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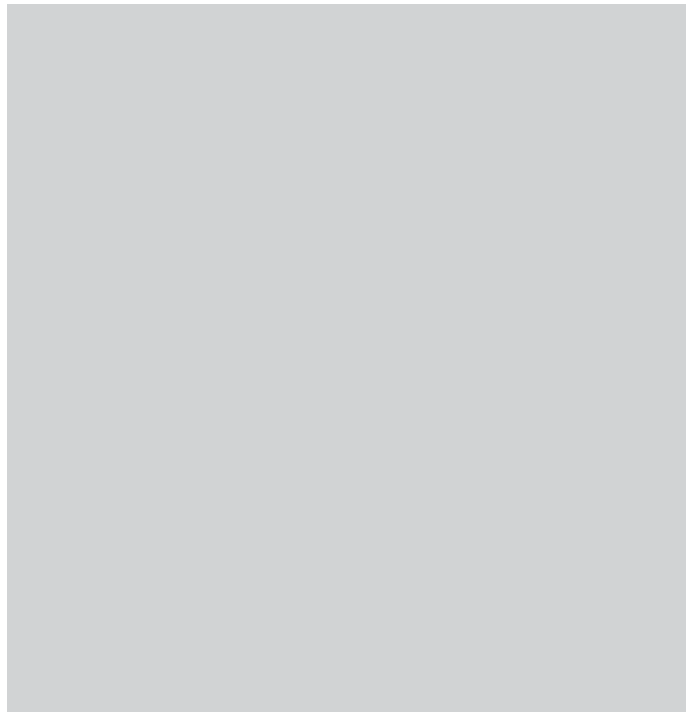
Is honesty a vital quality to do science? In fact 'misbehaviour' can be a vital part of the pursuit of knowledge, says **Michael Brooks**

AH, the naivety of the older generation. Nearly 500 eminent astronomers, biologists, chemists, physicists and earth scientists have identified the "core traits of exemplary scientists". Their answer? Honesty is critical, second only to curiosity.

Ironically, they are deceiving themselves. Researchers have never been whiter than white.

Here are a couple of relevant numbers. About two per cent of scientists admit to at least one act of research misconduct. But as a whole, researchers say around 14 per cent of their colleagues are involved in such behaviour. So someone is not being honest.

Those figures come from a 2009 meta-analysis, which is far more scientifically reliable than a single sample of "honored" academics, that also found one-third of scientists confessed to "questionable research practices"



such as cooking data, mining it for a significant result that is then presented as the original target of the study, selective publication or concealing conflicts of interest.

But we may never know for sure how widespread this behaviour is. A more recent meta-analysis shows scientists are becoming less likely to admit to fabrication, falsification or plagiarism. That study also found that researchers see plagiarism - stealing results from another scientist - as more heinous than making results up. They are more likely to report a colleague they catch plagiarising than fabricating or falsifying data.

How can this all be so, when honesty is supposedly such an essential attribute? Because a little bit of rule bending gets the job done. The University of Michigan's Raymond De Vries and colleagues have argued that data manipulation based on intuition

Must try harder

All schools should ensure children get the full facts on climate change, says **Michael Mann**

ARE schools in the US doing a good job teaching climate change? That's a vital question, given that today's children will be the ones dealing with the serious impacts of a warming world as adults.

The answer is distressing. Drawing on a comprehensive survey of science teachers at middle and high schools across

the US, a new report in the journal *Science* finds that we are failing students when it comes to both the quantity and quality of climate change education (doi.org/bcgt). It says teachers generally devote a paltry 1 to 2 hours to the topic. And despite the fact 97 per cent of experts agree climate change is mainly human-

caused, many teachers still "teach the controversy", suggesting a sizeable "consensus gap" exists. The survey showed seven in 10 teachers mistakenly believe that at least a fifth of experts dispute human-caused climate change.

Who is to blame for this sorry state of affairs? In one of my books, *The Hockey Stick and the Climate Wars*, I describe how those with interests in fossil fuels have spent tens of millions of dollars to create the impression of a consensus gap,

"Our children will bear the brunt of the climate crisis. We owe it to them to give them the facts"

orchestrating a public relations campaign aimed at attacking the science and the scientists, and confusing the public about the reality and threat of climate change. They also created a partisan political divide on the issue, most evident in the US.

