Beyond the Social Contract Myth

Science should move beyond a contractual relationship with society and join in the quest for the common good.

Robert Frodeman and Carl Mitcham

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In January of 1803, six months before Napoleon offered him the Louisiana Territory, President Thomas Jefferson asked Congress for an appropriation of $2,500 to conduct a scientific and geographic survey of the North American West. In his letter to Congress, the president emphasized the commercial advantages of the venture: the possible discovery of a Northwest Passage and the capturing of the British fur trade. In contrast, in his personal instructions to Meriwether Lewis, Jefferson highlighted the scientific bounty of the trip: contact with unknown Indian cultures, discovery of biological and botanical wonders, and the identification of the geographic and geologic features of the region. The result of these dual charges was one of the classic journeys of exploration in U.S. history.

Almost a century and a half later, in August of 1939, scientists Leo Szilard, Albert Einstein, and others proposed a program of atomic research to President Franklin Delano Roosevelt. Although the most immediate stimulus was to beat Nazi Germany to the atomic bomb, for Szilard especially atomic physics was a means to H. G. Wells' vision of endless energy in a "world set free" from toil. Indeed, Szilard thought it might even be a way to overcome international violence by uniting all nations in a common cause greater than politics: the conquest of space.

Did the Lewis and Clark expedition embody a social contract between science and society? Or was it more the expression of a vision of the common good, with political, economic, and scientific components? Similarly, in the case of atomic energy, didn't both private industry and the government support this research in order to win the war and to advance knowledge and human welfare in a broad and mutually reinforcing synthesis?

During the past two decades, it has become popular to discuss the relation between science and society in terms of a "social contract." Scientists, public policy analysts, and politicians have adopted such language in a largely unchallenged belief that it provides the proper framework for considering issues of scientific responsibility and the public funding of research. But neither of the cases mentioned above, nor a multitude of others that might have been chosen, involves a relationship that can be adequately described in terms of a contract. In fact, the language of a contract demeans all the parties concerned and belittles human aspirations (not to mention political discourse). Neither scientists nor citizens live by contract alone.

The social contract language is a legitimate attempt to step beyond the otherwise polarizing rhetoric of scientists and citizens in opposition. The idea of a social contract is a clear improvement over formulations that stress either the pure autonomy of science or its strict economic subservience. We believe, however, that the range of public discourse must be widened beyond that of contractual negotiation, even at the expense of opening up questions that lack simple answers. Surely human ideals demand as much attention as military security, physical health, and economic wealth, especially in a world where material achievements are greater than ever before in history. Scientists and citizens alike should strive to identify the common or complementary elements of a vision of the good, rather than discussing the quid pro quos of some illusory contract.

Testing a theory

It is ironic that social contract theory has been adopted to explain the relations between science and society just when that theory has been largely rejected as a framework for understanding politics in general. Indeed, a brief review of the rise and fall of the political philosophy of the social contract may help us appreciate the advantages and disadvantages of the notion of a social contract for science.

Social contract theory was first given modern formulation by political philosophers such as Thomas Hobbes, John Locke, and Jean-Jacques Rousseau. There are subtle distinctions among their different versions of the theory that need not concern us here. According to all versions, society originates when isolated and independent individuals make a compact among themselves to limit their freedoms in order to increase security. Before entering into their compact, individuals exist in a state of "perfect freedom" (Locke) unconstrained by any obligations to each other. The competition that results from this state of perfect freedom readily gives rise to a "war of all against all" (Hobbes). It therefore becomes desirable to subordinate individualism for the unity of a "general will" (Rousseau).

So conceived, the contractual relationship for both politics and science presumes independent parties with divergent goals. Neither future citizens nor scientists are thought to have any ties to one another before the creation of the political or scientific compacts. Nor does either group have responsibilities to the common good. Further, by definition there are no obligations that exceed the terms of the contract, for either society or science.

These factors identify the strengths of contractual relations: They clearly protect personal freedoms and limit governmental powers. But such strengths also expose the limitations of social contract language for understanding the place of citizens and scientists in our complex and interdependent society. Surely scientists have obligations both to each other and to nonscientists prior to any formulation of mere contractual relations.

The upshot of the social contract theory was to advance the argument for human rights and the justification of enlarged democratic participation in government. The application of social contract theory to a discussion of science policy has had the similar effect of defining and protecting the rights of scientists and inviting democratic participation in the setting of broad scientific research agendas. It is nevertheless significant that such language has been largely rejected in political philosophy, for at least two interrelated reasons.

