



Scientific Heresy

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IT is a great honour to be asked to deliver the Angus Millar lecture. I have no idea whether Angus Millar ever saw himself as a heretic, but I have a soft spot for heresy. One of my ancestral relations, Nicholas Ridley the Oxford martyr, was burned at the stake for heresy.

My topic today is scientific heresy. When are scientific heretics right and when are they mad? How do you tell the difference between science and pseudoscience?

Let us run through some issues, starting with the easy ones.

- Astronomy is a science; astrology is a pseudoscience.
- Evolution is science; creationism is pseudoscience.
- Molecular biology is science; homeopathy is pseudoscience.
- Vaccination is science; the MMR scare is pseudoscience.
- Oxygen is science; phlogiston was pseudoscience.
- Chemistry is science; alchemy was pseudoscience.

Are you with me so far? A few more examples. That the earl of Oxford wrote Shakespeare is pseudoscience. So are the beliefs that Elvis is still alive, Diana was killed by MI5, JFK was killed by the CIA, 9/11 was an inside job. So are ghosts, UFOs, telepathy, the Loch Ness monster and pretty well everything to do with the paranormal. Sorry to say that on Halloween, but that's my opinion.

Three more controversial ones. In my view, most of what Freud said was pseudoscience. So is quite a lot, though not all, of the argument for organic farming. So, in a sense by definition, is religious faith. It explicitly claims that there are truths that can be found by other means than observation and experiment.

Now comes one that gave me an epiphany: crop circles. It was blindingly obvious to me that crop circles were likely to be man-made when I first starting investigating this phenomenon. I made some myself to prove it was easy to do.

This was long before Doug Bower and Dave Chorley 'fessed up to having started the whole craze after a night at the pub. Every other explanation – ley lines, alien spacecraft, plasma vortices, ball lightning – was balderdash. The entire field of 'cereology' was pseudoscience, as the slightest brush with its bizarre practitioners easily demonstrated.

Imagine my surprise then when I found I was the heretic and that serious journalists working not for tabloids but for *Science* magazine, and for a Channel 4 documentary team, swallowed the argument of the cereologists that it was highly implausible that crop circles were all man-made.

So I learnt lesson number 1: the stunning gullibility of the media. Put an 'ology' after your pseudoscience and you can get journalists to be your propagandists.

A Channel 4 team did the obvious thing – they got a group of students to make some crop circles and then asked the cereologist if they were 'genuine' or 'hoaxed', i.e. man made. He assured them they could not have been made by people. So they told him they had been made the night before. The man was poleaxed. It made great television. Yet the producer, who later became a government minister under Tony Blair, ended the segment of the programme by taking the cereologists' side: 'of course, not all crop circles are hoaxes'. What? The same happened when Doug and Dave owned up; everybody just went on believing. They still do.

Lesson number 2: debunking is like water off a duck's back to pseudoscience.

In medicine, I began to realize, the distinction between science and pseudoscience is not always easy. This is beautifully illustrated in an extraordinary novel by Rebecca Abrams, called *Touching Distance*, based on the real story of an eighteenth century medical heretic, Alec Gordon of Aberdeen.

Gordon was a true pioneer of the idea that childbed fever was spread by medical folk like himself and that hygiene was the solution to it. He hit upon this discovery long before Semmelweis and Lister. But he was ignored. Yet Abrams' novel does not paint him purely as a rational hero, but as a flawed human being, a neglectful husband and a crank with some odd ideas such as a dangerous obsession with bleeding his sick patients. He was a pseudoscientist one minute and scientist the next.

Lesson number 3. We can all be both. Newton was an alchemist.

Like antisepsis, many scientific truths began as heresies and fought long battles for acceptance against entrenched establishment wisdom that now appears irrational: continental drift, for example. Barry Marshall was not just ignored but vilified when he first argued that stomach ulcers are caused by a particular bacterium. Antacid drugs were very profitable for the drug industry. Eventually he won the Nobel prize.

Just this month Daniel Shechtman won the Nobel prize for quasicrystals, having spent much of his career being vilified and exiled as a crank. 'I was thrown out of my research group. They said I brought shame on them with

what I was saying.'

