Medical Hypotheses (2008) **71**, 168–177

ELSEVIER

medical hypotheses

http://intl.elsevierhealth.com/journals/mehy

Editorial

Nine governance choices pertaining to science

Summary Science has played an influential role for at least the past 70 years in helping us to frame public policy in many areas of concern. But in recent years science itself has become an area of concern. This is partly because scientific theories can be difficult to understand, and partly because the evidence for evaluating them is rarely as definitive as we might hope. But it is also because scientific inquiry has increasingly come under the influence of a variety of factors that many people regard as non-scientific. Our society today is straddling several different ideas about what science is and what its primary goals should be—and the time has come to begin a public discussion to explore the different concerns that people might have about science and the different governance possibilities for addressing them. This editorial presents the main results of two panels that met on a monthly basis in Washington, DC from August 2005 through March 2007 to explore their concerns about science and to develop conceptual governance possibilities for public policy pertaining to it. The eight possibilities described below are not intended to be planks in a consistent policy platform for science. It would, indeed, be impossible to consistently adopt them all at once. But each possibility reflects serious concerns about science, and each of them merits further public discussion.

In January 2006, I published an editorial in these pages calling upon scientists and interested citizens to rethink science as an area of concern.[i] Science has clearly played an influential role for at least the past seventy years in helping us to frame public policy in many areas of concern. But it seemed to me that science, in recent years, had itself become an area of concern. I felt that this is partly because scientific theories can be difficult to understand, and because the evidence for evaluating them is rarely as definitive as we might hope. But I also felt that scientific inquiry has increasingly been influenced by a variety of factors that many people regard as non-scientific. I felt that our society was straddling several different ideas about what science is and what its primary goals should be—and that the time had come to begin a public discussion to explore the different concerns that people might have about science and the different governance possibilities for addressing them.[ii] By the time my editorial appeared, I had, in my capacity as a Fellow of the Interactivity Foundation (IF),[iii] begun a project in Washington DC designed to do just that. With the support of IF, two panels met each month from August 2005 through March 2007 to explore their concerns about science and to develop contrasting conceptual possibilities for public policy pertaining to it. One panel consisted of six interested citizens, the other of six citizens who work either as scientists or with science in their professional lives. The two panels collectively met for over 175 hours of confidential 'sanctuary' discussions in which they explored and developed their ideas and concerns about science as individuals, and not as representatives of groups, institutions, or special interests. I acted as facilitator for their discussions and as editor of their final report.[iv] And in what follows, I will briefly describe some of the project's main results.

Our discussions began with a wide-ranging exploration of the nature of science itself—what it is supposed to be, what it might be now, and what it might become in the future. The two panels collectively explored and developed over twenty possible concepts of science. I have described each of these concepts in the editorial notes to our report, along with some of the concerns that might be associated with each of them.

0306-9877/$ - see front matter
doi:10.1016/j.mehy.2007.10.004

Some of these concepts—such as 'Science as Method', 'Science as a Body of Knowledge', 'Science as Inquiry', 'Science as the Community of Scientists', and 'Science as Tools and Technologies'—are fairly well-known in the literature. But others—such as 'Science as a Handmaiden to Various Interests', 'Science as an Economic Engine', 'Science as Politics', 'Science as Art', 'Science as a Force that Drives the Future', 'Science as Authority and Intimidation', 'Science as Only One Way of Knowing', 'Science as an Adaptive Process for Change', and 'Science as Alienation and Detachment'—may seem less familiar.

Our panelists generally agreed that there is no one right way to think about science—no eternal Platonic form or true definition of its essence with which to compare these different concepts—and that the way we conceive of science is ultimately a matter of choice. But they also agreed that the different ways in which we conceive of science may lead us to have different concerns about it, and that it may also have very different conceptual and practical implications for what we choose to do about them.

Thus, if we think of science primarily as method, and if we have a generally positive attitude toward science, then we might be inclined to support only those scientific projects that adhere to accepted scientific methods. But if we think of science more as inquiry, then method may seem less important, and we might be inclined to support projects that address questions that we find interesting or fruitful, regardless of their methods.

