Promoting the Planck Club

How defiant youth, irreverent researchers and liberated universities can foster prosperity indefinitely

Donald W. Braben
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To Bill, Margie, and Ken, and to the memory of Jean
MAJOR BREAKTHROUGHS IN SCIENCE invariably involve the amalgamation of a kaleidoscope of disparate research studies making the development of any rational strategies a futile exercise. There are as many ways to do outstanding science as there are outstanding scientists. Research often starts off in a specific direction but, as results, unfold new avenues open up. Discoveries that appear to arrive from “left field” litter the history of the sciences and serve as ubiquitously unheeded warnings to those who think they know how research should be carried out and what science is important. In this crucially important book, Don Braben has assembled an overwhelming case based on a plethora of historically significant scientific breakthroughs. He shows how foolhardy and, in fact, dangerous for the economy are the present research funding strategies, which focus primarily on “impact” when it is blatantly obvious that, as far as fundamental science is concerned, “impact” is impossible to assess before a fundamental advance has been made.

I only hope that the people who presently control research funding are prepared to read this book, think carefully, and heed the advice.

Harry Kroto, The Florida State University, Nobel Laureate

DON BRABEN’S SOBERING BOOK is right on the mark regarding the current disastrous path of funding of scientific research. Funding agencies are increasingly making decisions based on the proposed research’s perceived impact and benefit for society. As Braben documents so well, the emphasis on short-term performance cannot lead to scientific revolutions such as Rutherford’s discovery of the nucleus and Townes’ invention of the laser. Scientists now eschew risky proposals, knowing that someone on a review panel will say the work is “impossible.” Even when scientists are able to secure funding, much of their time is sapped by the increased paperwork, such as frequent reports on how “benchmarks” are being achieved. If a scientist dares to spend a few years developing a novel idea, his or her funding will be lost because of the “lack of productivity.” Braben proposes an approach to turn the tide of preoccupation on short-term performance: each funding agency could set aside a small portion of its budget to fund non-peer-reviewed proposals. Braben illustrates how this could work using as a model the Venture Research Program he directed in the 1980s. One can hope that Braben’s model will be widely adopted—it could change the landscape of science in future decades.

Harry L. Swinney, University of Texas at Austin, Member of the US National Academy of Sciences

FUNDING AGENCIES AND POLICY-MAKERS should emulate Don Braben’s clear thinking, straight talking, wise values, broad learning, and acuity of insight. They might then liberate science, embolden innovation, and inspire academics in a more rational, prosperous, and interesting world.

Felipe Fernández-Armesto, University of Notre Dame, Indiana
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In this provocative book, Donald Braben presents compelling data, cogent analysis, and vivid historical episodes tracing the immense economic and social impact of frontier scientific research. He focuses on revolutionary discoveries that emerged from decidedly unorthodox “outlier” work of a relatively few scientists. Those pioneers he designates as the “Planck Club.” The name is apt: Max Planck, when early in the twentieth century, confronted with experimental results inexplicable by well-established physics, reluctantly advanced an iconoclastic idea. After gestation for more than two decades, his idea gave birth to quantum mechanics, which profoundly transformed understanding of the nature of light and matter and produced a myriad of technologies.

As in two sibling studies published by Wiley (Braben 2004 and 2008), Braben himself has emulated Planck. Armed with strong evidence, Braben has forthrightly challenged the now well-established and pervasive procedures for assessing and granting support for scientific research. These policies, based on “peer review” (actually, “preview” as Braben emphasizes) have evolved over decades. Well-intended, but in many respects deeply flawed, the procedures imposed have increasingly dire consequences.

Many scientists share Braben’s deep concern that prospects for support of future work of Planck Club caliber are becoming severely limited. This case was made starkly by the late Luis Alvarez, assuredly a Planck Club member. In his autobiography (Adventures of a Physicist, 1987), he wrote:

In my considered opinion, the peer review system, in which proposals rather than proposers are reviewed, is the greatest disaster to be visited upon the scientific community in this century. . . . I believe that U.S. science could recover from the
stultifying effects of decades of misguided peer reviewing if we returned to the
tried-and-true method of evaluating researchers rather than research proposals.
Many people will say that my ideas are elitist, and I certainly agree. The alterna-
tive is the egalitarianism that we now practice and that I’ve seen nearly kill basic
science in the USSR and in the People’s Republic of China.