It would be nice if teachers were immune to all this. Alas, it appears they are not.

Our educational system is a microcosm of society. If we are to restore objectivity to teaching of topics like climate change, we must restore objectivity to our broader public discourse.

Fortunately, there is a growing willingness among opinion

of what a result should look like is “normal misbehaviour”. They see such common misbehaviours as having ‘a useful and irreplaceable role’ in science. Why? Because of ‘the ambiguities and everyday demands of scientific research’.

In other words, data isn’t often as clean as you’d like. University of Texas ethicist Frederick Grinnell, says intuition is ‘an important, and perhaps in the end a researcher’s best, guide to distinguishing between data and noise’. Sometimes you just know a data point is an anomaly to be ignored.

Should we do something to make science more virtuous? Probably not. Those eminent academics questioned for the survey by Michigan State University are hopelessly optimistic when it comes to improving ethical standards: 94 per cent of them said students can learn scientific values and virtues from “exemplary scientists”.

Clearly they haven’t read the 1996 study that found teaching research ethics made students more likely, not less, to misbehave. Scientists, eh? It’s almost like they’re human.

Michael Brooks is a New Scientist consultant and the author of *The Secret Anarchy of Science* (Profile/

leaders and US media to name and shame those acting in bad faith, such as the billionaire Koch brothers, who fund groups intent on misleading the public.

Our children will bear the brunt of the climate crisis, battling coastal inundation, extreme weather, withering droughts and devastating floods. We owe it to them not only to give them the facts, but to help them clean up the mess that we created. ■

Michael Mann is distinguished professor of atmospheric science at Pennsylvania State University. His latest book is *Dire Predictions: Understanding climate change* (Pearson/DK)

ONE MINUTE INTERVIEW

Iran is ready to thrive

Freed from tough sanctions after a deal on nuclear activity, Iran can now prosper on the world stage, says **Abbas Edalat**



PROFILE

Abbas Edalat is a professor of computer science at Imperial College London, adjunct professor at the Institute for Research in Fundamental Sciences, Tehran, and founder of the Campaign Against Sanctions and Military Intervention in Iran

Some may think Iranian science is limited to nuclear technology. What is the reality?

Some of the best string theorists in the world are from Iran. It is strong in areas including molecular biology, stem cell research, robotics, cybersecurity and medicine. In 2014, the Fields medal in mathematics was won by an Iranian woman now in the US, Maryam Mirzakhani, the first woman to win it. There is huge talent in Iran.

How does it fare on the world stage?

Despite international sanctions, Iran has been the leading nation in terms of annual growth in scientific production in recent years and is 17th in the world in terms of output of papers, and first in the Islamic world. It has 4.5 million university students and 70 per cent of those in engineering and science departments are women.

What impact did sanctions have?

Ironically, virtually none on the government, but for many ordinary people they were devastating. Because the Iranian banking system was cut off

from the rest of the world, vital medicines could not be paid for. A lot of cancer patients died. For a couple of decades, researchers couldn’t download software from the US or buy vital equipment. As sanctions deepened, they could not even pay for journal subscriptions. US researchers were barred from visiting or giving advice without permission, and a lot of Iranian researchers could not get visas to travel – to the US or to Europe. It was very difficult to do any collaborative work.

And yet Iranian science seems in relatively rude health. How come?

Scientists in Iran took the view that failure was not an option. They would just try to get around the problems posed by sanctions – smuggling in the part they needed, building it themselves or devising ways to do without it. They innovated.

Has the situation changed since sanctions were lifted in January?

There is much more freedom of movement and researchers can now buy equipment and materials. Participation in international conferences will massively increase as well.

What are you most excited about?

A world-class astronomical observatory is being built in Iran. In 2018, construction will start on the country’s most important science project ever – a \$300 million synchrotron in Qazvin. Both projects involve international collaboration. Also, as a result of the nuclear deal, the Fordow site, which was used for fuel enrichment, will become a centre for cutting-edge research in areas such as nuclear fusion, astrophysics and medical isotopes.

So it’s all positive?

There are some caveats. Europeans who have been to Iran in the past five years will still not get the usual visa waiver if they want to go to the US, two top Iranian universities will have sanctions on them for eight more years and there are ongoing bans on some equipment based on possible dual use. But on the whole, things are looking up.

Interview by Jon White