If we think of science as authoritative and reliable knowledge, then we might want to require that public education, public policy, and publicly funded projects base themselves upon science. But if we think of science as only one among several different 'ways of knowing', then we might want to support humanistic, religious, and other cultural institutions—sometimes at the expense of our support for science—as a counterweight to the unsettling influence that science may have upon society.

If we think of science as a community of expert scientists, then we might be willing to follow the consensus of belief within the scientific community, regardless of the methods its members use or the efforts they make to test their theories, consider alternatives, ensure the reliability of their results, or forge consensus. But if we think of science as politics, or as a handmaiden of the various interests that support it, then we might be inclined to demand public disclosure of those interests, and we might begin to think of scientists more as lawyers than as objective inquirers. We might not, in that case, expect them to actually lie to us. But we would probably expect them to try to make the best possible case for the interests that fund their work, and we would probably expect them to emphasize research results that support those interests and to downplay or even ignore research results that do not.

Our panelists, again, did not agree about how we actually do—or should—think about science. But they generally agreed that it is better to be aware of the different ways in which people might think about science, and of the possible consequences of thinking about science in these ways. They thus discussed their concerns about each of the different concepts of science that they explored and developed. Many of their concerns focused upon the potential consequences of the cognitive and technological products of science, upon the integrity of scientific inquiry, and upon the influence that the funding of science may have upon its practice. I have described these concerns in some detail in the editorial notes to the report. But the panelists seemed to repeatedly return, in one way or another, to several basic themes during the course of their discussions. They thus repeatedly voiced concerns that:

- The body of scientific knowledge is fragmented and dispersed; that it changes over time; and that the general public, and even scientists, often have difficulty in knowing what they should regard as reliable scientific knowledge at any given time.
- Economic, political, and social forces both in and outside the scientific community may tempt scientists to cut methodological corners in their pursuit of new discoveries and technologies.
- The governance of science requires a special knowledge and expertise that non-scientists generally do not have.
- The interests that support science and scientists may exert hidden influences over the direction and conduct of their work in ways that might compromise their objectivity.
- New technologies may introduce potentially detrimental changes that we do not want and can neither control nor accommodate.
- The need to secure funding to support their work may tempt scientists to ignore pure scientific inquiry and ultimately harm applied science as well.
- The United States may lose its scientific, economic, and military superiority by spreading its science and technology around the world.

- Science is a powerful and expansive force that may overstep its proper boundaries and undermine other useful ways of knowing, moral values, traditional ways of living, and societal norms.

These concerns eventually led to the development of eight conceptual governance possibilities for public policy pertaining to science. In what follows, I will present each of these possibilities, along with a brief description of the thinking behind it—including reasons why someone might oppose it. Please bear in mind that these possibilities are not intended to be planks in a consistent policy platform for science. *It would, on the contrary, be impossible to consistently adopt all of them at once*. But they each reflect serious concerns that we might have about science, and I think that each of them merits public discussion.[v]

Clarify what counts as reliable scientific knowledge—and use it

The public, according to this possibility, would take steps to clarify what is and is not regarded as reliable scientific knowledge and to require the use of reliable scientific knowledge in public projects, programs, and policy decisions. It would also support efforts to organize and distribute scientific knowledge for scientific and public use, and efforts to improve science education and scientific literacy among the general public.

This possibility flows from concerns that scientific knowledge is fragmented and dispersed in books, journals, and libraries; that it is often difficult for the public to know what claims are generally regarded as reliable at any given time; and that the public too often ignores the best available scientific knowledge in making decisions that involve science. It thus aims at clarifying which knowledge claims are reliable, and at promoting the use of reliable scientific knowledge in public projects, programs, and policy decisions that involve science.