That's lesson number 4: the heretic is sometimes right.

What sustains pseudoscience is confirmation bias. We look for and welcome the evidence that fits our pet theory; we ignore or question the evidence that contradicts it. We all do this all the time. It's not, as we often assume, something that only our opponents indulge in. I do it, you do it, it takes a superhuman effort not to do it. That is what keeps myths alive, sustains conspiracy theories and keeps whole populations in thrall to strange superstitions.

Bertrand Russell pointed this out many years ago: 'If a man is offered a fact which goes against his instincts, he will scrutinize it closely, and unless the evidence is overwhelming, he will refuse to believe it. If, on the other hand, he is offered something which affords a reason for acting in accordance to his instincts, he will accept it even on the slightest evidence.'

Lesson number 5: keep a sharp eye out for confirmation bias in yourself and others.

There have been some very good books on this recently. Michael Shermer's *The Believing Brain*, Dan Gardner's *Future Babble* and Tim Harford's *Adapt* are explorations of the power of confirmation bias. And what I find most unsettling of all is Gardner's conclusion that knowledge is no defence against it; indeed, the more you know, the more you fall for confirmation bias. Expertise gives you the tools to seek out the confirmations you need to buttress your beliefs.

Experts are worse at forecasting the future than non-experts. Philip Tetlock did the definitive experiment. He gathered a sample of 284 experts – political scientists, economists and journalists – and harvested 27,450 different specific judgments from them about the future then waited to see if they came true. The results were terrible. The experts were no better than 'a dart-throwing chimpanzee'.

Here's what the Club of Rome said on the rear cover of the massive best-seller *Limits to Growth* in 1972:

Will this be the world that your grandchildren will thank you for?
A world where industrial production has sunk to zero. Where population has suffered a catastrophic decline. Where the air, sea and land are polluted beyond redemption. Where civilization is a distant memory. This is the world that the computer forecasts.

'Science is the belief in the ignorance of the experts', said Richard Feynman. Lesson 6. Never rely on the consensus of experts about the future. Experts are worth listening to about the past, but not the future. Futurology is pseudoscience.

Using these six lessons, I am now going to plunge into an issue on which almost all the experts are not only confident they can predict the future, but absolutely certain their opponents are pseudoscientists. It is an issue on

which I am now a heretic. I think the establishment view is infested with pseudoscience. The issue is climate change.

Now before you all rush for the exits, and I know it is traditional to walk out on speakers who do not toe the line on climate at the RSA – I saw it happen to Bjorn Lomborg last year when he gave the Prince Philip lecture – let me be quite clear. I am not a ‘denier’. I fully accept that carbon dioxide is a greenhouse gas, the climate has been warming and that man is very likely to be at least partly responsible. When a study was published recently saying that 98% of scientists ‘believe’ in global warming, I looked at the questions they had been asked and realized I was in the 98%, too, by that definition, though I never use the word ‘believe’ about myself. Likewise the recent study from Berkeley, which concluded that the land surface of the continents has indeed been warming at about the rate people thought, changed nothing.

So what’s the problem? The problem is that you can accept all the basic tenets of greenhouse physics and still conclude that the threat of a dangerously large warming is so improbable as to be negligible, while the threat of real harm from climate-mitigation policies is already so high as to be worrying, that the cure is proving far worse than the disease is ever likely to be. Or as I put it once, we may be putting a tourniquet round our necks to stop a nosebleed.

I also think the climate debate is a massive distraction from much more urgent environmental problems like invasive species and overfishing.

I was not always such a ‘lukewarmer’. In the mid 2000s one image in particular played a big role in making me abandon my doubts about dangerous man-made climate change: the hockey stick. It clearly showed that something unprecedented was happening. I can remember where I first saw it at a conference and how I thought: aha, now there at last is some really clear data showing that today’s temperatures are unprecedented in both magnitude and rate of change – and it has been published in Nature magazine.