First, there is no evidence that anything like a social contract ever took place in the formation of any society. The same may be said with regard to a social contract for science. Historically, the relations that we describe ex post facto in social contract terms were never created by explicit contractual means.

Second, the social contract theory presupposes atomistic individualism as its theory of human nature, a conception that is highly problematic psychologically and sociolog-

ically. As Aristotle argued, we are fundamentally political animals in that most of the features that make us distinctly human are products of the community. Language and culture are fundamentally social rather than individual creations, although individuals obviously contribute to the furtherance of both. At the very least, the emergence of individuals is a dialectic process, involving the creation of the individual through the blending of individual initiative and communal mores.

Science and the common good

A truer account of the science-society relationship is found in the conception of the scientific and political pursuit of the common good. Consider the issue of professional ethics in science. A scientist's ethical responsibilities are typically seen as beginning with a well-established set of obligations internal to the scientific community. Most conspicuously, these include maintaining the integrity of the research process through the honest reporting of data, fair and impartial peer review, and acknowledgement of contributions by others. But scientists also have what might be termed external obligations to avoid harming human subjects and to use their knowledge for the good.

To illustrate, compare the relation between scientists and their fellow citizens with that between physicians and their patients. When a physician saves a life, no cash payment can offer adequate compensation. One balks at describing such a relation as contractual: The nature of the exchange defies the possibility of clear and unequivocal recompense. Patients owe their physicians more than money, a fact symbolized by the social respect accorded the physician's role. Moreover, the set of obligations is reciprocal: Whereas patients and societies honor physicians, physicians take on lifetime commitments to their communities. If an illness suddenly worsens on Christmas morning, the physician must leave hearth and home. The life of the physician is closer to one of covenant and commitment than contract.

In recognition of this fact, physicians are referred to as "professionals"–that is, ones who profess or proclaim their commitment to live in accord with ideals beyond those of self-interest and the cash nexus, at least insofar as they practice medicine. One does not, for instance, expect everyone to keep confidentiality as strictly as we expect physicians to do. Similar notions of professionalism hold for lawyers, members of the military, the clergy, and engineers. The common denominator of all these practical professions is that they involve activities that go to the heart of the human condition, confronting matters that lie beyond the prosaic: issues of life and death, freedom, justice, and security.

Scientists and citizens alike should strive to identify the common or complementary elements of a vision of the good.

Curiously, however, scientists are seldom denominated professionals in quite the same way. Scientists may be thought of as theoretical professionals. Scientific societies have, for instance, been slower than medical, legal, or engineering societies to adopt

professional codes of ethics that increasingly affirm social responsibility above and beyond any contractual determinations. Moreover, when scientists are called professionals, this is often done to promote an independence that may be at odds with the social good, thus calling for qualification.

The good in science, just as in medicine, is integral to and finds its proper place in that overarching common good about which both scientists and citizens deliberate. Politics in this sense is more than the give and take of interest groups. Instead, it is that reflective process by which citizens make informed choices on matters concerning the shared aspects of their lives. Politics denotes the search for a common good, where people function as citizens rather than only as consumers.

From this perspective, the good intrinsic to science consists not only in procedures that are designed to preserve scientific integrity. It also expands into the goods of knowledge, of the well-ordered life, of fellowship and community, and the wonder accompanying our understanding of the deep structure of things. Indeed, there are even aesthetic and metaphysical dimensions of the good in scientific research. During the moon landings, the beauty of Earthrise over the lunar landscape and the collective sense of transcendence we felt in watching humans step out onto another world may well have been the enduring legacy of the moon missions, rather than any of the varied economic and technological spinoffs.

Although few politicians would admit to voting for a scientific project on its aesthetic or metaphysical merits alone, much of science has precisely such results. Contract economics must not be allowed to crowd out recognition of more expansive but absolutely fundamental motivations. Reductionism may not be a sin in science, but it is in politics.

Conceived under the sign of the common good, scientists have much broader obligations than those of simple scientific integrity. Indeed, even internal obligations find more generous and inclusive foundations in the notion of the common good than in the language of social contract. From the perspective of the common good, it is incumbent upon the scientist to preserve the integrity of science, treat all experimental subjects with respect, inform the community about research under consideration, provide ways for the community to help define the goals of scientificresearch, and report in a timely manner the results of the research in forums accessible to the nonspecialist.

Practical implications

The shift from thinking of science as involved in a social contract to science as one aspect of a continuing societal debate on the common good broadens science policy discourse. It also deepens reflection on the science-society relation in science and in politics.