Scientific knowledge is generally regarded as authoritative knowledge; and science institutions such as universities, conferences, journals, and textbooks try to preserve written records of what is currently 'known' by science. Some knowledge claims are generally accepted within the scientific community and form a 'hard core' of reliable scientific knowledge and others lie at the more speculative periphery. But new data, concepts, theories, models, and explanations are added to the body of scientific knowledge every day; we are frequently told that scientists no longer believe what they once did; and even the 'hard core' of scientific knowledge sometimes changes. The upshot is that it is often difficult for scientists themselves, let alone teachers and the general public, to know which knowledge claims are currently regarded as reliable by the scientific community.

This possibility would take actions to clarify what should and should not be regarded as reliable scientific knowledge at any given time, and to require the use of the most reliable scientific knowledge in public projects, programs, and policy decisions. It would thus support efforts to collect, codify, and organize reliable scientific knowledge; and to make it accessible to scientists, teachers, and the general public. It would also support efforts to improve both education about reliable scientific knowledge and scientific literacy among the general public, so that citizens would be better able to make informed judgments about policy questions that involve scientific knowledge.

But even if you share the concerns and aims that inspire this possibility, you might wonder how we could implement this possibility without turning science and scientific knowledge into something that it is not supposed to be. If even our best and most certain scientific theories are subject to change, then we should ask ourselves whether and how it is possible to clarify which knowledge claims are reliable without pretending that science has a greater claim to certainty and authority than it actually does.

Ensure fidelity to reliable scientific methods

The public, according to this possibility, would promote efforts to ensure the quality of scientific methods and to improve its own understanding of them. It would also refuse to support projects that do not adhere to accepted scientific methods, and it would encourage the deliberate use of scientific methods even in areas that are far-removed from what is conventionally regarded as science.

This possibility flows from concerns that economic, political, and other social pressures may sometimes tempt scientists to cut methodological corners in their attempts to develop new knowledge and technologies; that the public often has difficulty recognizing 'junk science' and faulty scientific methods; and that some people may try to stifle the use of scientific methods in favor of non-scientific ways of knowing. It thus aims at ensuring the quality of scientific knowledge by ensuring the quality of the methods that scientists

use to acquire it, and at applying those methods wherever possible.

There are many good methods for conducting scientific inquiry, and they do not all involve hypothesis-driven controlled experiments. But scientists typically propose tentative solutions to problems and test those solutions in an attempt to discover and correct the errors that may be lurking in them. This makes science a conscious and institutionalized self-correcting process of 'trial and the elimination of error' that enables scientists to recognize problems in their theories and techniques, and to devise new theories and techniques when the situation requires them. Not all ways of knowing have this flexibility—and governments, institutions, and whole societies may collapse if they cannot adapt to changes in their environments.

This possibility regards the deliberate and faithful use of scientific methods as the best way of acquiring reliable knowledge. It thus seeks to clarify scientific methods, to improve the public's understanding of them, and to ensure that publicly funded scientific work adheres to them. It also encourages the deliberate use of scientific methods wherever possible, including areas that are sometimes far-removed from what is conventionally regarded as science—such as government, politics, religion, business, and social programs that have implications for a society's success and survival.

But even if you share these concerns and these aims, you may think that trying to ensure that scientists use accepted methods somehow puts the cart before the horse. If there are many good methods for conducting scientific inquiry and if these methods have evolved over time, then you may wonder how we can ensure that scientists use reliable methods when it is only the actual use of a method that enables us to determine whether and to what extent it is reliable. You may thus worry that requiring scientists to use reliable methods may impose an overly narrow definition of 'scientific method' that impedes rather than ensures scientific progress.

Let the scientific community govern itself

The public, according to this possibility, would allow the scientific community to govern itself with only limited public oversight and direction.

This possibility flows from a concern that non-scientists do not have the expertise that is necessary to successfully govern science. It thus maintains that the scientific community should, as far as possible, be given the autonomy and power to govern itself.

