Science and Society

Scientific understanding has probably expanded more in the past 50 years than in all previous history. Its applications have made our lives better. As one example, global average life expectancy at birth 50 years ago was around 46 years and today is 64 years; over this interval, the average difference between developed and developing worlds has shrunk from 26 to a still shameful 12 years. Increasingly, however, we recognize unintended adverse consequences of our well-intentioned activities: Witness climate change and the loss of biological diversity. More regionally, we worry about the ethics of, or risk from, possible applications of advances in bioscience, such as stem cell cloning, genetically modified crops, and xenotransplants.

In the United Kingdom, and in Europe more generally, every week seems to bring a new committee, report, or debate on "science and society." And a good thing too. I believe we need to do a better job of deliberately asking what kind of world we want—subject to the opportunities offered by scientific advances and the constraints that science clarifies—rather than just letting things happen. A recent poll shows that 84% of Britons think that "scientists and engineers make a valuable contribution to society" and 68% think that "scientists want to make life better for the average person." But the real issue, as the same poll showed, is that roughly 50% thought that the pace of current scientific advance was too fast for government to keep up with through effective oversight and regulation. So how best to conduct the dialogue, as old as democracy itself, between government policymakers and the public in complex scientific areas, in a way that fosters trust?

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I begin with the principles set out by the UK Office of Science and Technology and recently reaffirmed by a House of Lords committee on Science and Technology and by the Phillips Inquiry into the history of bovine spongiform encephalopathy: Consult widely and get the best people, but also make sure dissenting voices are heard; recognize and admit uncertainty; and above all, be open and publish all advice. Try to separate risk assessment from risk management, and aim at management that is proportional to the risk involved. Wherever possible, make the facts and uncertainties clear and leave it to individuals to choose (for instance, whether to eat beef off the bone or not).

All this is easier said than done. Even when risk can be assessed, people's subjective views may be different (people feel that cars are safer than trains, even though they are more than a hundred times more dangerous). And often the questions are outside the envelope of known science, and the risks can only be guessed at. This is especially awkward for a public that experiences science—in school, in university, and on quiz shows—as the certainties of established knowledge, not the unknown terrain at or beyond the frontiers. It is easy to say "let all voices be heard," but many will bring other agendas to the debate, and the resulting babble of voices is uncomfortable for a civil servant used to confidential, anonymous, and consensual advice to a minister. However, these admitted and awkward costs of wide and open consultation, and of open admission of uncertainty, are outweighed by their trust-promoting benefits. And anyway, the world that deferred to authority, advised by confidential cabals, has gone. I do not mourn its passing.

I see the recent UK debate and decision about extending the limited use of embryonic stem cells from research on human fertility to other specified therapeutic uses as a model for the above principles in action. There were three years of wide-ranging debate, engaging scientists, lawyers, ethicists, patient groups, and the general public in its many forms. Then free votes (not constrained by party positions) in both the Lower and the Upper Houses of Parliament, against a background of lobbying for and against; much technical information and misinformation; medical benefits for some; and ethical anguish for others. Clear decisions (by more than 2 to 1 in both houses) were made to allow the research to proceed, under well-specified constraints. This is democracy in action, notwithstanding the complexity of the science. The Royal Society is committed to showing leadership in this area of dialogue and has launched a 5-year program of consultations throughout the United Kingdom and across society.

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Supplementary references are available on *Science* Online at www.sciencemag.org/cgi/content/full/292/5519/1021/DC1