THIS WEEK

Retraction challenges

Cleaning up the literature can be difficult.

A key responsibility of any journal is to correct erroneous information that it has published, and as quickly as possible. Easily said! It is straightforward enough for authors to correct a paper. But if it becomes clear after publication that the conclusions are fundamentally flawed, a retraction is appropriate — and things can then get a lot more challenging.

Why, other than through enforcement after misconduct, would anyone retract a paper in a high-profile journal? Regrettably, given the reputational damage that a retraction might yield, it may take a strong code of honour, and a strong consensus among sometimes many co-authors, to go public, rather than just let the paper join the many others that turn out to be flawed and fade away.

That is why the literature of retractions in high-impact journals might be skewed towards misconduct that has been proved through investigations. But all praise to the authors who decide to behave honourably. Where authors make it clear that nothing more than an honest error was involved, their retraction should bring them credit.

Where misconduct — a deliberate attempt to deceive — has been involved, things tend to get complicated. Universities fear misconduct for the immense trouble that it can cause them in investigations, for the legal tussles that can then ensue if the proceedings are contested, and for the potential damage to their reputations. But when such investigations prove misconduct, they often lead to retractions of one or many papers. Even then, if the conclusions are contested, journals might find themselves threatened with a lawsuit for the proposed retraction itself, let alone a retraction whose statement includes any reference to misconduct.

For years, with occasional exceptions, *Nature*'s annual number of research-paper retractions tended to average around one or two. But over the past two years, we have seen a considerable rise — six in 2013, and seven, so far, in 2014. We have reviewed these and previous retractions and would like to make some observations on the basis of their content and on the experiences of publishing them.

A high proportion of *Nature*'s retractions in recent years have come about through honest error, where authors have either discovered mistakes themselves after publication, or have had the errors brought to their attention and taken action.

Another observation is that negotiating some retractions can involve unavoidable delays of years because of some combination of the complexity of the science, disputes between co-authors, the need to await outcomes of lengthy investigations, and disputes over these proceedings. Journal editors have neither the authority nor the means to police authors or their institutions, and can be dependent on proceedings whose details are confidential to institutions. They also need to be sensitive to the interests of blameless co-authors.

Even when an institution and a journal both want a retraction, their interests in doing so may collide. An institution might be bound by confidentiality agreements and therefore unable to release the results of its scientific investigations, leaving editors in the dark as to the circumstances behind erroneous work. An institution may also wish the wording of the retraction to bolster its case against a wrong-doer, whereas a journal's interest is to avoid lengthy disputes, push the paper into oblivion, and avoid further wasted effort by researchers. Whether for that reason or, occasionally, for legal reasons, we have concluded that we cannot usually use retraction statements as a means of highlighting wrong-doing.

Why the sudden pulse of *Nature* retractions in 2013 and 2014? (The last year to reach such heights was 2003, when we retracted seven fraudulent papers by the physicist Jan Hendrik Schön.) We can only speculate. The publication dates of the papers retracted in the past two years range from 1994 to 2014. Data are nowadays more openly available and online scrutiny is increasingly vigorous. Some of the rise may parallel the growth in formal corrections associated with increased problems of irreproducibility, which in turn can arise from sloppiness in some overly pressurized laboratories.

"The duty to retract a demonstrably false paper remains paramount."

That should add to the concern of those worried about wasted funds for research. But the concerned should also pay attention to what must be increasing costs in legal fees, because those under investigation increasingly turn to lawyers to defend themselves and their reputations, and their employers and journals are more frequently having to respond accordingly. But whatever the obstacles, the duty to retract a demonstrably false paper remains paramount. ■

Warming up

Prospects for international agreement on combating climate change look brighter.

There is much for the world to be pessimistic about these days. The double crises of the Ebola outbreak in West Africa and Islamic extremism in the Middle East, for example, pose real dangers. So it says much for the one-day United Nations summit on climate change, held in New York City last week, that not only did it receive widespread media coverage, but also the enduring message sent by the meeting was one of optimism.

There have been enough 'turning points' in the politics of the effort to curb global warming to send anyone dizzy. That is the narrative the story demands: incremental progress is boring; grand gestures are preferred. Every meeting and announcement is the most important, at least since the previous one.

The politics and the science of climate change have long since parted

company. The science demands political action to aggressively curb greenhouse-gas emissions. The politics, as the saying goes, is a bit more complicated than that. But it is politics, not science, that offers the opportunity for intervention. (The science, of course, can help to guide policy, as is explained in a Comment on page 30 on the absurdity of the 2 °C target for global temperature rise.)

If last week's meeting marked a political turning point (and these things are best judged from a distance), then it came with the first signs that the world's largest economies (and worst polluters) are at long last forging an alliance. Even so, the message that seeped from many speeches and presentations was sobering: the combustion of fossil fuels that powers mobility and production in the globalized economy and that keeps our homes warm will probably lead to greater climate change than civilization can easily handle. There is no easy way out of that situation. But although time is running out, the world is not yet doomed.

