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No place for bullies in science

High-profile allegations of bullying at a German research institute highlight the need for better systems to protect young scientists.

Picture the scene: You are an enthusiastic young scientist, with, you think, the world at your feet. You have an exciting offer to join a world-leading research institute in another country. And then, to your dismay, you find yourself in a workplace where everything feels wrong. Your supervisor intimidates you and you receive upsetting e-mails, but the institute leadership seems indifferent. You are alone in a foreign culture, and you don't know what to do. Your friends tell you to complain, but you are afraid of repercussions — and of losing the opportunity you fought so hard for. And, anyway, you don't know who to trust.

This has apparently been the situation for years for some young researchers at the Max Planck Institute for Astrophysics in Garching, Germany. Details of their struggles with alleged bullying by one of the directors — Guinevere Kauffmann — erupted in the media in the past two weeks.

According to the allegations, problems at the institute have simmered for years. The institute put in place coaching and monitoring for Kauffmann, who says: "I believe I have modified my behaviour very substantially in the last 18 months since the complaints were made." The institute also circulated an anonymous survey to young researchers, asking whether they think the problems are continuing and whether they have enough support. The results are to be presented to the institute this week, but, according to a leaked copy of the report, they show three fresh allegations of bullying against current staff, although it is not known against whom. The institute says it is investigating.

In *Nature*'s opinion, young researchers there have been let down over the years. These researchers say the institute and its parent body, the Max Planck Society — also one of the world's leading research organizations — failed to control the situation in a timely manner. It is hard to disagree.

Most scientific institutions in Germany — including the Max Planck Society — already have formal procedures in place to deal with misconduct in the lab. These focus mainly on plagiarism, fabrication and falsification. But they usually also include an ombudsman system — a supposedly independent figure who can hear complaints and weigh in. Students and staff should be able to raise allegations of bullying in this way. In this specific case, this didn't happen. Young scientists who say they were bullied found the system inadequate because no one to whom they could complain within the Max Planck system seemed to them to be truly independent. The Max Planck Institute for Astrophysics says it is already revising its code of conduct and making sure its internal mechanisms for addressing concerns are accessible. The Max Planck Society says that it will also look at the way it deals with allegations of inappropriate behaviour. It should do so urgently.

A key relationship in science is that between student and supervisor, in which the student is often entirely dependent on the supervisor and that person's support to progress in their career. Students embarking on postgraduate or postdoc years are sometimes unprepared for the demands that are placed on them. And many supervisors have only their own experiences to draw on. It's possible that what a supervisor views as firm direction or lively banter crosses the line into bullying and abuse.

Institutions will argue — correctly — that allegations must be addressed with due process, typically with a need for confidentiality. That can and does take time. But rapid protection for those who may be suffering and, more generally, the protection of vulnerable young employees at the start of their careers must take precedence.

The issue of sexual harassment in science has received overdue and welcome attention recently, and most observers believe the high-profile cases reported so far are the tip of an iceberg. Could bullying be equally prevalent? The data are not yet there, but it is telling that of the 300-plus responses sent in relation to a recent Editorial (*Nature* **556**, 5; 2018) about poor postgraduate mental health, a significant number highlighted a dysfunctional — or worse — relationship with their supervisor.

"The protection of vulnerable young employees must take precedence."

We will never know how many promising scientific careers around the world have been brought to a premature end because young researchers felt they could not continue to work under a bullying senior figure. But it should stop. Now. Those affected must be shown that the system will protect them if they choose to speak out. Institutions should ensure they have explicit policies in place for dealing with bullying, and, as part of that, define what constitutes bullying. And senior scientists who see colleagues behave in an inappropriate way should speak out. ■

Form is temporary

Analysis of career-long impact offers renewed hope for scientists waiting for success.

"There are no second acts in American lives," wrote F. Scott Fitzgerald, and he should know. He never quite equalled the form he found with his novel *The Great Gatsby* in 1925 — although some might say neither has anyone else.

The phenomenon of form — and how it can cluster into claimed hot streaks — is much discussed by movie buffs. Does anyone doubt that the Oscars for Martin Scorsese's 2006 film *The Departed* were belated recognition for the director's peerless streak between 1973 (*Mean Streets*) and 1980 (*Raging Bull*)? For that matter, has Robert de Niro ever topped his performances in the latter film and in Scorsese's *Taxi Driver* (1976)? It's the same story in music: the stars of Madonna, Björk and Beyoncé have all shone their brightest at particular times.

Such examples could suggest that if you haven't produced any big hits by the middle of your career, you've missed your chance. But a study published this week in *Nature* offers hope for those still waiting

(L. Liu *et al. Nature* https://doi.org/10.1038/s41586-018-0315-8; 2018). It examines the occurrence of hot streaks — runs of high-impact works — in the oeuvres of tens of thousands of film-makers, artists and scientists. It finds that most careers contain at least one relatively hot streak, and that this occurs at an apparently random stage in an individual's sequence of works.

From 'hot hands' in basketball to 'momentum' in football, folk wisdom tends to dominate discussions of form, just as it does beliefs about gamblers' winning streaks. Some will claim that 'everyone knows' artists and scientists produce their best work when they are young: Mary Shelley wrote *Frankenstein* at 19, and Jocelyn Bell Burnell was in her 20s when she discovered the first pulsar. But then, how to explain the late second blooming of novelist Philip Roth? Others place the peak of performance at mid-career, when the benefits of experience aren't yet counteracted by declining faculties — look, for example, at the musicians Ella Fitzgerald and Nina Simone.