Yet it has been utterly debunked by the work of Steve McIntyre and Ross McKittrick. I urge you to read Andrew Montford’s careful and highly readable book *The Hockey Stick Illusion*. Here is not the place to go into detail, but briefly the problem is both mathematical and empirical. The graph relies heavily on some flawed data – strip-bark tree rings from bristlecone pines – and on a particular method of principal component analysis, called short centering, that heavily weights any hockey-stick shaped sample at the expense of any other sample. When I say heavily – I mean 390 times.

This had a big impact on me. This was the moment somebody told me they had made the crop circle the night before. For, apart from the hockey stick, there is no evidence that climate is changing dangerously or faster than in the past, when it changed naturally. It was warmer in the Middle Ages and medieval climate change in Greenland was much faster.

Stalagmites, tree lines and ice cores all confirm that it was significantly warmer 7000 years ago. Evidence from Greenland suggests that the Arctic ocean was probably ice free for part of the late summer at that time. Sea level

is rising at the unthreatening rate about a foot per century and decelerating. Greenland is losing ice at the rate of about 150 gigatonnes a year, which is 0.6% per century. There has been no significant warming in Antarctica, with the exception of the peninsula. Methane has largely stopped increasing. Tropical storm intensity and frequency have gone down, not up, in the last 20 years. Your probability of dying as a result of a drought, a flood or a storm is 98% lower globally than it was in the 1920s. Malaria has retreated not expanded as the world has warmed.

And so on. I've looked and looked but I cannot find one piece of data – as opposed to a model – that shows either unprecedented change or change is that is anywhere close to causing real harm.

No doubt, there will be plenty of people thinking 'what about x ?' Well, if you have an x that persuades you that rapid and dangerous climate change is on the way, tell me about it. When I asked a senior government scientist this question, he replied with the Paleocene–Eocene Thermal Maximum. That is to say, a poorly understood hot episode, 55 million years ago, of uncertain duration, uncertain magnitude and uncertain cause.

Meanwhile, I see confirmation bias everywhere in the climate debate. Hurricane Katrina, Mount Kilimanjaro, the extinction of golden toads – all cited wrongly as evidence of climate change. A snowy December, the BBC lectures us, is 'just weather'; a flood in Pakistan or a drought in Texas is 'the sort of weather we can expect more of'. A theory so flexible it can rationalize any outcome is a pseudoscientific theory.

To see confirmation bias in action, you only have to read the Climategate emails, documents that have undermined my faith in this country's scientific institutions. It is bad enough that the emails unambiguously showed scientists plotting to cherry-pick data, subvert peer review, bully editors and evade freedom of information requests. What's worse, to a science groupie like me, is that so much of the rest of the scientific community seemed OK with that. They essentially shrugged their shoulders and said, 'Yeah, big deal, boys will be boys'.

Nor is there even any theoretical support for a dangerous future. The central issue is 'sensitivity': the amount of warming that you can expect from a doubling of carbon dioxide levels. On this, there is something close to consensus – at first. It is 1.2 degrees centigrade. Here's how the IPCC put it in its latest report.

