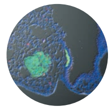
**PUBLISHING** Nature journals tighten the rules on conflicts of interest **p.6**

**WORLD VIEW** Assess the social dynamics of peer-review panels **p.7**



**CANCER** Nanoparticles made of sugar target tumour cells **p.9**


# Lucky science

*Scientists often herald the role of serendipity in research. A project in Britain aims to test the popular idea with evidence.*

Science-fiction writer Isaac Asimov is widely credited with saying that "the most exciting phrase to hear in science, the one that heralds new discoveries, is not 'Eureka!' but 'That's funny'." Scientific folklore is full of tales of accidental discovery, from the stray Petri dish that led Alexander Fleming to discover penicillin to Wilhelm Röntgen's chance detection of X-rays while tinkering with a cathode-ray tube.

That knowledge often advances through serendipity is how scientists, sometimes loudly, justify the billions of dollars that taxpayers plough into curiosity-driven research each year. And it is the reason some argue that increasing government efforts to control research — with an eye to driving greater economic or social impact — are at best futile and at worst counterproductive.

But just how important is serendipity to science? Scientists debating with policymakers have long relied on anecdotal evidence. Studies rarely try to quantify how much scientific progress was truly serendipitous, how much that cost or the circumstances in which it emerged.

Serendipity can take on many forms, and its unwieldy web of cause and effect is difficult to constrain. Data are not available to track it in any meaningful way. Instead, academic research has focused on serendipity in science as a philosophical concept.

The European Research Council aims to change that. It has given biochemist-turned-social-scientist Ohid Yaqub a sizeable €1.4-million (US$1.7-million) grant to gather evidence on the role of serendipity in science. Yaqub argues that he has found a way to do so.

First, he defines serendipity in a way that goes beyond happy accidents, by classifying it into four basic types (O. Yaqub *Res. Policy* **47,** 169–179; 2018). The first type is where research in one domain leads to a discovery in another — such as when 1943 investigations into the cause of a mustard-gas explosion led to the idea of using chemotherapy to treat cancer. Another is a completely open hunt that brings about a discovery, such as with Röntgen's X-rays. Then there are the discoveries made when a sought-for solution is reached by an unexpected path, as with the accidental discovery of how to vulcanize rubber. And some discoveries find a solution to a problem that only later emerges: shatterproof glass for car windscreens was first observed in a dropped laboratory flask.

Starting in the archive of US sociologist Robert K. Merton, Yaqub gathered hundreds of historical examples. After studying these, he says, he has pinned down some of the mechanisms by which serendipity comes about. These include astute observation, errors and "controlled sloppiness" (which lets unexpected events occur while still allowing their source to be traced). He also identifies how the collaborative action of networks of people can generate serendipitous findings.

Yaqub, who works at the University of Sussex in Brighton, UK, is now looking to build a team to use this classification system as a framework for mining the world's scientific grants. By following the publications and patents that emerge from grants, he hopes to find out how often serendipity arises, and to understand its significance and nature. The hunt will start in biomedicine, but could grow to examine other disciplines.

This seems like a smart way to start attempting something very difficult. And if it proves possible to test the role of serendipity, researchers should do so. Given the paucity of existing evidence, even weak or partial observations could help policymakers to examine the most efficient way to fund research. That could let them balance different modes of funding, for example, or create the environments that encourage serendipity and permit researchers to capitalize on unexpected results.

***"Studies rarely try to quantify how much scientific progress was serendipitous."***

If happy accidents are just as likely to occur through goal-oriented research as they are through blue-skies research — witness Roy Plunkett's accidental discovery of non-stick Teflon while looking for non-toxic refrigerants — that could weaken the suggestion that serendipity and research-targeting are necessarily at odds with each other. (The heavy-handed oversight that sometimes goes hand in hand with applied research is a different issue.)

Giving curious minds free rein to explore nature may well be the best way to generate discoveries, but there is no harm in testing that assumption. As taxpayer demands for scrutiny and accountability grow ever louder, just-so stories about Petri dishes and non-stick frying pans, however compelling, no longer make a convincing case. ■

# Early warning

*A seminal study 50 years ago warned of the demise of the West Antarctic Ice Sheet.*

Fifty years ago, many scientists were looking up. In 1968, the Russians sent the first animals to orbit the Moon (including a couple of tortoises), and NASA's Apollo programme kicked into gear to produce the first views of Earth from space. But in Antarctica, John Mercer was looking down — and he was concerned about what he saw.

That year, the late Mercer, a glaciologist at Ohio State University in Columbus, first warned about the potential for rapid sea-level rise from melting ice caps. His landmark paper drew on fieldwork at the Reedy Glacier, which feeds into West Antarctica's Ross Sea (J. H. Mercer *Int. Assoc. Sci. Hydrol. Symp.* **79,** 217–225; 1968). Geological evidence from a former lake, located at an altitude of 1,400 metres in the Transantarctic Mountains, suggested that the area was once awash with open water and floating icebergs. Mercer took that as evidence that the entire

West Antarctic Ice Sheet had once melted away.

The paper was an intriguing synthesis of the science of the times. Using multiple lines of evidence, Mercer sought to explain how sea levels could have risen by 6 metres in the previous interglacial period, around 120,000 years ago. The melting of Greenland or the East Antarctic Ice Sheet could not explain it, because both are located on solid earth and would respond relatively slowly to warming. By contrast, much of the West Antarctic Ice Sheet is grounded well below sea level. That makes it a "uniquely vulnerable and unstable body of ice", Mercer wrote.