One major limitation of the idea of a social contract for science is that it has implications only for publicly funded science. Science policy discussions emphasizing

social contract language exclude a large segment of the scientific community not funded by government. Science policy discussions focusing on questions of the common good (without denying important distinctions between privately and publicly funded science) will include concerns of a far larger constituency. For instance, shouldn't we be asking questions about the goodness of human cloning, not simply whether the tax dollars of those who oppose human cloning should be used to fund it?

For scientists themselves, working in both the private and public sectors, trying to articulate a common good will point beyond justifications of science merely in terms of economic benefit. What science can bring to society are not just contractual benefits but enhanced intelligence and even beauty. Using the language of the common good, scientists will be encouraged to make a case for science as a true contributor to culture. E. O. Wilson's defense of biodiversity through "biophilia" and his notion of a "consilience" between science and the humanities are but one salient expression of such an approach.

Of course, using the framework of the common good opens science to being delimited by other dimensions of human experience. Science is not the whole of the common good, and as part of that whole it may sometimes find its work restricted in order to serve more inclusive conceptions of the good life. Liberal democratic societies restrict experimentation on human subjects because of a good that overrides any scientific knowledge that may result from such work. But surely this is a vulnerability that science can survive, and should affirm. This approach will also help take public discussion out of the framework of a hackneyed contest between reason and revelation, as in the evolution versus creationism controversy. It is possible, after all, to have a reasonable discussion on the nature of the good life without constant reference to the facts of science or the claims of fundamentalism.

The new vision

Given the extraordinary effects of scientific discoveries and technological inventions during the 20th century, effects that will only increase throughout the 21st century, social contract theory cannot give a sufficiently comprehensive account of the science-society relationship. Scientists, like all their fellow citizens, must be concerned not just about advancing their own special interests but more fundamentally about the common good. This broader obligation is operative on two levels: that of internal professional responsibility and that of citizenship.

Professional responsibilities commonly described as internal as well as external have become unavoidable for the scientist today, especially for the scientist employed or supported by federal money. Appreciating such demands–acknowledging the claims of community without compromising the integrity of the scientific process–has become a central issue for practicing scientists and for those engaged in science education.

This transcontractual view of scientific responsibility challenges the long-held belief that the integrity of the scientific process is founded on the exclusive allegiance to facts and the banishment of values of any kind. It has been an honored principle that scientists qua scientists must not attempt to draw political conclusions from their scientific research and that their work should be isolated from political pressures of all types. With scientists recognizing their own citizenship, and citizens realizing the scientific fabric of their lives, these claims become tenuous.

First, as the social contract language recognizes, there are inevitable, and increasing, places where the scientist and the public interact. This is a result of a wide set of changes in society. These changes include the loss of a clear consensus about societal goals with the end of the Cold War and the state of emergency that it fostered, more rigorous standards of accounting for the spending of public monies, and the increasing relevance of scientific data to various types of environmental questions and controversies. This means that scientists' responsibilities include understanding the concerns of the public as well as being able to explain their work to the community.

Second, it is a truism of recent philosophy of science that although the scientific research process can and must be fair, the full exclusion of values is an unattainable and even undesirable goal. Human interests are always tied to the production of knowledge. The collection and interpretation of data are constrained by a variety of factors, including limitations of time, money, and expertise. The most rigorous objective scientific procedure is motivated by personal or social values, whether they be economic (generating profits or gaining tenure), political (nuclear deterrence or improving community health), or metaphysical (the love of understanding the deep nature of things). Finally, various types of methodological value judgments inevitably come into play, such as the perspectives one brings on the basis of past experience and training.

The social contract language has arisen in an attempt to take account of such factors. But it is only the principle of the common good that can do full justice to them. In 1970, during testimony before Congress, A. Hunter Dupree, the dean of U.S. science policy historians, called for the creation of a new kind of Manhattan Project. The World War II Manhattan Project had brought together a spectrum of atomic scientists and engineers to create the atomic bomb. Dupree's new Manhattan Project "would do away with the conventional divisions between the natural and social science and humanities, and by drawing on people from many disciplines . . . would provide the enrichment and stimulation of unaccustomed patterns." The goal of such a pluralistic project might well be described as a full and rich articulation of the common good, for scientist and nonscientist alike.

Dupree opened his testimony with a quotation from John Wesley Powell, one of the founders of public science in the United States and the second director of the U.S. Geological Survey. Charles Groat, the current director of the USGS, in a recent interview echoed Dupree by calling for a future in which science "is more cooperative, more integrated, and more interdisciplinary." It is not the refining or renegotiation of

a contract that will lead in this direction, but public discussion of the common good of science and of society.

