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How to be good

A proposed international code of ethics can serve as a springboard for discussion on how scientists can take positive action in their own workplace.

You are an early-career scientist poised to publish a paper that you think will be your big break. It describes your imaginative hypothesis — a potential scientific insight with substantial implications — along with the experiments you designed and constructed, and the carefully documented data that support your initial insight. It's a genuine advance for the field and will be widely cited. Your lab head will be satisfied. Job done!

Then, disaster. You wake in the small hours and realize a possible flaw: another way in which the data could be interpreted, that would throw the conclusion into doubt. No one else will spot the problem — the lab head is too busy and no editor or reviewer will realize — and further experiments to settle the issue will take time. Worse, fresh results could sink the hypothesis (and subsequent grants). So, do you publish anyway?

Of course not! Science puts the pursuit of truth above all else, right? Well, not always. The dilemma above is a real one faced by real scientists, and not all of them jump the right way. What can help them to make the right decision? Some scientists think it might help to discuss this idea: "Pursuing the truth means following the research where it leads, rather than confirming an already formed opinion."

That statement opens one of seven presentations in a 'Code of Ethics for Researchers' produced by a group of scientists convened by the World Economic Forum. These scientists, drawn from many countries, are all under 40 but well established in career terms, with decades of research and leadership ahead of them. This combination makes them well qualified to explore the realities and pressures of modern lab life, so their ideas deserve to be considered by the scientific community.

Many science organizations have issued similar recommendations to their own research communities — the Science Council of Japan, for example, has made a valiant effort. But it can be difficult to persuade busy and pressured scientists to take notice of such guidelines, especially when — usually — they are expressed in rather terse form, as if on tablets of stone. This document, carrying the weight of an international consensus, demonstrates well how consideration of ethical issues is not additional to research practice, but an integral and essential component. It has the virtue of being presented in an engaging and persuasive style.

Each of the seven pages is headed by an exhortation such as "Minimize harm" and "Support diversity", backed by an explanation of why the entreaty matters and a brief presentation of the ultimate goal and practical approaches to achieving it. A collection of real-life anecdotes helps to illustrate their relevance.

The effort is valuable because, alongside fundamental tenets of research behaviour (such as "Be accountable" and "Be a mentor"), the code contextualizes natural sciences in a time of rapid technological change and popular questioning of expertise. Its authors see it as helping to redefine "the social and moral contracts that bind researchers to society" and infuse research with "the most irreproachable behaviours".

Some of this context is familiar: it is hardly original to seek to minimize harm to citizens (ranging from wasted public money to damage to health and the environment), or to say that engaging with the public is important. But there are more radical suggestions, too: that such engagement should sometimes include public involvement in the "identification of the question, conception of a project, discussion of results and dissemination". Some will see that as extreme. Yet many research projects fail to make the societal impacts they aim for because they lack precisely this depth and breadth of engagement.

Any well informed reader will spot ways in which this code is contentious to researchers, and could find ways to fault it. But that would be to miss its virtues as a focus for discussion, not just by active researchers but also by those in positions of influence in universities, research institutions, governments and private funding bodies. Nothing in the document is fundamentally new, and yet it will still be interpreted by many as highly aspirational and even unrealistic. Who in the real world, critics might scoff, would be willing to divert funding from postdoctoral posts into better training for principal investigators or other means by which the code can be better pursued?

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As the authors state, their purpose is to stimulate open conversations "to safeguard a positive and sound research environment". Accordingly, *Nature* readers may do themselves and others some good by visiting http://wef.ch/coe and providing feedback. Even better, they might discuss the ideals expressed, and consider how to live up to them in their own lab, research institution or funding agency. We at *Nature* are trying to do so, too. ■

Wasted energy

Oil and gas emissions could exceed current estimates — and governments need to act.

When it comes to harmful emissions from the oil and gas industry, much of the focus tends to fall on methane, a potent greenhouse gas. But ethane and propane deserve scrutiny too.

Scientists know that ethane emissions rose during the early twentieth century and then began to decline in the 1970s as modern air regulations took effect. More recent monitoring suggests that the trend reversed in 2009, when atmospheric concentrations again began to rise, probably due to emissions from the expanding oil and gas industry, and particularly in the United States. Yet reconciling the atmospheric data with current emissions inventories has been tough.

This week in *Nature Geoscience*, researchers report progress (S. B. Dalsøren *et al. Nature Geosci.* http://dx.doi.org/10.1038/s41561-018-0073-0; 2018). The team simulated multiple emissions scenarios in an effort to reproduce observational data, including those gleaned from ice cores. They accounted for natural emissions from sources such as geological seeps and mud volcanoes, and plugged in detailed information about emissions from the fossil-fuel industry. The results suggest that the industry's ethane and propane emissions have been drastically underestimated, and are two to three times higher than figures used by the Intergovernmental Panel on Climate Change.