Many credit a 1974 paper by Johannes Weertman, a geophysicist at Northwestern University in Evanston, Illinois, with providing a technical explanation for how such a massive ice sheet could disintegrate (J. Weertman *J. Glaciol.* **13,** 3–11; 1974). And the late Bob Thomas, a NASA glaciologist, spent years investigating and explaining how floating ice shelves acted as corks, stemming the flow of land-bound glaciers into the sea. But Mercer still deserves credit for sounding the alarm.

It took a while for the idea to take hold. Advanced numerical ice-sheet models developed in the late 1980s tended to downplay the risk of rapid ice loss from western Antarctica, and the Intergovernmental Panel on Climate Change suggested in its 1995 report that Antarctica as a whole was stable. But evidence to the contrary mounted: the massive Larsen A and B ice shelves collapsed in 1995 and 2002, respectively, followed by a major rift in Larsen C in 2017. In 2014, a team of scientists declared that the loss of ice in the Amundsen Sea Embayment had accelerated and appeared "unstoppable".

The future of the ice sheet, which holds enough water to boost global sea levels by more than three metres, is now at the top of the Antarctic research agenda. Scientists are still scouring the world for palaeoclimate records to pin down past sea-level change, modellers are refining their calculations and fieldwork continues apace. As early as next month, the US National Science Foundation and the UK National Environmental Research Council are expected to jointly announce the recipients of a US$25-million fund for research on the future of the Thwaites glacier, which flows into the Amundsen Sea. Satellite measurements indicate that melting there has doubled in the past several years, and now accounts for roughly 10% of the global sea-level rise. In a 1978 paper in *Nature*, Mercer updated his arguments in clear and elegant terms. "A disquieting thought is that if the present highly simplified climatic models are even approximately correct," he wrote, "this deglaciation may be part of the price that must be paid in order to buy enough time for industrial civilisation to make the changeover from fossil fuels to other sources of energy" (J. H. Mercer *Nature* **271,** 321–325; 1978).

***"The future of the ice sheet is now at the top of the Antarctic research agenda."***

That thought still rings frighteningly true. Thus far, the 2015 Paris climate agreement, which commits the world to limiting warming to 1.5–2 °C, remains intact, despite the objections of US President Donald Trump. But grand commitments aside, the governments of the world, and by extension the citizens that they represent, have yet to demonstrate that they are up to the task of reducing greenhouse-gas emissions quickly enough to avert the most disastrous consequences.

Fifty years is the blink of an eye in geological terms, but it is long enough for science to raise its voice. It might feel like pushing against the tide, but researchers have to keep making the point that strong action on emissions could still prevent the worst. Without it, significant sea-level rise will become a certainty. In the long run, higher oceans could well become one of humanity's most obvious self-inflicted wounds. ■

# Outside interests

*Nature Research journals will ask authors to declare non-financial conflicts.*

What makes a conflict of interest in science? Definitions differ, but broadly agree on one thing: an influence that can cloud a researcher's objectivity. For some people, that influence can be money. But there are other influences that can interfere, such as institutional loyalty, personal beliefs and ambition.

*Nature* and the other Nature Research journals (including the Nature research and reviews journals, *Nature Communications*, *Scientific Reports*, *Scientific Data*, the Nature Partner Journals and the Communications journals) are taking into account some of these non-financial sources of possible tension and conflict. From February, authors of research articles, reviews, commentaries and research analyses will be asked (and expected) to disclose them (see go.nature.com/2ddg12z).

For this purpose, competing interests (both financial and non-financial) are defined as a secondary interest that could directly undermine, or be perceived to undermine, the objectivity, integrity and value of a publication through a potential influence on the judgements and actions of authors with regard to objective data presentation, analysis and interpretation. Non-financial competing interests can include a range of personal and/or professional relationships with organizations and individuals, including membership of governmental, non-governmental, advocacy or lobbying organizations, or serving as an expert witness.

We recognize that not everybody shares the same level of concern about non-financial conflicts. Some argue, for example, that because non-financial conflicts cannot be removed, whereas financial conflicts can, focusing on the former could send a message that it's enough to simply declare financial conflicts rather than remove them. And few would agree with the judge in Scotland who, in a 2005 case, concluded that non-paid expert witnesses were more likely to be biased (because they wanted to push an agenda) than the highly remunerated experts who spoke on behalf of a tobacco company (L. Friedman and R. Daynard *Tob. Control* **16,** 293; 2007).

Numerous studies have demonstrated that financial competing interests in industry-sponsored research have the potential to introduce bias into study design, analysis and reporting; by comparison, the impact of non-financial competing interests has been much less well studied. Nevertheless, it is fair to expect that these associations could colour study design, interpretation and the subsequent reception of published findings; to guard against that, a number of clinical and biomedical journals have required disclosures of non-financial interests for several years. At a time when there is increasing scrutiny of the scientific process, transparent disclosures that allow readers to form their own conclusions about the published work are the best way to maintain public trust.

Nature journals will make full disclosure statements available to peer reviewers as part of the review process and will publish them online. However, although we will facilitate disclosure during the peer review and publication process, the responsibility for appropriately disclosing, managing and eliminating competing interests rests with the authors and their institutions. If we become aware of undisclosed interests that could qualify as a competing interest, in most cases we will amend the published work by issuing a correction. However, in rare cases in which the competing interest is important enough to raise concerns about the reliability of the study, more-serious action may be warranted. Nature Research journals already invite peer reviewers to exclude themselves in cases in which there is a significant conflict of interest, financial or otherwise. And journal editorial staff are required to declare to their employer any interests.

The Nature journals' competing financial interest policy for authors, which was first introduced in 2001, focused on primary research articles only. We expanded the remit in subsequent years to include review articles and other types of externally authored material, including News & Views, book reviews and opinion articles. The current move is the latest in an evolving process, and we welcome feedback on the change. ■