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Letter Responses

Robert Frodeman and Carl Mitcham have opened the door on a subject that requires the critical attention of the scientific community ("Beyond the Social Contract Myth," *Issues*, Summer 2000). There is great angst among scientists concerning their relations with society in general and with the funding organs within society in particular.

The Government Performance and Results Act of 1993 (GPRA) sought to impose a strategic planning and performance evaluation mechanism on the mission agencies and thus took a giant step in introducing congressional oversight to science management. Government patronage accounts for only about a third of research done in the physical sciences in the United States, but there is a qualitative difference between this research and the two-thirds funded by industry (support from foundations and local government is ignored in this assessment since it constitutes a relatively small percentage of the total). A great deal of the research funded by the National Science Foundation, Department of Energy, National Institutes of Health, and other agencies is fundamental in nature and is not likely to be supported by others. Thus an overriding precept of such support is that a "public good" is derived, which warrants public investment but will be of little immediate benefit to the private sector.

However, economists have estimated that as much as 50 percent of the growth of the U.S. economy since the end of World War II is directly attributable to public investments in science. It is further argued that as much as 60 to 70 percent of the annual expansion of the economy is a direct result of such investment. There is a contradiction inherent in this view that only government can support an enterprise that so materially benefits industry.

We can say that publicly funded research is too amorphous in intent and direction and therefore too risky to be supported by the private sector. But isn't GPRA intended to give strategic direction to the nation's science enterprise, thus ensuring increased productivity (whatever this means) and greater economic benefit?

In reality, Congress has hijacked the idea of the public good and clothed it in statutory language; to wit, each mission agency must provide a plan that, among other things, will "...establish performance indicators to be used in measuring or assessing the relevant outputs, service levels, and outcomes of each program activity..." There

is little if any room in this context to view science as a cultural activity capable of manifesting, in Frodeman's and Mitcham's words, "...the love of understanding the deep nature of things."

Thus success in the physical sciences is measured in economic terms and the scientist is held to professional performance standards. The scientist is patronized and owes the patron full and equal measure in return for the support received. Social contract theory is now contract law.

So I am reduced to asking a series of questions: What is a public good? How do we measure it? How do we reach agreement with the keepers of the public larder?

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Robert Frodeman and Carl Mitcham make two points. One is important and correct and the other questionable and dangerous. The correct point is that social contract theory alone cannot give an adequate account of the science/society relationship. The questionable point is that society ought to shift from a social contract to a common good way of viewing science.

Point 1 is important because scientists' codes of ethics have changed in 25 years. Beginning as statements to protect the welfare of employers and later employees, scientists' professional codes now make protecting the public welfare members' paramount duty. Frodeman and Mitcham are correct to want science/society behavior to reflect these changed codes.

Point 2, that one ought to substitute a theory of the common good for a social contract account of the science/society relationship, is troublesome for at least three reasons, including Frodeman and Mitcham's use of a strawman version of the social contract theory they reject. They also err in their unsubstantiated assertion that society has abandoned the social contract. On the contrary, it remains the foundation for all civil law.

First, historically point 2 is doubtful because part of the Frodeman-Mitcham argument for it is that parties to the social contract were conceived as atomistic individuals with neither ties nor obligations to each other before the contract. This argument is false. Social contract theorist John Locke, architect of the human rights theory expressed in the U.S. Constitution, believed that before the social contract, all humans were created by God, shared all natural resource "common property," and existed in an "original community" having a "law of nature" that prescribed "common equity" and "the peace and preservation of all mankind." They were hardly atomistic individuals.

Second, Frodeman and Mitcham err in affirming point 2 on the grounds that no explicit social contract ever took place. Almost no social contract theorist believes that an explicit contract is necessary. This century's most noted social contract theorist,

Harvard's John Rawls, claims that people recognize an implicit social contract once they realize how they and others wish to be treated. The social contract is created by the mutual interdependencies, needs, and benefits among people. When A behaves as a friend to B, who accepts that friendship, B has some obligation in justice also to behave as a friend. Society is full of such implicit contracts," perhaps better called commitments or relationships.

Third, claim 2 is dangerous because it could lead to oppression–what Mill called the "tyranny of the majority." Centuries ago, Thomas Jefferson demanded recognition of an implicit social contract and consequent equal human rights in order to thwart totalitarianism, discrimination, and civil liberties violations by those imposing their view of the common good. The leaders of the American Revolution recognized that there is agreement neither on what constitutes the common good nor on how to achieve it. Only the safety net of equal rights, a consequence of the social contract, is likely to protect all people.

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Robert Frodeman and Carl Mitcham are, of course, very right in challenging the very idea of the social contract between science and society. This is an abstraction, a convenient myth that obscures more than it conveys.

