# THIS WEEK

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# School daze

*As US states turn the screw on science education, researchers everywhere should pay more attention to how their subject is presented.*

Last week, state legislators in Iowa introduced a bill that would require teachers in state public schools to include "opposing points of view or beliefs" in lessons on topics including global warming, evolution and the origins of life. It's the latest in a surge of what advocacy group the National Center for Science Education calls "antiscience" bills introduced in US state houses in recent weeks.

Since last month, Indiana, Idaho, Alabama, Texas, Oklahoma and Florida have all introduced and discussed similar tweaks to the way in which they want to educate their children. A related move in South Dakota has been blocked — and researchers and science organizations that spoke up in opposition there deserve credit for doing so.

Although these proposed changes are typically presented by their supporters as giving teachers the chance to discuss genuine scientific controversies, in truth they are (very) thinly veiled attempts to pursue political and religious agendas that have no place in school science lessons — for whatever age. They seek to import the alternative facts and misleading rhetoric of the new federal government and to impose it on children who deserve much better from those elected to serve them.

In the wake of President Donald Trump's election, many scientists in the United States have taken to asking themselves and others what they can do. Here is something: join the voices and campaigns that seek to protect educational standards, speak out against damaging changes and support others who are already doing so, including those in the education system. Get involved: visit schools, meet teachers and assist people who want to continue to offer kids the best possible education by helping to prepare materials and lesson plans.

Scientists in other US states, and indeed other countries, should also pay more attention to what is happening in school science lessons. Largely unnoticed by anyone apart from specialists, arguments are brewing over the best way to give pupils a flavour of how science is done, as well as the facts and theories that it produces. This, after all, addresses one of the most common complaints that scientists have about how the public perceives their work — that much of science is value-laden, contested and highly contingent on who asks the questions and how. And, just as for their knowledge of the periodic table and the laws of thermodynamics, most non-specialists are heavily influenced by what they learnt in their days in the classroom.

Some have long argued that people who do not wish to pursue scientific careers are better off being schooled in how science works rather than in its outcomes, because this helps them to assess evidence and understand unresolved scientific issues in a way that, say, knowing about the structure of DNA and knowledge of chemical reactions do not. The problem there, of course, is that such information is crucial for those who do wish to pursue science beyond school — and, at such an early age, it is difficult to distinguish one type of student from the other.

The classroom compromise has been the inclusion in many national curricula of something called the nature of science (NOS). Teachers are encouraged to talk about the scientific process, and since the late 1990s or so, a fairly robust consensus has emerged on how this can be done. As a result, school science lessons typically feature discussions on hypothesis testing and the scientific method, how data can be interpreted in different ways and how scientific knowledge is tentative, subjective and open to challenge.

Like all good scientific consensuses, this one is now subject to challenge. Critics complain that it focuses too narrowly on how science is done, and not enough on who does it and why — and how this can influence the results. (Researchers in Spain last month described how, as a possible alternative, they have introduced into the curricula for trainee secondary-school science teachers discussions of the long and bitter dispute between Louis Pasteur and Justus von Liebig over the nature of fermentation.)

***"Not all science is tentative, and researchers should not be shy about saying so."***

Perhaps a more pressing criticism of the way NOS is taught in schools is that it encourages rather too much doubt over scientific ideas. Many findings, after all, are well established and, indeed, taken as such by professional scientists who use them as shoulders to stand on. Not all science is tentative, and researchers should not be shy about saying so — both to those in schools and to those in charge of schools. ■

# Dutch courage

*Science is already losing out as the rise of populism gets its next test in the Netherlands.*

Geert Wilders is unlikely to lead the Netherlands after next week's parliamentary elections, but perhaps he doesn't need to: his influence and agenda are already being felt. Wilders, who is head of the Party for Freedom (PVV) and tipped by many to win the majority of votes, gained popularity with a campaign that bears a striking resemblance to the strategies of Donald Trump.

Wilders' populist and derivative catchphrase 'Make the Netherlands ours again' is aimed firmly at the spectre of mass immigration and 'Islamization', which he says will bring about social destabilization, violence and terror. And his (extremely vague, single-page) manifesto doesn't try to hide his extremism. It calls for a halt to all government support for development aid, wind power, art, innovation and broadcasting: "Here is our plan: instead of financing the entire world and people we don't want here, we'll spend the money on ordinary Dutch citizens."

Success for Wilders' openly xenophobic and Eurosceptic

strategy would mark a political earthquake in a traditionally liberal country — a founding member of the European Union — whose advanced economy owes much to its strong science and innovation base. The Netherlands punches above its weight in science. Dutch host institutions, for example, have won 634 European Research Council grants in the past decade, more than Italy, Spain or Switzerland. In terms of such grants by number of universities and research staff, the Netherlands is Europe's best performer.

Although Wilders is unlikely to become Dutch prime minister even if he wins the popular vote — the Netherlands has a proportional representation system, and most other parties in the country's highly fragmented political landscape have ruled out forming a coalition with the PVV — the success of his aggressive campaign might not leave Dutch science unscathed.