One lesson, at least, does seem to have been learnt. The top-down approach to emissions reductions — binding caps and legally mandated targets for cuts — is a logical response to the climate problem, but an unworkable one. Global warming is a real and omnipresent risk, but it proceeds slowly and is essentially unobservable to the general public. Unlike escalating epidemics or savage acts of terrorism, a shifting climate has not forced societies and policy-makers to make it a priority. Despite headlines about extreme weather, that is unlikely to change.

Given this political reality, if a new global agreement to tackle climate change is to be agreed by the end of next year — as the UN schedule dictates — then it cannot follow the top-down model of the Kyoto Protocol. But the legal architecture and modes of operation of a contrasting 'bottom-up' agreement remain to be defined. Parties to the United Nations Framework Convention on Climate Change must yet resolve such thorny issues as compliance, verification of reported emissions, and rules of emissions trading. Such technicalities, which often prove to be pitfalls, do matter. But if China, the United States and the European Union — the world's largest emitters — pull together as they have promised, then a meaningful international climate agreement is well within reach.

Will such an agreement limit warming to 2 °C? Almost certainly not. Will it respond appropriately to the scientific evidence of the scale of the likely threat? Definitely not. Is it the best the world can do? Probably.

Regardless of its specifics and legal force, however, a climate agreement will not 'save the world', but nor would a failure of the Paris climate summit in December 2015 automatically mean Armageddon.

"The ultimate goal of closing the door on the fossil-fuel age seems far off."

The binary rhetoric that campaigners tend to apply in environmental matters does not do justice to the complexity of the task at hand. It would be too easy to blame this or that government for not doing enough when man-made climate change is really the result of collective economic activities, past and present, that cannot be broken like a habit. Key to coming to terms with the unprecedented dilemma we face is effective international cooperation across all aspects of economic and social life, with the ultimate goal of closing the door on the fossil-fuel age.

That goal seems far off, given the continued lure of oil and gas and the huge amount of 'locked-in' emissions from the army of new coal-powered plants in China and elsewhere. And the world population keeps growing: by mid-century, when global emissions will already need to have declined substantially to avoid excessive warming, billions of 'consumers' in Africa and Asia will remain trapped in the fossil-fuel age regardless of the low-carbon technologies that might then be available — unless they are helped out of poverty. Rich countries, meanwhile, must improve their public transport systems, encourage energy-saving construction and invest in grids and energy-storage technology that can accommodate the ebb and flow of electricity from renewable sources. Without these and countless other steps, any climate agreement will ultimately fall short. ■

BRAIN gain

A mixture of focus and innovation is the way forward for big neuroscience.

As *Nature* went to press, the US National Institutes of Health (NIH) was preparing to announce which scientists it has chosen to help it decipher the brain. To borrow a phrase from Winston Churchill, the announcement could mark the end of the beginning of an effort described by the White House as the greatest since the Human Genome Project. Now all that remains is to unlock the mysteries of the most complex object in the known Universe.

US President Barack Obama announced the BRAIN Initiative (Brain Research through Advancing Innovative Neurotechnologies) 18 months ago. Responsibility for the US$100-million-a-year project was shared between three agencies: the NIH, the National Science Foundation (NSF) and the Defense Advanced Research Projects Agency (DARPA).

Barely had the initiative fired a synapse before critics attacked its nebulous goal of 'mapping the brain'. Congress had no plans to grant new money for it, and neuroscientists worried that funds would be redirected from other research to support a poorly conceived government mandate. BRAIN's creators enjoyed comparing it with the Human Genome Project, but others drew comparisons with the European Union's Human Brain Project (HBP): a controversial €1-billion (US$1.3-billion) investment supporting a single researcher's vision of building a computational model of the human brain.

The NIH last year put together a working group to draw up a complex 146-page plan outlining priorities and milestones for BRAIN until 2025. It did a good job. Although the resulting $4.5-billion wish list for the project is a tall order, researchers overall are satisfied with an outline for mapping and monitoring the brain that leaves room for innovation.

Fans of both top-down and bottom-up science also got their way. DARPA, with typical military precision, announced that it wanted therapeutic devices for brain disorders that affect soldiers and veterans. It awarded a handful of multimillion-dollar grants to test brain-stimulation systems for purposes such as restoring memory and treating traumatic brain injury. The therapeutic goals are regimented, but the recipients must relish the chance to learn about brain function.

The NSF, which does not normally fund medical and applied research, has taken the opposite approach. In March, it sent out a letter inviting researchers to submit any and all brain-circuit-related ideas as two-page documents. That culminated in a set of 36 small projects, developing everything from tools to image neuron activity to predictive models of brain function. More than any other agency, the NSF shows that big science need not swamp investigator-driven research.

With other brain projects springing up — Israel's investment in brain technologies and Japan's effort to map connections in a marmoset brain, to name just two — the world looked set to form a global collective mind. Then, in July, the HBP derailed less than a year after its launch (see *Nature* **511,** 133–134; 2014). Scientists mutinied against director Henry Markram, asking the European Commission to intervene in what they saw as poor management and a focus on simulation rather than neuroscience. As the project struggles with its future, faith in big neuroscience has been shaken and joint HBP–BRAIN plans have been postponed.

The US BRAIN Initiative has the chance to get the concept back on its feet. Success will probably be down to a careful balance between focused order and innovative chaos — much like the organ itself. ■

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