The new analysis, which looks at crowdsourced film ratings and art auction prices, says that there is no typical career point for a hot streak. The authors argue that creative impact shows the features of 'bursty dynamics' — just like other human traits, including movement and e-mail and telephone communications (K.-I. Goh & A.-L. Barabási *EPL* **81**, 48002; 2008). This is not quite the same as saying that large or significant events happen at random; rather, their occurrence is correlated, such that the average time between successive events is smaller than random. If one occurs, another is likely to follow soon — but that sequence can't last long. That's precisely what a hot streak is.

For the 20,000 scientists included in the study, the proxy for impact was the citations of an individual's papers over the ten-year period following each paper's publication. One could quibble that some scientific papers draw most attention only decades after publication — but that's rather rare. Hot streaks here correspond to a run of papers cited significantly more than an individual's average.

The good news is that around 90% of artists and scientists have at least one such hot streak in their career. The bad news is that it's typically not repeated: 64% of artists and 68% of scientists have only one, and more than two is very rare. F. Scott Fitzgerald was mostly right, then. And there might be little one can do to influence the matter: hot streaks do not, for example, correlate with productivity. The authors of the study make no claim that 'impact,' as they measure it, is a good proxy for creativity. After all, there's still no consensus about how creativity should be defined and measured, let alone whether or how it can be cultivated and nurtured. And scientific impact goes beyond citations.

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Indeed, it would be a sad day when the intrinsic value of a work was judged by how much it can be sold for. But the disconnect between popularity and worth perhaps goes to the heart of what to make of these findings. To use economics terminology, are the dynamics of success endogenous — driven by the fluctuating inspiration of the creator, say — or exogenous, produced by the vicissitudes of the marketplace? It's tempting to imagine a bit of both: that the creator suddenly finds he or she has tapped into the zeitgeist — only to discover, a little further down the line, that the world has moved on.

Maybe the most appealing message, however, is that the dynamics of science are no different from those of the arts: success in both depends on a resonance between the individual's imagination and the shifting moods and desires of the audience. ■

Depth charge

Nations must weigh the environmental costs before mining minerals on the ocean floor.

The biggest deep-sea mining operation so far was a cold-war ruse. In 1974, the US Central Intelligence Agency launched an elaborate operation to recover a Soviet submarine northwest of Hawaii, under the cover of a commercial venture to mine manganese nodules located on the sea floor. The spooks got a piece of the submarine but left any valuable minerals in the area for future prospectors.

Despite mounting interest in such sea-bed resources, little has happened since. But the world's first commercial mining venture in the deep sea seems only a matter of time. Estimates vary, but optimists claim there could be huge untapped piles of precious metals, including gold and silver, down there. Several countries, including Papua New Guinea, Japan and South Korea, are pursuing sea-bed mining in their territorial waters, and interest in international waters is on the rise, as well. The International Seabed Authority (ISA), which was established in 1994 under the United Nations' Law of the Sea and regulates activities that occur outside national jurisdictions, has already issued 28 exploration permits to entities in 20 countries.

At a meeting next week, the ISA's council will once again discuss a possible process to permit, monitor and end mining operations, which will eventually cover more than half of the ocean floor — collectively known as 'the Area'. The ISA began deliberations in earnest in January 2017, and observers think that the regulations could be formalized as early as 2020. Many of the details must still be ironed out.

The impact of the regulations will necessarily be limited: 29 countries, including the United States, have yet to either sign or ratify the Law of the Sea, and so are not technically bound by the ISA's authority. And within national waters, each country must craft sensible regulations. But the ISA could help to create best-practice policy that will aid governments in regulating domestic activities.

For a time, it looked as if the first commercial project could be in Papua New Guinea, where the Canadian firm Nautilus received its first lease in 2011. The site is located at a depth of 1,600 metres in the Bismarck Sea, between the islands of New Britain and New Ireland, but the company's quest for copper and gold deposits has encountered numerous legal and economic challenges. It remains unclear when or whether operations will move forward.

The slow pace of development has given a little breathing room to scientists who are scrambling to understand the impacts of sea-bed mining. Already, researchers have raised a host of potential problems. The most obvious is that scouring the ocean floor will destroy a landscape — and an ecosystem — that is unlikely to recover quickly: after all, it took millions of years for these mineral deposits to form.

But the impacts could stretch well beyond the immediate mining area. The dredging and collection process create underwater plumes of particles, and any material left over after the initial processing on ships could be released back into the ocean. That material will spread and eventually sink, potentially affecting life at all ocean depths.

The ISA's priority now must be to create strong environmental safeguards. In particular, regional environmental management plans must be put in place before any mining occurs. This is where research comes in: experts must determine how much of the ocean floor should be set aside, and where, to preserve biodiversity. And it can help to explain how dense particle plumes can become, and how far they should be allowed to spread. Researchers worldwide are investigating these issues.

Governments must look at mining and minerals holistically. Where possible, the goal must be to reduce consumption and increase recycling, through more-systematic recovery efforts and better product designs. But demand for metals is unlikely to abate soon. And mining on land comes with its own environmental impacts. It could even be that venturing into the sea — if done properly, and with the correct safeguards — makes more sense than digging yet another ugly hole in a sensitive terrestrial environment. But we can't say so yet. ■