That in itself is a concern, because the two gases contribute to smog — but the study also underscores troublesome questions about industrial emissions of methane, which are second only to those of carbon dioxide when it comes to warming the planet. Where there are ethane and propane being released, there tends to be methane too. The ratios vary across oil and gas fields — but, once understood, they can be used to differentiate industrial methane emissions from those from other sources, including livestock, rice paddies and wetlands. As it happens, atmospheric methane concentrations also resumed their historical rise in 2007, after a nearly decade-long plateau.

This rise, some scientists have argued, implies that US methane emissions are also underestimated — they could be as much as double the US government's inventory — and that the fossil-fuel industry is largely to blame. But questions remain. Another line of research using carbon isotopes to determine methane's source found no such rise in industrial emissions, and suggested that the culprit for spiking methane concentrations is more likely to be rampant agricultural expansion in the tropics.

Governments don't need to know all the details before they act. The International Energy Agency estimates that the industry emits roughly 76 million tonnes of methane per year globally, and that three-quarters of those emissions could be eliminated with current technologies if companies fixed or replaced leaky equipment. Implementing just those measures that pay for themselves would be akin to reducing carbon dioxide emissions by 160 billion tonnes by 2100 — nearly 47 times the annual emissions of the European Union.

"Governments don't need to know all the details before they act."

Sadly, the administration of US President Donald Trump is moving in the opposite direction, undermining rules intended to reduce methane emissions. So far, courts have blocked these efforts, but the battle is heating up. On 22 February, the US Bureau of Land Management proposed a rule that would loosen requirements on oil and gas companies to reduce methane emissions.

The message is getting through internationally. Last year, a coalition involving industry, academia and environmentalists launched a research initiative to better document where and how much methane is being emitted from oil and gas operations. In November, eight of the world's major oil and gas producers committed to shoring up their operations. They understand the case for plugging leaks; now the United States must catch up. ■

ANNOUNCEMENT

Two documents for greater transparency

As part of a broader effort to improve reporting quality, *Nature* and the Nature journals introduced a reporting checklist for life-sciences papers in 2013. This asked authors to reveal some key details of experimental design. Last year, this checklist evolved into a broader reporting-summary document that is published alongside manuscripts to promote greater transparency.

We have now developed two new versions of the reporting summary: one for the behavioural and social sciences, launching this week, and one for ecology, evolution and environment (EEE) research, to follow later this month. Authors will be prompted to use these documents to provide important details of study design, data collection and analysis before papers are sent out for review.

In-house editors in behavioural and social sciences across the Nature journals developed the first document to address the distinct needs of research in this field — one that is remarkably broad, and includes numerous disciplines with distinct identities. Even in the same area, research protocols can vary substantially, ranging from qualitative and interpretative methods to deductive and quantitative approaches.

This presents some challenges when deciding on priorities. Most experimental approaches value sample size, for instance. But survey-based projects must also consider whether data are collected from an appropriately representative sample. Data collection methods may be relatively easy to standardize in a laboratory, but they can vary in fieldwork when scientists use a wide array of tools, or when language or literacy barriers must be overcome.

Despite these variations, our editors think it is valuable to consider all behavioural- and social-sciences research together to try to bridge the methodological divides between and within fields. We hope that describing study elements in a standardized way across the full suite of social-sciences methodologies and data types will help our multidisciplinary readers to appreciate and understand diverse research approaches.

The reporting-summary document for the behavioural and social sciences was developed on the basis of feedback from researchers with different disciplinary backgrounds and methodological expertise, including quantitative and qualitative analysis, and lab-based and field studies. It aims to capture key elements of how studies were designed, conducted and analysed — but it does not seek to enforce a specific set of standards.

For instance, determining sample size statistically using a power analysis might be best practice in experimental psychology, but it is not a necessary or sensible step in an anthropological study of a small village, which may have low sample size but effectively encompasses the entire available population. However, in both cases, authors should be able to provide a full report of how sample size was selected. Accordingly, the reporting summary is designed to be flexible.

Similar considerations motivated the design of the reporting-summary document for EEE studies. The Nature journals are among thousands of publications and organizations that have signed up to the Transparency and Openness Promotion (TOP) guidelines (B. A. Nosek *et al. Science* **348,** 1422–1425; 2015). The EEE reporting summary is being designed by in-house editors using the Tools for Transparency in Ecology and Evolution as a guide.

EEE studies include many distinctive features, and the reporting summary is being designed with those in mind. For example, there will be questions about fieldwork conditions and the treatment of wild animals, and authors of palaeontological work will be asked to describe specimen provenance, deposition and dating methods. We are currently integrating feedback from researchers into a final version.

The reporting-summary documents are a first step towards ensuring that the relevant communities pay systematic attention to reporting and transparency. These documents are not static, and the first iterations are intentionally broad. We look forward to receiving comments and thoughts. ■