative to the competitive peer review grant system that the NIH and NSF might consider for funding specific research projects is DARPA, the Defense Advance Research Projects Agency. This agency manages and directs selected research for the Department of Defense. At least up until now it has been "an entrepreneurial technical organization unfettered by tradition or conventional thinking" within one of the world's most entrenched bureaucracies (Van Atta *et al.*, 2003). Eighty project managers, who each handle $10–50 million, are given free reign to foster advanced technologies and systems that create "revolutionary" advantages for the U.S. military. Managers, not subject to peer review or top-down management, provide grants to investigators whom they think can challenge existing approaches to fighting wars. As long as the state controls funding for research, managers like this might help break the logjam of innovation in the biomedical and physical sciences. Science under the government grant system has failed and new kinds of funding, with less government control, are sorely needed.

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