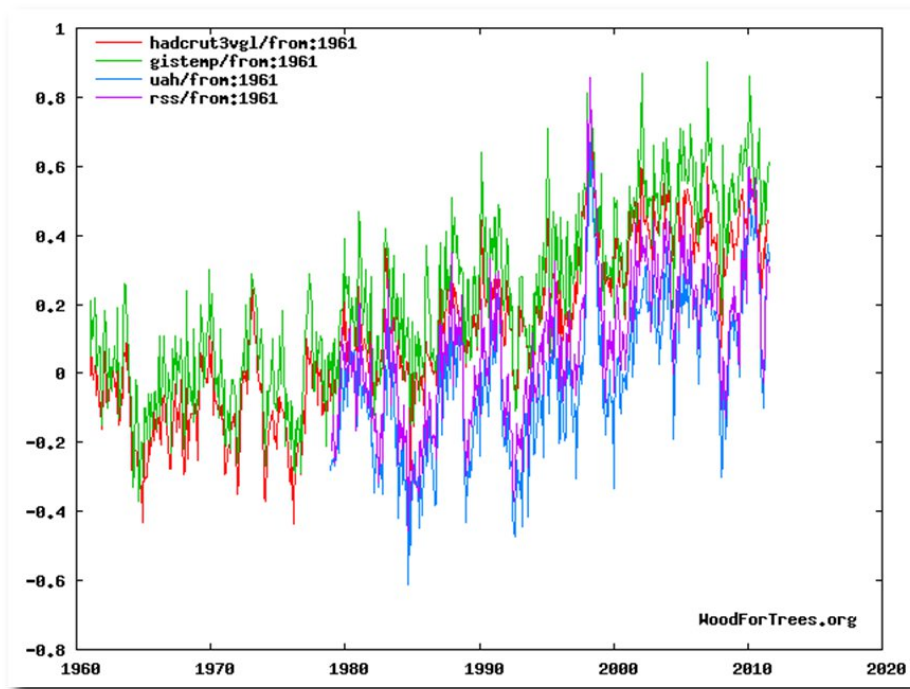
'In the idealised situation that the climate response to a doubling of atmospheric CO₂ consisted of a uniform temperature change only, with no feedbacks operating... the global warming from GCMs would be around 1.2°C.' Paragraph 8.6.2.3.

Now the paragraph goes on to argue that large, net positive feedbacks, mostly from water vapour, are likely to amplify this. But whereas there is good consensus about the 1.2°C, there is absolutely no consensus about the net positive feedback, as the IPCC also admits. Water vapour forms clouds

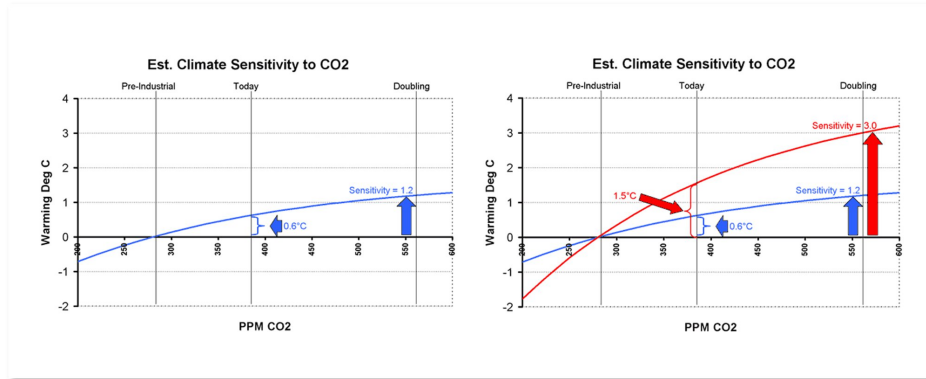
and whether clouds in practice amplify or dampen any greenhouse warming remains in doubt.

So to say there is a consensus about some global warming is true; to say there is a consensus about dangerous global warming is false.

The sensitivity of the climate could be a harmless 1.2°C , half of which has already been experienced, or it could be less if feedbacks are negative or it could be more if feedbacks are positive. What does the empirical evidence say? Since 1960 we have had roughly one-third of a doubling, so we must have had almost half of the greenhouse warming expected from a doubling – that's elementary arithmetic, given that the curve is agreed to be logarithmic. Yet if you believe the surface thermometers (the red and green lines), we have had about 0.6°C of warming in that time, at the rate of less than 0.13°C per decade – somewhat less if you believe the satellite thermometers (the blue and purple lines).



So we are on track for 1.2°C. We are on the blue line, not the red line.



Remember Jim Hansen of NASA told us in 1988 to expect 2–4 degrees in 25 years. We are experiencing about one-tenth of that. We are below even the zero-emission path expected by the IPCC in 1990.