The scientific community is distinguished from other communities in our society by the education, beliefs, aims, values, interests, and methods of its members. These all tend to eschew beliefs based upon tradition and authority in favor of theories and explanations that can be tested by evidence and logic. The scientific community has created institutions such as peer review, journals, conferences, universities, laboratories, foundations, and professional associations to evaluate and govern its work. These institutions work together with the community to educate each new generation of scientists, and to determine what kinds of research, methods, theories, and technologies are regarded as 'scientifically reliable' at any given time. The scientific community and its institutions thus form a self-perpetuating meritocracy within our society—which may raise questions about why citizens of a democratic society should support the scientific community and its institutions, let alone allow it to govern itself.

It seems clear that scientists have beliefs, values, and interests that are sometimes, if not often, at odds with those of the general public; that the institutions they have created may sometimes impede the free flow of ideas and stifle creative and innovative thinking; that they may also engender conservative and defensive attitudes that may sometimes even seem hostile to new ideas; and that the costs to the public that are associated with science and science institutions have dramatically increased over the years. But this possibility flows from the belief that science has greatly improved the quality of human life, that the public generally lacks the scientific and economic expertise that is necessary to determine whether the money that it invests in science is well spent, and that attempts on the part of non-scientists to govern science might ultimately pose more problems than they solve.

But even if you believe that attempts on the part of non-scientists to govern science would pose more problems than they solve, you might still be reluctant to let the scientific community govern itself. You may feel that the scientific community, like any other community, has an interest in its own survival and that allowing it to govern itself is like putting the fox in charge of the henhouse. You may feel that it will only increase the costs associated with scientific institutions and scientific inquiry while at the same time engendering conservative and defensive attitudes that, in order to protect the *status quo*, will sometimes be hostile to new and creative ideas. And you may feel that these

problems will ultimately outweigh the problems that we might experience if we allow non-scientists to try to govern science.

Let the interests that support science govern it—but require transparency and accountability

The public, according to this possibility, would generally allow the public and private interests that support science to direct inquiry in order to ensure that it is responsive to public concerns and values. But it would seek disclosure of those interests in an effort to make the competitive battles for resources both accountable to the democratic process and as open and transparent as possible. It would also actively support scientific research that reflects public interests when private interests fail to do so.

This possibility flows from a concern that the various interests that support science may undermine its integrity by influencing the kind of research that is and is not done, by tempting scientists to cut methodological corners, and by restricting publication of research results. It also flows from a concern that policy makers may try to meddle in, suppress, or even ban useful research that undermines their interests. It thus aims at ensuring transparency and accountability in decision-making processes regarding science.

Many people regard science as an objective, reliable, and authoritative source of knowledge; and many public and private agencies are willing to support it in the hope that it will produce knowledge and technologies that bolster their interests. Some of these interests are economic. Others are social, political, governmental, religious, legal, and cultural. But they all compete for public and private funds. It is often possible, however, to find scientists whose research can be used to support different interests—regardless of what they are or how they may conflict. This may be the nature of science. But the more scientists appear to produce results that support their patrons' interests, the less objective, reliable, and authoritative they may seem to be—and the more they may appear to be 'hired guns' employed to conduct research, construct theories, and give testimony that endorse their patrons' interests.

This possibility flows from a belief that the political interplay between competing interests is fundamental to the democratic process. It would thus allow the public and private interests that support science to set directions for new research. But it would require full disclosure of scientific methods, findings, and funding sources—along with the disclosure of vested interests and the potentially detrimental consequences of new technologies—in order to help the public assess new scientific knowledge claims, technologies, and research projects. It would also encourage government to support scientific research that reflects the public interest when private agencies fail to do so.

But even if you share these concerns and these aims, you may worry about the effects that this possibility might have upon our willingness to trust scientists and scientific knowledge—or upon our ability to assess their claims. You may, indeed, feel that knowing who or what interests have supported a given project is at best a very superficial way of evaluating controversial scientific claims, technologies, and research projects.

