Science exiled

How the complexities of science suffer in the arena of public policy.

Politicizing Science: The Alchemy of Policymaking
edited by Michael Gough
Hoover Institution: 2003. 313 pp. $15

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Power surge: science would have benefited if Richard Feynman had made it to the White House.

This is not suitable bedtime reading — not if you want to fall asleep, that is. Those who think that public policy should be based on sound science will be left in despair that such a goal can ever be achieved in the midst of the competing political interests endemic to modern industrialized democratic societies, exacerbated by scientific illiteracy on the part of both leadership and electorate.

Politicizing Science relates the personal trials and tribulations of 12 scientists whose careers were directly affected when their scientific advice conflicted with the political interests of those in power. Although several of its US stories pertain to the Clinton administration, the recent death of Edward Teller, bringing with it memories of the Oppenheimer affair, reminds us that conflicts between science and policy determination are ideologically invariant. These days, for instance, scientists who thoughtfully question the efficacy of the Bush administration's limited missile-defence initiative are not exactly welcome to spend the weekend on the president's ranch at Crawford, Texas. The essays in *Politicizing Science* illustrate that the risk of a given scientific issue becoming politicized depends on the difficulty of its proof and falsification, and on its perceived risks and potential benefits. A few examples from the book will illustrate the point.

The first essay is by William Happer, a professor of physics at Princeton University, who was director of basic energy sciences in the US Department of Energy during the administration of the first President Bush. Happer's tenure saw the 'discovery' of cold fusion, an event that rapidly became politicized. After all, who could ignore cashing in on the energy deliverance of mankind? Happer compares this episode with the Soviet agronomist Trofim Lysenko's subversion of genetic inheritance in favour of 'environmental determinism'. What they had in common was that each was clearly subject to Karl Popper's litmus test: scientists must attempt to falsify their hypotheses. Cold fusion was quickly disposed of in the West, where the litmus test could not easily be politically coloured. By contrast, the totalitarian Soviet Union protected the 'correct' interpretation of genetic inheritance until Stalin's demise.

When a hypothesis or assertions are precise and can be tested, a free society that demands full disclosure will eventually sort it all out. A recent example of just that was the satisfactory resolution of last year's Bell Labs scandal (see *Nature* **419**, 419–421; 2002). But when the science gets 'fuzzy', as with carbon dioxide-forced global climate change, the effects of radiation or chemical agents, or bioengineering plants or animals for human purposes, opportunities for the politicization of science compound and abound.

Bernard Cohen, a nuclear physicist, has spent a large part of his later career on efforts, mostly unsuccessful, to attract coverage in the wide-circulation media of the facts about radiation and health. Especially revealing is his compilation of the numbers of stories relating to various 'everyday' accidents in *The New York Times* during the years 1974–78, before the 1979 crisis at the Three Mile Island nuclear plant. There were, on average, 120 reports per year on road accidents (US death toll: 50,000 per year), 50 on industrial accidents (12,000 killed each year in the United States) and 20 on asphyxiation (4,500 US deaths per year). For accidents involving radiation, there were 200 entries, despite the fact that none involved related illnesses or fatalities.

Robert Nilsson, a professor of toxicology, has worked for the Swedish Environmental Protection Agency, as well as that country's National Chemicals Inspectorate. Nilsson recounts the rise of politicized environmentalism in Sweden, enforced through a plethora of regulatory agencies created by a parliament long dominated by a single party and whose oversight seldom involves a single scientist. These agencies have a long reach, descending even to the composition of the sand piles in playgrounds (crystalline silica has been identified as a low-risk carcinogen).

Roger Bate is concerned with the harm that the imposition of environmental standards devised for industrialized nations can do to developing societies. In particular, he focuses on how a ban on the use of the pesticide DDT in Africa has led to a disastrous re-emergence of malaria, which now kills 3,000 African children a day. DDT spraying in Africa began in the 1950s and greatly reduced the incidence of malaria. But environmental and economic pressures brought by developed nations led to its almost total discontinuance until recently, when attempts were begun to 'vector' its application to the walls of houses. However, the long-standing ban on DDT use means that almost none is now made, and there is a danger that the supply may run out.

But perhaps the most egregious example of political interference in the free and open discussion of unsettled scientific issues was the campaign conducted by an associate of the former senator and later vice-president Al Gore and members of his staff against Fred Singer and his colleagues, all vocal sceptics of a link between carbon dioxide emissions and climate change. Singer, a pioneer in the field of atmospheric measurements, was the first to predict that population growth would result in a greater concentration of methane, an important greenhouse gas. He is also a prolific writer on issues of the environment and climate change. In *Politicizing Science*, Singer recounts the pressure that was exerted on him to remove the name of the

distinguished oceanographer Roger Revelle from a paper they had jointly published expressing the view that the scientific basis for global warming was insufficient to justify immediate policy action at that time. A libel lawsuit filed by Singer against an individual working closely with Senator Gore was settled in 1994 by a full and complete admission by the individual of facts at issue, with a retraction and apology for the insinuations that led to the action being brought.

A common theme throughout the tales told in *Politicizing Science* is the notion of the precautionary principle or, more prosaically, "Look before you leap". We should always be conscious of the possible consequences of our scientific endeavours and cautious in the deployment of new applications of science. But, taken to its extreme, the precautionary principle can result, as Nilsson says of the situation in present-day Sweden, in "Look, but never leap".

The antidote to an overdose of the precautionary principle is the discipline of risk analysis and management, as argued many times by the contributors to this book. Risk analysis attempts to measure the risk of a given technology to the individual against its potential benefit to society as a whole. In the words of Chauncey Starr, one of the founders of probabilistic risk analysis, "the moral high ground assumed by well-meaning activists for single health causes may well be socially immoral when evaluated by the welfare of the total population".