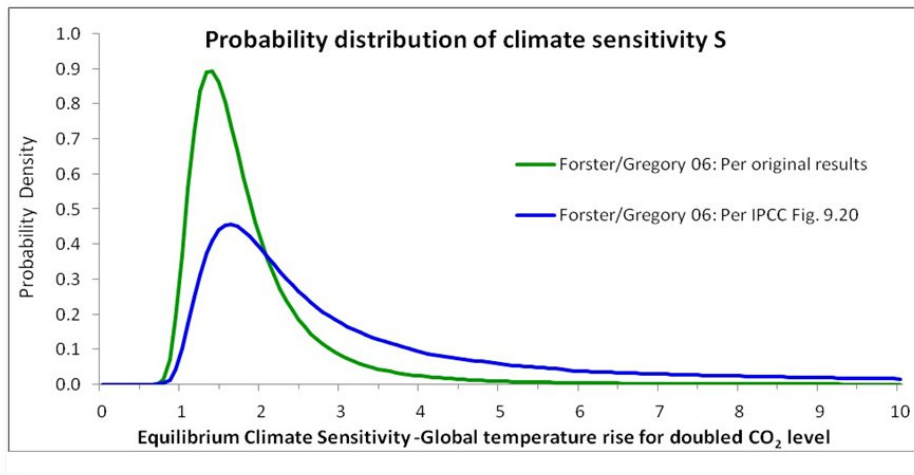
Ah, says the consensus, sulphur pollution has reduced the warming, delaying the impact, or the ocean has absorbed the extra heat. Neither of these post-hoc rationalisations fit the data: the southern hemisphere has warmed about half as fast as the northern in the last 30 years, yet the majority of the sulphur emissions were in the northern hemisphere.

And ocean heat content has decelerated, if not flattened, in the past decade.

By contrast, many heretical arguments seem to me to be paragons of science as it should be done: transparent, questioning and testable.

For instance, earlier this year, a tenacious British mathematician named Nic Lewis started looking into the question of sensitivity and found that the only wholly empirical estimate of sensitivity cited by the IPCC had been put through an illegitimate statistical procedure which effectively fattened its tail on the upward end – it hugely increased the apparent probability of high warming at the expense of low warming. When this is corrected, the theoretical probability of warming greater than 2.3°C is very low indeed. Like all the other errors in the IPCC report, including the infamous suggestion that all Himalayan glaciers would be gone by 2035 rather than 2350, this mistake exaggerates the potential warming. It is beyond coincidence that all these errors should be in the same direction. The source for the Himalayan glacier mistake was a non-peer reviewed WWF report and it occurred in a chapter, two of whose coordinating lead authors and a review editor were on WWF's climate witness scientific advisory panel. Remember too that the glacier error was pointed out by reviewers, who were ignored, and that Rajendra Pachauri, the head of the IPCC, dismissed the objectors as practitioners of 'voodoo science'.

Journalists are fond of saying that the IPCC report is based solely on the peer-reviewed literature. Rajendra Pachauri himself made that claim in 2008, saying:



... we carry out an assessment of climate change based on peer-reviewed literature, so everything that we look at and take into account in our assessments has to carry [the] credibility of peer-reviewed publications, we don't settle for anything less than that.

That's a voodoo claim. The glacier claim was not peer reviewed; nor was the alteration to the sensitivity function Lewis spotted. The journalist Donna Laframboise got volunteers all over the world to help her count the times the IPCC used non-peer reviewed literature. Her conclusion is that: 'Of the 18,531 references in the 2007 Climate Bible we found 5,587 – a full 30% – to be non peer-reviewed.'

Yet even to say things like this is to commit heresy. To stand up and say, within a university or within the BBC, that you do not think global warming is dangerous gets you the sort of reaction that standing up in the Vatican and saying you don't think God is good would get. Believe me, I have tried it.

Does it matter? Suppose I am right that much of what passes for mainstream climate science is now infested with pseudoscience, buttressed by a bad case of confirmation bias, reliant on wishful thinking, given a free pass by biased reporting and dogmatically intolerant of dissent. So what?

After all there's pseudoscience and confirmation bias among the climate heretics too.

Well here's why it matters. The alarmists have been handed power over our lives; the heretics have not. Remember Britain's unilateral Climate Change Act is officially expected to cost the hard-pressed UK economy £18.3 billion a year for the next 39 years and achieve an unmeasurably small change in carbon dioxide levels.

