COMMENT

POLARIS/EYEVINE

US Representatives Rush Holt and Nancy Pelosi tour a magnetic resonance imaging facility.

Politicians should think like scientists

A more rigorous, analytical and far-sighted approach would improve the US political process, says **Rush Holt**.

Before I was elected to the US Congress in 1998, I taught and researched topics such as solar spectroscopy and plasma physics. This background inspired some of my constituents to make bumper stickers that read: "My congressman IS a rocket scientist!" The residents of central New Jersey seemed to be calling for more science, or at least more scientific thinking, in Congress.

I agree. Scientists, engineers and technologists are not necessarily smarter or wiser than others, but we have many habitual practices of mind that would be valuable in the sluggish legislative process. 'Scientific thinkers' — and to be clear, not all such thinkers are professional scientists — have a deep appreciation for evidence. They have a realistic understanding of technology's promises and pitfalls. They work comfortably with estimates and data. They use statistical reasoning. They are more alert to the mental tricks that they, like all humans, play on themselves. Most importantly, they understand that the path towards good solutions is paved with uncertainty, trial and error; that conclusions should be tentative; and that alternative views should be entertained.

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Although the legislative branch rarely deals with matters involving, say, stellar chromospheres or the radio-frequency heating of ions, it tackles many issues in which scientific thinking does (or should) come into play. For example, after the vote-counting controversy of the 2000 US presidential election, I saw a difference in approach between scientists and others as Congress moved to update our nation's voting technology.

Lawmakers and election officials around the United States — most of them non-scientists — quickly embraced the idea of electronic voting machines, and Congress provided more than US$3 billion to help states to convert their voting systems. According to advocates, electronic machines would eliminate incompletely punched ballots ('hanging chads') that could misrepresent voters' intentions; they would prevent people from voting for more than one person in the same race ('over-voting') or neglecting to cast ballots in other races ('under-voting'); and they would produce a quick tally on election night. What could be better?

Computer scientists were alarmed. Software, they pointed out, is prone to subtle errors. In the privacy of the voting booth, how will the voter know that her or his vote has been recorded as intended? And after the voter leaves the booth, how will election watchers ensure that each vote was recorded as the voter intended? A potentially even greater problem is that elections are tempting targets for hackers.

Most legislators, having little training in scientific thinking, either did not recognize these limitations or assumed that such problems could be pre-empted by testing software. The best solution — and one that I have proposed many times in Congress ▶

— is to use a paper ballot marked by the voter or by a machine in view of the voter. Yet, today we still do not have a national standard for voter-verified, auditable ballots.

Scientific thinkers are also more alert to the cognitive biases that can lead to irrational decisions. For example, politicians (like everyone else) are often guilty of 'short-term-ism': the desire to enjoy rewards now rather than invest them for later. Yet government actions — infrastructure projects, say, or education programmes — play out over decades, long past the careers of individual lawmakers. Scientists are generally comfortable thinking about processes on different timescales — of millions or even billions of years. Scientific thinking can thus build strong arguments for investment in roads, bridges, trains and laboratories that will not produce profits tomorrow but will pay off powerfully in the decades to come.

NUMBERS GAME

Many lawmakers are uncomfortable with statistical reasoning. Take surveillance, for example: the New York City Police Department, as part of its counterterrorism programme, has conducted surveillance of suspected Muslims at restaurants and stores and monitored student groups and mosques around the United States. When I spoke in opposition to these surveillance programmes and called them 'profiling', some of my non-scientist colleagues said that such profiling is keeping the United States safe, even if it is ethnically discriminatory.

But my colleagues were disregarding the fact that terrorists are exceedingly rare. Since 2001, Muslims have boarded planes in the United States perhaps 50 million times. If officials had screened each of these travellers using a protocol that could detect terrorists with, say, 99.9% accuracy, about 50,000 people would have been wrongly accused of terrorism. Billions of dollars would have been wasted in profiling and detaining innocent people, creating profound distrust among targeted communities.

"Scientific thinking builds arguments for investments that will pay off powerfully in the decades to come."

Statistical reasoning would lead one to recognize that this money would be far better devoted to on-the-ground intelligence gathering.

Scientists are just more comfortable with uncertainty than non-scientists. This trait would come in handy for lawmakers, who often must take action despite conflicting evidence. For example, a failure to understand ordinary fluctuations in noisy climate data allows some members of Congress to believe that claims of human-induced climate change are a hoax, or that the data are so chaotic that no policy action can be devised.

A similar discomfort with uncertainty is evident on the first Friday of each month, when politicians react to the labour department's monthly jobs report. Earlier this month, legislators (egged on, it should be said, by the news media) spent countless hours debating the implications of a report that businesses created 29,000 fewer jobs in August than economists expected. Yet few grasped that the survey's margin of error was 100,000 jobs at the 90% confidence level. Those 29,000 jobs could very well have been a statistical blip rather than a real trend.

How can we increase scientific thinking in Congress? One way, of course, is to elect more scientists — and I strongly encourage scientists to consider seeking political office. But that is an unlikely solution. More non-scientists need to feel comfortable thinking like scientists. This is not without precedent — not all legislators hold law degrees, but all must be comfortable thinking like lawyers when drafting a bill or reading a statute. When I need to think like a lawyer, I turn to legal professionals for help. Congress has a staff of lawyers at the Office of Legislative Counsel, which helps members to turn their ideas into legislative language. Shouldn't legislators who have scientific questions be able to seek similar guidance from scientists and, over time, pick up more scientific ways of thinking?

Until 1995, Congress had a dedicated staff of professional scientists in the Office of Technology Assessment. This office was eliminated in a round of foolish budget cuts. It should be re-established, and in the interim, we scientists should seek to make our voices heard in other ways: through meetings with members of Congress, letters to editors, town halls and other public forums. ■

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Know your representatives

Lawrence Goldstein urges researchers to talk to lawmakers about science.

Twenty years ago, after moving to San Diego, California, I went to visit the US congressman for my new district. I was responding to the American Society for Cell Biology, which had encouraged its members to visit their congressional representatives and tell them why federal funding for the US National Institutes of Health (NIH) was important to the welfare of the United States. I had heard that this congressman was a former fighter pilot and very conservative, but nothing could have prepared me for our first meeting.

As soon as we sat down, he told me that he thought that the NIH should be privatized. I was surprised, but being stubborn, I continued to visit him once or twice a year for the next few years. Each time, I would explain how biomedical research leads to a better understanding of basic biology and disease, and how this translates to new and successful approaches to disease therapy. Over time, his meetings with me and with other scientists and patient advocates in our community led to a dramatic change in his view on public funding for biomedical research.

This conservative congressman became a member of a key appropriations subcommittee, on which he fought for substantial increases in NIH funding and even voted to loosen restrictions on funding for embryonic stem-cell research. Personal interactions between scientists and legislators are crucial in today's increasingly technological world, in which science policy and funding become more important with each passing year.

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GOOD INFLUENCE

Some of my colleagues prefer not to interact with members of Congress — they think that one scientist's voice doesn't carry much weight amid the cacophony that assails most officials. Yes, the executive branch of the US government receives considerable formal advice on science policy[1]. But the president can get very little done without the support of Congress.

Members of Congress determine the amount of money available for science,