Promote technology to fuel our economic engine—but with an eye toward potential detrimental consequences

The public, according to this possibility, would promote scientific research on technological projects that have foreseeable useful applications. It would generally allow industry and the market to set the priorities for research and development in an effort to reap their economic benefits. But it would encourage government to regulate scientific research that has potentially detrimental consequences, and scientists to anticipate and disclose the potentially detrimental consequences of their work.

This possibility flows from concerns that the economic motives that fuel scientific research and development may stifle new research directions, discoveries, and solutions to our problems if and when it seems profitable to do so—and that they may also accelerate the creation of tools and technologies that we may not want and can neither control nor accommodate. It thus aims at promoting the development of useful tools and technologies to stimulate economic growth, while, at the same time, trying to anticipate and prevent their potential detrimental consequences.

The technologies that science has developed have increased our abilities to predict and control events in the world. They have also improved our living conditions and quality of life. And they have paved the way for economic investments that yield significant financial returns. Investments in science and technology, due to the promise of such returns, now constitute a significant economic

activity that often sets the direction for new research. Science thus helps to drive the economy through its development of new technologies, and it is often driven by the economy's need to continually develop new and better technologies.

But modern science can also transform human life and the environment in ways we may not like, and the potentially detrimental consequences of some tools and technologies raise concerns about whether and to what extent we should permit their development and use. Some tools and technologies may have such decisively negative consequences that science is not able to develop a response in a timely manner. Public policy responses may also take a long time to be effective. This possibility would thus allow industry and the market to set the priorities for applied science in an attempt to provide the kinds of tools and technologies that people actually want, while at the same time encouraging governments to regulate scientific inquiry that we know to be dangerous. It would thus encourage the development of useful tools and technologies while at the same time trying to limit the potentially detrimental consequences that they may have for individuals, society, and the environment.

But even if you share these concerns and these aims, you may wonder whether and to what extent this possibility could work. Science has enabled us to predict and control many events in the world—but it cannot enable us to foresee the unforeseeable. The truth is that technology can transform human life and the world in ways that we may not like and simply cannot predict. Public policy and science itself may take a long time to respond to unintended detrimental consequences once the cat is out of the bag. And some tools and technologies may have such decisively detrimental and irreversible consequences that no response may be effective. You may think that this possibility could too easily impede innovation and new research, since scientists will always be able to find potentially detrimental consequences of their work if we ask them to anticipate them. But you might also think that the potential consequences of some tools and technologies are so dangerous and irreversible that we simply should not permit their development and use.

Support pure inquiry, creativity, and the free flow of ideas

The public, according to this possibility, would support and foster pure scientific inquiry about fundamental scientific questions, regardless of its foreseeable practical applications. It would also support creative scientific investigations that challenge well-entrenched ideas and interests both in and outside of science. And it would welcome, protect, and promote the free flow of ideas as a universal public good.

This possibility flows from concerns that science today is often driven less by curiosity about the 'big questions' than by a desire to profit from practical applications; that the demands that government, the market, and society make for new tools and technologies may direct scientific inquiry exclusively toward useful applied research; and that the institutions that fund science, along with the emphasis that is often placed upon scientific methods and the body of scientific knowledge, may impose detrimental constraints upon pure scientific inquiry. It thus aims at protecting pure scientific inquiry as a universal public good.

Pure scientific inquiry is a free, creative, and open-ended process of asking and exploring possible answers to fundamental questions about the natural world, society, and the cosmos without concern for their possible eventual applications. Scientists who engage in this kind of inquiry may thus often challenge well-accepted ideas. Their questions may jangle our nerves. And their theories may force us to reexamine our existing beliefs—including our social and ethical norms—and to see the world in new and sometimes disturbing ways. But pure inquiry may also lead to a better understanding of the changing world and further the goal of achieving a more sustainable, just, and ethically responsible society.

