Peer review processes risk stifling creativity and limiting opportunities for game-changing scientific discoveries


Today, academics must prepare written proposals describing the research they wish to conduct and submit them to funding agencies for evaluation – a process known as peer review. According to ***Don Braben*** *and* ***Rod Dowler****, the current peer review process actually serves as a blocker to more radical research, stifling creativity and limiting opportunities for game-changing discoveries. Obviously peer review should not be abandoned entirely, but it is time to recognise the need for a separate category of highly innovative research with appropriate funding.*

Einstein's theory of relativity was criticised in 1931 in a book titled "100 authors against Einstein". He replied that if they were right, one author would have been enough. This is an extreme example of the perils of peer review when dealing with brilliant researchers at the cutting edge of science. It is of vital importance right now to avoid suppressing genius in favour of apparent practicality. To achieve this, we need to find a way to continue to allow for the exceptional and to produce the science seeds that blossom into economic prosperity.

Academics once provided insights into an unknown future because they were largely free from peer review's grip. In science, this produced enormous economic successes on a global scale. Most of the approximately 500 20th-century Nobel Prize winners were academics and their research led to such unpredicted discoveries as penicillin, the laser, the role of DNA, and many other biological discoveries that radically transformed the lives of us all.

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The primary goal of the rapid expansion of academia was to greatly increase the number of students attending universities, a highly laudable objective. But an unforeseen consequence was that the ranks of academics engaged in research also grew far beyond that which could be supported more or less unconditionally and public financial support had to be rationed.

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Today, academics must prepare written proposals on what they want to do and submit them to funding agencies for their evaluation – a process known as peer review. There is no escape from this process, which can take months that would otherwise be spent on research. Funding success rates are rarely more than 25 per cent. The agencies support only excellent proposals but as a result, freedom of research has been severely curtailed.

For example, the Engineering and Physical Sciences Research Council, the UK's largest Research Council (a funding agency) confines its support to 111 fields of science and engineering selected by the agency on the grounds that research in those fields can make a near-term difference to UK prosperity. Researchers must also express opinions on their works' impact. Even experienced business people, however, have difficulty predicting which developments or which technologies will succeed, and it appears that Councils are indulging in wishful thinking. The Research Councils believe that the more rigorous they can make these arrangements the greater will be the UK's prosperity. As policies are evidence-based these arrangements can change, creating new uncertainties for researchers.

Excellence is not an absolute concept but nevertheless peers are routinely required to assess proposals and grade them according to levels of excellence they perceive. Councils claim that the introduction of these hurdles does not affect researchers' creativity. This is inconceivable. Scientific research should be open-ended. Serious-minded researchers should be capable of noticing anomalous behaviour in a system, carefully exploring wherever it may lead and hopefully thereby making great discoveries. How can constraining them not affect their creativity?

A recent example of this approach is the unexpected discovery of the so-called CRISPR-Cas9 system in biology. A young Spanish PhD student, Francisco Mojica, who was interested in how certain extremophiles (a type of organism) found in the local salt marshes survive changes in salinity, discovered the mysterious repeat sequences of CRISPR in bacterial genomes almost 30 years ago. The appreciation that CRISPR operates as an adaptive bacterial immune system protecting against viruses by attacking their DNA took many years of curiosity-driven research. It was repeatedly rejected by peer review but eventually enabled the editing of genes of many organisms with unprecedented accuracy, transforming biomedicine – a beautiful example of the fruits (and long timescales) of curiosity-driven research.

Today, this game-changing discovery is at the centre of a litigious storm as scientists from the east and west coast of the USA fight for who should get the credit for its subsequent development and perhaps also the accompanying Nobel Prize, in which Mojica might also share. Nowadays, however, funding based on perceived excellence is far too targeted, is directed towards established groups and, most important, young scientists rarely get a look in.

Current policies make sense for incremental or near-market research that may well lead to the creation of new technologies based on existing fundamental theories. The casualty of such policies, however, will be hard-to-predict radical discoveries, which are the ones that offer opportunities for growth on a global scale.

We know that nowadays there are many scientific fields where understanding is poor. These include aging, consciousness, chemistry-at-a-molecular-address, the nature of gravity, and the origin of life, to name only a few. The global economic value of the unpredicted 20th century discoveries can probably be measured in hundreds of trillions of dollars. The UK has a particularly fine record with these types of basic research. Uninhibited exploration of these fields would almost certainly reveal unimaginable opportunities for growth and enrichment. However, they are in danger of being strangled by bureaucratic processes that would have denied funding for many of the 20th century's major discoveries.

The problems discussed here are much the same in every advanced country in the world. They also apply to academic research outside of the physical and life sciences. For example, in economics, the dominance of neoclassical theories has made it almost impossible for universities to pursue pluralistic alternatives despite the singular shortcomings of current theories. However, some solutions would cost little. We are not proposing the abandonment of peer review but, rather, the recognition of the need for a separate category of highly innovative research with appropriate funding.

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One approach could be for a few universities to support their own innovative research funding schemes from their own resources. Exceptionally high standards should be set, but above all, the people they fund should be chosen without using consensus. Participating universities should accept that funding success rates would be very low but in some cases the results would be dramatic. Based on the personal experience of one of the authors, this is an inexpensive form of research as the scientists involved are not competing and expensive equipment is rarely required. This is an effective way to expand knowledge and support basic research. There may be others.

We strongly believe that action is needed to meet funding needs that peer review does not satisfactorily address. The resulting benefits would be incalculable and continue to allow the blossoming of creativity over the coming years, just as we have benefited from the work of Einstein and other greats.

About the authors

Donald Braben *is an honorary professor in the Earth Sciences department and in the office of the Vice-Provost (Research), University College London. His latest book is "Promoting the Planck Club: How defiant youth, irreverent researchers and liberated universities can foster prosperity indefinitely", Wiley, 2014.*

Rod Dowler *is Chair of the Industry Forum, a Professorial Research Fellow at the Global Policy Institute, part of London Metropolitan University, and a former KPMG partner.*