At least sceptics do not cover the hills of Scotland with useless, expensive, duke-subsidising wind turbines whose manufacture causes pollution in Inner

Mongolia and which kill rare raptors such as this griffon vulture.

At least crop circle believers cannot almost double your electricity bills and increase fuel poverty while driving jobs to Asia, to support their fetish.

At least creationists have not persuaded the BBC that balanced reporting is no longer necessary.

At least homeopaths have not made expensive condensing boilers, which shut down in cold weather, compulsory, as John Prescott did in 2005.

At least astrologers have not driven millions of people into real hunger, perhaps killing 192,000 last year according to one conservative estimate, by diverting 5% of the world's grain crop into motor fuel.

That's why it matters. We've been asked to take some very painful cures. So we need to be sure the patient has a brain tumour rather than a nosebleed.

Handing the reins of power to pseudoscience has an unhappy history. Remember eugenics. Around 1910 the vast majority of scientists and other intellectuals agreed that nationalizing reproductive decisions so as to stop poor, disabled and stupid people from having babies was not just a practical but a moral imperative of great urgency.

'There is now no reasonable excuse for refusing to face the fact', said George Bernard Shaw, 'that nothing but a eugenics religion can save our civilization from the fate that has overtaken all previous civilizations.' By the skin of its teeth, mainly because of a brave Liberal MP called Josiah Wedgwood, Britain never handed legal power to the eugenics movement. Germany did.

Or remember Trofim Lysenko, a pseudoscientific crank with a strange idea that crops could be trained to do what you wanted and that Mendelian genetics was bunk. His ideas became the official scientific religion of the Soviet Union and killed millions; his critics, such as the geneticist Nikolai Vavilov, ended up dead in prison.

Am I going too far in making these comparisons? I don't think so. James Hansen of NASA says oil firm executives should be tried for crimes against humanity. (Remember this is the man who is in charge of one of the supposedly impartial data sets about global temperatures.) John Beddington, Britain's chief scientific adviser, said this year that just as we are 'grossly intolerant of racism', so we should also be 'grossly intolerant of pseudoscience', in which he included all forms of climate-change scepticism.

The irony of course is that much of the green movement began as heretical dissent. Greenpeace went from demanding that the orthodox view of genetically modified crops be challenged, and that the Royal Society was not to be trusted, to demanding that heresy on climate change be ignored and the Royal Society could not be wrong.

Talking of Greenpeace, did you know that the collective annual budget of Greenpeace, WWF and Friends of the Earth was more than a billion dollars globally last year? People sometimes ask me what's the incentive for scientists to exaggerate climate change. But look at the sums of money available to those who do so, from the pressure groups, from governments and from big

companies. It was not the sceptics who hired an ex News of the World deputy editor as a spin doctor after Climategate, it was the University of East Anglia.

By contrast scientists and most mainstream journalists risk their careers if they take a skeptical line, so dogmatic is the consensus view. It is left to the blogosphere to keep the flame of heresy alive and do the investigative reporting the media has forgotten how to do. In America, Anthony Watts who crowd-sourced the errors in the siting of thermometers and runs wattsupwiththat.com; in Canada, Steve McIntyre, the mathematician who bit by bit exposed the shocking story of the hockey stick and runs climateaudit.org; here in Britain, Andrew Montford, who dissected the shenanigans behind the Climategate whitewash enquiries and runs bishop-hill.net; in Australia, Joanne Nova, the former television science presenter who has pieced together the enormous sums of money that go to support vested interests in alarm, and runs joannenova.com.au.

The remarkable thing about the heretics I have mentioned is that every single one is doing this in his or her spare time. They work for themselves, they earn a pittance from this work. There is no great fossil-fuel slush fund for sceptics.

In conclusion, I've spent a lot of time on climate, but it could have been dietary fat, or nature and nurture. My argument is that like religion, science as an institution is and always has been plagued by the temptations of confirmation bias. With alarming ease it morphs into pseudoscience even – perhaps especially – in the hands of elite experts and especially when predicting the future and when there's lavish funding at stake. It needs heretics.

Thank you very much for listening.