Commentary

How to talk about climate change with politicians

Scientific training is largely silent about how to engage effectively with politicians. Fortunately, practices familiar to professional scientists are powerful in the policy arena, and what they need beyond their specialized training is within grasp.

Policy choices, like decisions of any kind, have the greatest chance to benefit people when they are informed by the best available knowledge and understanding. Evidence and information are never the only—or even the most important—factors in policy choices because values, interests, and personal preferences heavily influence what constitutes the most desirable option. But evidence is central to understanding options, their trade-offs, and their political implications.

Assessing and communicating information is what scientists are trained to do, and that expertise can be an enormously beneficial contribution to the policy process, which often resembles courtroom advocacy: People present only the evidence that supports their side and leave counterarguments to others. Scientists know the importance of controlling for biases, poking holes in their own views when they can, and incorporating all evidence, whether supportive or contradictory of a particular conclusion, into assessments of knowledge. Those practices are foundational to evidence-informed deliberation, and when shared broadly they can help improve and democratize decision making.

But scientists also need to engage policymakers with humility. Politicians are highly skilled, and most are much more high-minded than either the policy process or public narratives give them credit for. If that seems surprising, then it's especially important to spend time understanding politics and the policy process and what it takes for politicians to succeed. Few scientists would succeed as politicians without practice, training, and experience.

Politicians are experts in communicating; engaging with the public; knowing the views and interests of their constituents, supporters, colleagues, and rivals; and understanding the political opportunities and constraints that they face. If they aren't skilled in those areas, they won't win their elections, which is the primary prerequisite of their jobs. Some politicians may have areas of policy expertise, but that is the exception. Politicians have responsibility for many issues—they are generalists—but policy decisions are highly complex and require detailed understanding. Staffers, colleagues, and other policy professionals can focus more narrowly and provide that detailed policy expertise.

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To engage effectively requires having a healthy respect for your audience members and being clear about your goals with yourself and with them. It's terrific when scientists help provide the best available understanding to inform decision making. It's also fine to ask for help, to promote your interests, or to champion what you care about. Being a scientist doesn't require relinquishing one's values or one's membership in the broader public. But care is needed to distinguish between the role of providing scientific understanding, for which scientists have specialized training, and that of being a member of public society, for which one's personal values and beliefs become directly involved even when informed by science. Failure to be clear on that distinction can damage science and weaken democratic principles by allowing one's professional standing to unduly support one's personal views.

Whatever scientists' goals are, they will be most effective in achieving them if they can align them with a policymaker's needs and objectives. Why does the science matter from the politician's perspective? How might the objectives help meet the needs of the policymaker? Effectiveness with engagement almost certainly depends on understanding and navigating the political landscape the decision maker faces. How will your policy solution impact the politician's constituents, and perhaps more importantly, how do the people perceive your issue and the stance you'd like a politician to take?

Climate change is a terrific illustration because it is an intensely researched scientific topic and a contentious public issue. It brings together scientific understanding, policy, and politics, and it is both politically challenging and crucial to everyone's future.

So what are the scientific conclusions at the foundation of evidence-informed policy deliberations on climate change?

► **Climate change is extraordinarily dangerous to humanity and all life.** That is because climate, and its stability within a relatively narrow range, is a requirement for life as we know it. The global change in climate people are causing is larger and faster than any humanity is known to have endured since beginning the societal transition from hunting and gathering to agriculture.[1] The physical characteristics of the planet, biological systems and the resources they provide, and social institutions that humans have created all depend heavily on climate, are central to human well-being, and are sensitive to climate change.

► **Solutions are available and highly promising—a serious reason for optimism.** Greenhouse gas emissions are an economically harmful market failure—a classic example of an economic externality. Those who emit pollution to the atmosphere shift the costs of climate damage onto everyone, including future generations. Making emitters pay for all the costs of their use of the atmosphere would help correct that failure and thereby improve economic well-being. Regulatory approaches can speed the adoption of best practices and better technologies, or promote fairness and the public interest. As a result, reducing greenhouse gas emissions can increase climate security, national security, the well-being of people and biological systems, and economic vitality. Existing and emerging technologies, such as rooftop solar panels, electric vehicles, and electric heat pumps, can reduce greenhouse gas emissions, improve air quality in homes and cities, and often provide superior products or services. Building resilience against climate impacts makes communities stronger and better able to deal with both existing vulnerabilities and emerging threats.

Comprehensively addressing the dangers of climate change will require two things: reducing, and ultimately eliminating, climate pollution as soon as possible and building the capacity to avoid—when possible—and otherwise overcome the consequences of climate change.

► **Broad scientific conclusions, like those described briefly here, result from decades of intensive research and examination.** The scientific evidence has been assessed comprehensively and repeatedly by independent experts convened by highly respected scientific institutions. Accuracy is central to credibility for scientific institutions, including the US National Academies of Sciences, Engineering, and Medicine; the American Meteorological Society (for which I work); and the American Association for the Advancement of Science, all of which have assessed climate science. I am not aware of any contradictory assessments from a credible scientific institution. People who target public audiences with messages that contradict broad scientific conclusions are not credible.

People are changing climate, and it poses serious dangers to humanity. A wide range of response options are well understood and would be broadly beneficial, if implemented. Scientists who are up to speed with the evidence have the opportunity to help inform societal deliberations on climate change. That contribution will be crucial for the advancement of evidence-informed policy responses. If scientists, recognizing that societal decisions go beyond science, provide information so that it enables broad public participation in decision making, even among those whose values and preferences differ, then they will simultaneously advance science and strengthen the broader society that they serve.

Therein lies an even greater opportunity for scientists and humanity. If scientists can engage effectively with the broader society to address the climate problem, they may contribute to a template for the wide range of challenges and opportunities facing humanity at this point in the 21st century.

Reference

1. D. Kaufman et al., *Sci. Data* **7**, 201 (2020).

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LETTERS

Antiquark asymmetry

It was interesting to read the item by Johanna Miller (PHYSICS TODAY, May 2021, page 14) on the asymmetry between up and down antiquarks in the proton. It does indeed provide fascinating insight into the quark structure of the proton and especially the role of chiral symmetry, which requires that the proton be surrounded by a pion cloud.

But I feel that it is necessary to add a little to the incomplete discussion of the history of that asymmetry discovery. Using the cloudy bag model, which successfully incorporates chiral symmetry into the MIT bag model, I predicted the asymmetry[1] in 1983, almost a decade before the violation of the Gottfried sum rule was experimentally confirmed.[2]

The mechanism is the dominance of the π^+–neutron configuration when the proton emits a pion. The pion contribution to deep inelastic scattering was first mentioned by J. D. Sullivan and Richard Feynman and is often referred to as the Sullivan process. In 1983, however, almost no one in the high-energy-physics community took the idea of a contribution from the pion cloud seriously, as deep inelastic scattering was such a short-distance phenomenon; the constraints of chiral symmetry there were not understood. Certainly no one else, including Sullivan, had discussed the process as a source of flavor asymmetry.

In a November 2021 letter (page 11), Edward Shuryak describes an alternative explanation of the effect and suggests that lattice quantum chromodynamics can be used with the Δ baryon to test the mechanism. The idea of using lattice quantum chromodynamics calculations of the Δ^+ to test the role of chiral symmetry in generating such an asymmetry was published several years ago.[3] In particular, one can