This possibility recognizes that the truth of a scientific theory does not depend upon the methods that scientists use to obtain it, that scientists can raise interesting questions without knowing how to investigate them or test their possible answers, and that pure scientific inquiry has often provided the seeds for unforeseen practical applications that have paid real dividends. But it also recognizes that further scientific inquiry may be worthwhile even if no practical applications come from it, and even when we think that we already have a true theory in hand. The public may not always understand or appreciate these aspects of science—and it may sometimes even seem hostile to them. Thus, some people seem to think that pure inquiry about the 'big questions' is useless. There are forces outside the scientific community that may try to restrict or even eliminate it. And even some members of the scientific community may try to suppress new research that challenges well-accepted theories. There is clearly a need for applied science. But it is the free and creative

activity of pure scientific inquiry—driven by curiosity and the desire to discover answers to fundamental questions at the horizons of understanding—that lies at the very core of our attempt to understand the world. And this possibility tries to promote it.

But even if you believe in pure inquiry, creativity, and the free flow of ideas, you may have doubts about whether and to what extent it is good to support inquiry that challenges well-accepted ideas. You may think that the results of pure scientific inquiry about the 'big questions' are often difficult to evaluate. Or you may think that pure inquiry about fundamental scientific questions may require extensive public funding, since its practical applications, if any, may be discovered long after it has been conducted. And you may feel that pure scientific inquiry is simply too expensive for the public to support without the promise of at least some foreseeable practical benefits.

Encourage international science—but protect our national power and interests

The public, according to this possibility, would generally encourage international scientific collaboration and the sharing of scientific information, methods, and technologies in an effort to promote progress in science and international friendships. But it would also try to balance our support of international science with protecting and developing our own national power and interests.

This possibility regards international science as a universal public good and it would seek to eliminate some of the barriers that still exist to it. But it also flows from a concern that it is becoming increasingly difficult to control the use of our scientific information and technologies abroad; that we may be losing our international superiority in science—and our military and economic superiority with it—by spreading our science and technology around the world; and that our own science and technology may some day be used against us. It thus aims at supporting the further development of international science while, at the same time, protecting our own national power and interests.

Scientists have often worked and studied outside their native countries and international science journals and conferences have long been commonplace. But the acceptance of free trade, the increasingly low cost of international travel, and the rise of the internet have greatly expanded opportunities for international scientific collaboration. These developments present us with new opportunities by enabling an increasing number of scientists to work and study abroad. But they also present us with new challenges.

Science progresses faster as an international enterprise and certain kinds of scientific problems can be addressed only through international cooperation. Support for international science can also help to advance our national interests by influencing the development of new governments and leaders that are friendly to them. It can encourage tolerance, foster international friendships, promote cross-cultural understanding, focus attention upon global problems, and facilitate global management. There is, moreover, a sense that we may have a moral obligation to make our scientific knowledge and technologies available to other countries for humanitarian purposes. But the success of international science requires a willingness to share our scientific knowledge and technologies with other countries. And this can make us vulnerable to potential enemies who might try to use our scientific knowledge and technologies for their own economic and military advantage.

But even if you think that we should balance our support for international science with our own national power and interests, you may wonder whether and to what extent this possibility could work. We were able to influence the direction of science and maintain our national power in the past by investing more money in science than other countries, by training foreign scientists at our universities, and by limiting their access to sensitive information and technologies. But other countries are increasingly investing more money in science, their students are increasingly studying science at home, the internet is making it increasingly more difficult to control the flow of scientific information—and our own students are increasingly pursuing careers outside of science. You may wonder how we can maintain our current scientific superiority in the face of these trends. But you may also worry that trying to protect our national power and interests might lead us to clamp down on our borders, hoard scientific information, and restrict international collaboration in ways that might ultimately impede both international science and our own scientific development.

Balance science with humanistic, religious, and other cultural institutions

The public, according to this possibility, would treat science as only one among several valid ways of knowing. It would take steps to bring it under

democratic control. And it would support humanistic, religious, and other cultural institutions—sometimes at the expense of its support for science—as a counterweight to the unsettling effects that science may have upon society.