The country's recent approach to developing a national science agenda has been unique. In 2015, the public were invited to submit questions about science. Some 12,000 questions were translated into investment priorities for research, from energy transition to health care and the search for the origin of life. Traditionally, the Netherlands has also relied on science for evidence-based policymaking — to restrict the use of antibiotics in livestock farming, for example. But political priorities, including science, have shifted in the run-up to the elections as immigration and terrorist concerns became more and more central.

As right-wing populism has spread to the political mainstream, so Dutch universities and research institutions have seen some of their international programmes and policies publicly questioned. Meanwhile, plans by the University of Groningen to create a campus in China have raised objections in parliament over tax money being inappropriately spent abroad. And Wageningen University, a hub for agricultural science with almost 50% foreign students, international classrooms and English-language courses that have been unquestioned for decades, is suddenly being perceived by some as problematic.

Anxiety is rising in the science community. The rectors of Dutch universities expressed their concerns last month in an open letter, reminding politicians and the public of the merits of freely pursuing science and the drawbacks of restricting immigration for scholars and researchers. It is indeed worrisome that fears of cuts and isolationism have spread to one of Europe's strongest and most multicultural research nations, whose universities do very well in international rankings. Public trust in science is higher in the Netherlands than in most other highly developed countries. And Dutch citizens expect a lot from science in terms of policy guidance and wealth creation. The country will be hit exceptionally hard if nationalism and vague anti-science sentiment gain traction.

***"The Dutch vote will set the stage for elections later this year in France and Germany."***

Any coalition resulting from next week's elections should therefore renew the Netherlands' firm commitment to science. The current government's 'top sector' approach aimed to improve collaboration between public research institutions and industry in nine key areas, including agriculture and food, water, life sciences and health. That approach, combined with sound funding for curiosity-driven basic research, is a promising strategy with which to address specific societal needs that arise from the country's economy and physical location.

In general, the next government should continue the national science agenda. In terms of specific policies, it must also reconfirm the Netherlands' commitment to clean energy and to taking part in international efforts to fight global warming.

Disdain for science and environmental concerns, a common characteristic of populist movements, pays a criminal disservice to humankind. Thankfully, Wilders' plan to steer the Netherlands into chauvinism is unlikely to work in that country, no matter how hard he tries to copy Trump in rhetoric and world view. But the Dutch vote, which has rarely attracted so much attention in Europe, will set the stage for elections later this year in France and Germany — two nations in which right-wing populism is strongly on the rise. Either way, Dutch voters and policymakers are about to set an example. ■

# Fake news

*Science journalism can be evidence-based and compelling but still get it wrong.*

There has been much gnashing of teeth in the science-journalism community this week, with the release of an infographic that claims to rate the best and worst sites for scientific news. According to the American Council on Science and Health, which helped to prepare the ranking, the field is in a shoddy state. "If journalism as a whole is bad (and it is)," says the council, "science journalism is even worse. Not only is it susceptible to the same sorts of biases that afflict regular journalism, but it is uniquely vulnerable to outrageous sensationalism" (see go.nature.com/2mhmupd).

News aggregator RealClearScience, which also worked on the analysis, goes further: "Much of science reporting is a morass of ideologically driven junk science, hyped research, or thick, technical jargon that almost no one can understand" (see go.nature.com/2lrzx8d).

How — without bias or outrageous sensationalism, of course — do they judge the newspapers and magazines that emerge from this sludge? Simple: they rank each by how evidence-based and compelling they subjectively judge its content to be. Modesty (almost) prevents us from naming the publication graded highest on both (okay, it's *Nature*), but some names are lower than they would like. Big hitters including *The New York Times*, *The Washington Post* and *The Guardian* score relatively poorly.

It's a curious exercise, and one that fails to satisfy on any level. It is, of course, flattering to be judged as producing compelling content. But one audience's compelling is another's snoozefest, so it seems strikingly unfair to directly compare publications that serve readers with such different interests as, say, *The Economist* and *Chemistry World*. It is equally unfair to damn all who work on a publication because of some stories that do not meet the grade. (This is especially pertinent now that online offerings spread the brand and the content so much thinner.)

The judges' criterion of evidence-based news is arguably problematic, as well. Many journalists could reasonably point to the reproducibility crisis in some scientific fields and ask — as funders and critics are increasingly asking — just how reliable some of that evidence truly is. Mainstream science reporters have typically taken peer review as an official stamp of approval from the research community that a published finding is sufficiently robust to share with their readers. Yet this kind of evidence-based reporting is only as reliable as the evidence it reports on. And many scientists would complain (even if only among themselves) that some published studies, especially those that draw press attention, are themselves vulnerable to bias and sensationalism.

This is one reason why the rise of the scientist (and non-scientist) as blogger, along with other forms of post-publication review, has been so valuable. Many scientists know about the problems with some fields of research. Many journalists do, too — articles on questionable practices from statistical fishing to under-powered studies are an increasing presence in most of the publications in the infographic. The relationship between science and media reporting is far from simple, and both sides should remember this. ■