Alvarez would be still more dismayed by how US science has become
further burdened by current funding policies. At top-flight research universi-
ties, many professors must seek funding from several agencies in order to
maintain their research groups. That requires them to devote inordinate time
to writing proposals and reports, to the detriment of their teaching, mentoring,
and own creative efforts. Thereby, graduate education has been degraded. The
vital need to generate grant proposals causes faculty to avoid teaching small,
advanced classes and also to discourage their graduate students from taking
courses not directly relevant to their research project. Serving as hired hands
on a project is also a major factor in stretching out the time to obtain a PhD,
since veteran students are most useful in obtaining results to justify a grant
renewal. Once usually about 4 years, the median time to obtain a PhD is now
6 or 7 in most fields of science. For postdoctoral fellows, terms have likewise
become prolonged. Overall, the funding system has tended to narrow the train-
ing of our young scientists, prolong apprenticeship, and inhibit changing fields.

Braben acknowledges that peer previewing of proposals will likely remain
prevalent. Then it is all the more important to address problems and advocate
feasible reforms. Here I want to augment his suggestions by commenting on
two aspects. First, the previewing process, as now implemented, is needlessly
capricious. Typically, National Science Foundation and other agencies accept
grant proposals only during a “window” that is a month or so wide each year.
The applicant usually is not informed of the fate of the proposal for a full year
or more and is not provided with the assessments of the five or so anonymous
previewers until a few weeks later. That deprives the applicant of objecting if
one or more of the assessments is egregiously in error, or even resubmitting a
revised proposal until the next window, another year hence.

Such a system is misnamed “peer review.” For papers submitted to scientific
journals, the author can respond to objections of anonymous reviewers, so has
a fair chance to persuade the editor that the paper merits publication. I suggest
that funding agencies try out a similar approach. The grant applicant could be
given the option to post the proposal on a web site to which only viewers
registered with the funding agency are given access. The agency would post
the assessment from each anonymous previewer as soon as it has been received.
Then the applicant could respond to criticism and actually be a “peer” in, say,
two or three exchanges with the previewers. Also, the applicant and perhaps
the agency, could designate a few other scientists, not anonymous, to have
access to the web site and post comments on both the proposal and the anony-
mous assessments.
Second, funding of university research is largely to support graduate students and postdoctoral fellows, an essential investment in producing our scientific workforce. That investment is weakened by inflation of the time to obtain a doctorate, which makes pursuit of a scientific career less attractive to many students, especially women. In my generation, young scientists usually launched their independent research careers before reaching 30; now that is rare. For scientists receiving their first grant from the National Institute of Health, the median age has reached 42. That alarming situation has led the current director of NIH to initiate an “Early Independence Program,” for exceptional students, providing funds to enable them to bypass usual postdoctoral work and pursue their own ideas.

I hope more such programs appear but urge that a much wider, radical approach is needed, which I’m convinced would markedly shorten the apprentice time and enhance its quality. Stipends in support of graduate students (and eventually postdoctoral fellows also) should be uncoupled from project grants to individual professors. The same money could be put into expanding greatly fellowships students could win for themselves, as well as into block training grants to university science departments. Winning a fellowship or obtaining a training grant profoundly influences a student’s outlook and approach to research; they are certified as national resources rather than as hired hands. Also important is the freedom to choose, without concern for funding, which research group to join. That would especially benefit young faculty. In applying for the student support (as done now for more limited NIH training grants), science departments would need to shape more coherent graduate programs, designed to produce doctorates who have broader backgrounds and perspectives and who are better equipped to be architects of science rather than narrow technicians.

Donald Braben deserves gratitude from everyone concerned about wisely managing our investments in science, particularly in developing our future scientists. May a “Braben Club” arise to amplify his clarion calls!

Dudley Herschbach
Professor of Chemistry and Nobel Laureate
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