This possibility regards science as only one of several valid 'ways of knowing', and it flows from a concern that deferring too much to science can have serious detrimental consequences. Today there is a widespread presumption that science has a special kind of authority that non-scientists should not question, and that we should do anything that science has discovered it possible to do. This possibility is a reaction to those presumptions. It maintains that science can shape the future in undesirable ways that are beyond our control; that it can present us with physical, social, legal, and ethical problems before we have developed resources for dealing with them; that deferring to science may lead us to neglect valuable insights that may be gained from non-scientific ways of knowing; that governments may impose its theories and technologies upon us in areas that impinge upon our cultural values and political freedoms; and that many people have become alienated from it and intimidated by its authority as a result. This possibility thus aims at bringing science under democratic control; at ensuring that it does not overwhelm other societal institutions; and at maintaining a healthy respect for other ways of knowing, social institutions, and authorities.

We would like to think that science allows us to predict and control the future, but the truth is that it just as often controls us. Science often leads us to dismiss insights gained from other ways of knowing as irrational and subjective. It also exerts a pressure upon us to use its discoveries and technologies regardless of whether we need them, have chosen them, or fully understand their consequences. It sometimes makes people feel alienated from what matters most to them. And its authority can be used to control individuals and whole societies in ways that can easily be abused. There is, indeed, a growing sense that modern science is transformative, aggressive, and imperialistic by its very nature; that it can easily destroy traditional cultures and values; that it cultivates a disinterested frame of mind that often seems oblivious to these consequences; and that we need to somehow restrain it from overwhelming other valuable social institutions and ways of knowing.

This possibility recognizes that the history of science has seen a succession of theories that have been so different from one another that they might be regarded as competing world views. It also recognizes that scientific knowledge is always subject to revision; that scientific methods have their limits; and that there are non-scientific ways of knowing that may provide useful and reliable knowledge that is compatible, complementary, or even superior to scientific knowledge. It thus maintains that the public should have a greater say in decisions about what we should believe and do as a society—including a right to say 'no' to science, regardless of how good it may be.

You may, of course, completely disagree with the idea that science is only one among several valid ways of knowing. But even if you share these beliefs and concerns, you may wonder how we would determine in advance where the proper domains of science begin and end, how we would resolve the boundary disputes with other ways of knowing that would inevitably arise from our attempts to do so, whether it would actually be a good thing to bring science under democratic control, and how we could possibly do it without destroying what was valuable about science in the first place.

I would like to say a few words, in closing, about how these eight conceptual possibilities fit into our current discussions about science policy. Daniel Sarewitz recently asked the question 'Does science policy matter?', and answered it by saying 'It would if we had a real science policy, but what we have now is science politics'.[vi] Sarewitz says that most of our current discussions about science policy focus upon how much money government should budget for science—'and avoid like the plague serious questions about 'what for'.[vii] He seems, in the spirit of our report, to conceive of science partly as politics, partly as an economic engine, and partly as a handmaiden to various interests. But what is, perhaps, more important is what he says about science policy. Sarewitz writes that 'if science policy is mostly science budget policy, then one can reasonably assert that there is no such thing as a national science policy in the United States'.[viii] He writes that 'if one cannot choose among alternative policies in terms of what they may achieve, then policy preferences are revealed as nothing more than expressions of parochial values and interests'.[ix] And he writes that the fact that there are no mechanisms or forums to explore tensions between different goals, or between different approaches to the same goal, is 'precisely the problem'.[x] The discussion project on science that I conducted for the Interactivity Foundation, the 'Citizen Staff Work Report on Science' that we produced, and this editorial might all be regarded as tentative first steps toward redressing this problem. They are, however, only first steps. And the decision whether or not we should discuss such pos-

sibilities at all is the ninth governance choice about science that we must make.