Unfortunately, *Politicizing Science* lacks any discourse on how best to 'de-politicize' science. Here and there are hints that we need to 'get more involved'. Many, if not most, scientists are put off by the political process, forgetting that the pursuit of success in one's own profession is often quite political. We should seek and cultivate those rare individuals who combine the ability to carry out creative science with a personal populist appeal and an unshakeable belief in that paradigm of democracy: "You can't fool all of the people all of the time."

Perhaps the greatest native-born American scientist of my generation was Richard Feynman. His untimely death took from us not only a giant in physics but also a man of the people who was just beginning to capture the popular imagination and trust — and liked it. Think of a Feynman in the US Senate or White House, and the impatience he would have had with the cold-fusion imbroglio and the hand-wringing over the precautionary principle. Somewhere, sometime, another like Feynman is sure to surface. When that happens, let's campaign to get him or her elected to executive or legislative power in Washington, London, Moscow or Beijing, or wherever they're most needed. ■

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Smashed into orbit

The Big Splat, or How Our Moon Came to Be
by Dana Mackenzie
John Wiley: 2003. 240 pp.
$24.95 (US), $38.95 (Canada), £17.50

Joseph A. Burns

Ours is a violent world and always has been. The whole Universe was produced in an unimaginable cataclysm, the Big Bang, about 13.7 billion years ago. Much later, 4.6 billion years ago, a nearby supernova explosion may have triggered the collapse of the protosolar cloud that became our Solar System.

This slim volume, written straightforwardly and engagingly by Dana Mackenzie, a mathematician turned freelance writer, describes how a collision produced Earth and the Moon. The giant-impact hypothesis — the 'Big Splat' of the title — maintains that an object larger than Mars slammed into proto-Earth during the final stages of its accumulation, giving birth to the Moon.

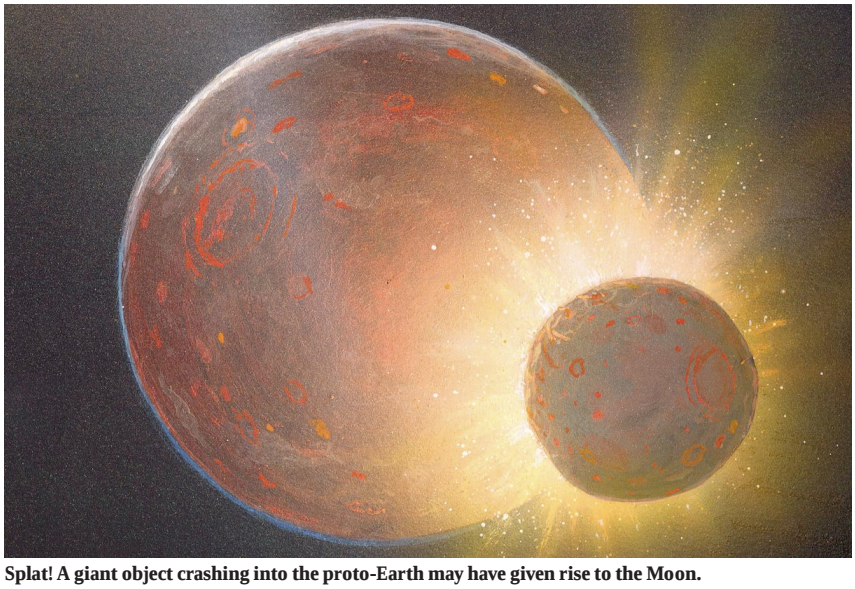
The Big Splat lays out ancient thoughts about the Moon's place in the cosmos, sketches the contributions of the greats of classical physics (Galileo, Kepler, Newton and Laplace), detours into topics such as celestial mechanics and navigation, recalls the Apollo programme, and finally describes the collisional model of the Moon's origin.

This historical tour turns out to be somewhat circular. The first known attempt to explain the Moon's origin occurred in the fifth century BC, when the Greek thinker Anaxagoras, after viewing a meteorite that had been observed falling from the sky, speculated that all celestial objects were glowing 'stone stars' flung off Earth. Apparently he got it right in the case of the Moon, but astronomy textbooks only a generation ago were not so sure. They still listed three scenarios for lunar origin that had been developed in some mathematical detail a century earlier: the reclusive mathematician Edouard Roche contended that the two bodies were siblings, having 'co-accreted' as an orbiting binary; the scholarly George Darwin (son of Charles) promoted the idea that the Moon was our planet's child, having split off when a rotationally distorted primordial Earth became unstable; and later a cantankerous crackpot, T. J. J. See, argued that the Moon formed elsewhere, only to be snared intact by our planet.

These classical hypotheses were still debated vigorously as the space age dawned, even though the flaws of each were well recognized. Co-accretion would yield less angular momentum — the combined 'spin' of the Earth and Moon about one another — than the Earth–Moon system in fact has. Fission would require much more angular momentum than exists now, and there is no plausible explanation for how it could have started off. And the capture of an intact body is ridiculously improbable.

The Nobel Prize-winning chemist Harold Urey believed that the Moon, alone among the terrestrial bodies, was formed cold. To test this hypothesis of the Solar System's formation, Urey used his political influence in 1958 to get NASA's founding mission statement to focus on the origin of the Universe, which was "written plain to our eyes on the surface of the Moon". So Earth's only satellite became the primary scientific target of the US space programme. The lunar rocks returned by the Apollo and Luna missions showed that the Moon had much lower proportions of iron and volatiles than Earth, but their isotopic signatures had striking similarities to Earth's — as well as occasional differences. As is often the case, no model of origin survived its confrontation with data.

The final third of this book describes the



W. K. HARTMANN

Splat! A giant object crashing into the proto-Earth may have given rise to the Moon.