Earlier I said that the policy possibilities that my project developed should not be understood as planks in a consistent policy platform for science—and that it would, indeed, be impossible to consistently adopt all eight of them at once. I suspect that some people will find our report, and this editorial, unsatisfying as a result. For we have, after all, described eight different conceptual possibilities for public policy pertaining to science—and over twenty different concepts of science—without ever taking a stand or recommending the adoption or rejection of any of them. But the point of our project was not to decide what science is, or even what it should be, let alone what we should do about it—as if someone had given us the authority to do any of these things. It was, on the contrary, to illuminate the different possible concepts of science, the different conceptual possibilities for public policy pertaining to science, and their different practical consequences as clearly as we could—so we could see more clearly what science might become under their influence; so we could be in a better position to choose how we should think about science and how it should interact with public policy in democratic open societies with market economies like our own; and so others might use our work as a springboard for their own discussions about science and science policy. I am thus hoping that you will discuss our different concepts of science and our different policy possibilities—and that you will do so not so much with an eye toward determining whether they are accurate as descriptions or attractive as ideals, as with an eye toward understanding what our future science, scientists, research, and scientific knowledge might become under their influence. I fully expect that your discussions will explore and develop many more governance choices for public policy pertaining to science than the eight that are included in our report. But it is only by rethinking science in this way that we will knowingly be able to choose which way we want to go.

Endnotes

[i]Mark Amadeus Notturno, 'Rethinking science as an area of concern', Med Hypotheses, 2006; 66(2) 217—9.

[ii]See my *Science and the Open Society* (CEU Press, New York, 2000), especially Chapter 4, 'Science and The Institution', and Chapter 10 'The Choice between Popper and Kuhn: Truth, Criticism, and the Legacy of Logical Positivism' for a more in-depth discussion of these concerns.

[iii]IF believes that policy discussions often focus upon the actions that governments might take instead of the concepts that might motivate them; that the wise choice of a public policy in an area of concern requires an exploration of a wide range of contrasting conceptual possibilities for public policy; that governments often act without considering a wide range of possibilities; and that citizen discussions of such possibilities can improve both our public policy choices and our ability to make them. IF thus supports citizen discussion projects to explore, develop, articulate, and test a wide range of contrasting conceptual possibilities for public policy in selected areas of concern. Our aim is not to recommend or advocate specific conceptual policy possibilities or actions to implement them—and IF does not have a policy position in any of its areas of concern—but to encourage citizens to discuss their concerns and the different conceptual possibilities for addressing them. We thus regard our 'Citizen Staff Work Reports' as preliminary staff work prepared for citizens by some of their fellow citizens. And we encourage our panelists to explore and develop a wide range of contrasting possibilities for public policy, including possibilities that they might personally oppose.

[iv]You can download IF's 'Citizen Staff Work Report on Science' at: www.interactivityfoundation.org. The report describes eight contrasting conceptual possibilities for public policy pertaining to science; our panelists' thoughts about the actions that might be taken to implement the possibilities that they developed; and their thoughts about the effects that those actions might have upon individuals, groups, institutions, and society at large. It also describes over twenty different concepts of science and a variety of concerns that might be associated with each of them. It does not, however, recommend the adoption of any of the possibilities that it describes—or any of the actions that might be taken to implement them. There are, in fact, possibilities in the report that few if any of our panelists would endorse, but which they nonetheless thought should be part of the public policy discussion about science. We hope that the report will provide a conceptual springboard for citizens who wish to participate in discussions about the different possible ends pertaining to science that we might want to achieve as a society. And we offer it to the public, along with opportunities to discuss it, to stimulate and aid such discussions.

[v]I encourage you to refer to our full report for more developed discussions of each of them.

[vi]Daniel Sarewitz, 'Does Science Policy Matter', ISSUES IN SCIENCE AND TECHNOLOGY, Summer 2007, p. 31.
[vii]Sarewitz, p. 37.
[viii]Sarewitz, p. 32.
[ix]Sarewitz, p. 37.
[x]Sarewitz, p. 37.

Mark Amadeus Notturno
Interactivity Foundation,
71 Randolph Place NW,
Washington,
DC 20001-1123, USA
Tel.: +1 202 518 0534
E-mail address: manotturno@comcast.net