Having observed the spectrum of proposal-writing academic scientists up close for 50 years, I can state with some confidence that very, very few of them ever think of either a social contract with society or the "common good" that Frodeman and Mitcham advocate. I have found that the question "What do you owe society, your generous patron, or your fellow citizens who pay for your desires? elicits some bewilderment. "I? Owe someone something? I am doing good research, am I not?"

The saddest part is that ever since 1950 and the beginning of the unidirectional "contract" between a small part of the federal government and a cadre of scientists whom they thought could help defense, health, and maybe the economy, the collective science enterprise (such as professional societies and the National Academies) has talked so little within the community about their responsibility to society. It could be argued that a scientist working on a targeted project of a mission agency to achieve a mutually agreed-upon goal of value to society is fulfilling his or her contract by doing the research diligently. But that does not apply to a very high percentage of investigator-initiated research.

Among Frodeman and Mitcham's enumerated ways to preserve the integrity of science are reasonable demands: The community should define goals and report results to

the nonspecialist. In the real world of externally funded science, goals are only defined for the narrowest set of peers. Reporting to the public is routinely abused by some unscrupulous academics who egregiously exaggerate their regular "breakthroughs," the imaginary products that will follow, and their value to society. These exaggerations are amplified by science reporters, who also have a reward structure that thrives on exaggerated claims and buzzwords. My appeals for decades to my own National Academy hierarchy to institute a serious effort to control this, the form of scientific misconduct most dangerous to the nation, has never even been sent to a committee. An important national debate could be about what we scientists as individuals and groups owe to society for its inexplicably generous financial support.

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I share Robert Frodeman and Carl Mitcham's criticism of contract theory and their sympathetic plea for a more democratic and deliberative model for the science and society relationship. However, I disagree that the deliberations of the modern citizen (including the scientist as a citizen) should or could focus on the identification of the common good. The old Aristotelian notion of a citizenry that seeks to agree on the common good is simply not appropriate for complex modern societies, let alone in steering the direction of science.

First, modern pluralist society is not based on a community that shares a common ethos that could motivate citizens to join in a quest for the common good; even if they tried, it is not hard to imagine that they would fail to reach consensus in any substantial case. In modern societies, citizens adhere to a constitution that allows them to regulate their political matters in such a way that different groups can equally pursue particular interests and shared values. In addition, the output of science and technology cannot be intentionally directed and limited to the scope of predefined and shared values: Science and technology can be used for good and bad, but what precisely is good or bad is to be settled during the process of development; and to avoid negative outcomes, this process should be the subject of continuous public deliberation.

Second, modern society is characterised by distinct systems, such as science, the market, politics, and the legal system. The balance between those systems is rather delicate: We want to avoid political abuse of science, and we oppose any substantial political intervention in the market, among other things. Any subordination of one system to another should be seen as a setback in the development of the modern world. The 20th century provided us with some dramatic cases. In postwar Germany,

as a result of the experiences with the Nazi regime, freedom of research became a constitutional right.

Here I arrive at the point where I can share Frodeman and Mitcham's call for a more deliberative approach to science. I believe that rather than including the sphere of science in a broad ethical-political motivated debate on the common good, those deliberations should primarily begin when our societal systems evolve in a way that threatens a particular balance. I believe that in a growing number of cases, such an imbalance causes the erosion of science. I have described a number of cases elsewhere and limit myself here to one example related to the Human Genome Project (a common good?). The patentibility of yet-undiscovered genes, for which the U.S. legal system has given support, results in an economization of science: Scientists start to compete with each other as economic actors in order to appropriate genes as if they were real estate, while at the same time undermining science as a collective enterprise for the production of knowledge, for which open communication and the sharing of data among scientists are essential. At the same time, our traditional deliberation-based political system is not capable of coping with the rapid developments of science and technology. We therefore need to extend those deliberations to the public realm.

Social contract theorists may defend an economization of science in terms of serving a particular common good; for instance, by arguing that the economic gain resulting from a patenting practice would result in economic prosperity for the whole nation. This is also a reason why social contract theory is unsatisfactory and we need to look for alternatives.

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Anything from Carl Mitcham merits serious attention. With most of the purport of his and Robert Frodeman's article I empathize. There is a need for science and scientists to have regard for the social consequences of what they do and to orient their efforts toward benefiting humanity. This has been a recurrent theme in the writing of many scientists, particularly in the 20th century: J. B. S. Haldane, Hyman Levy, J. D. Bernal, and many more. Most recently, Joseph Rotblat, the Nobel Peace laureate, has been calling for a scientist's code of conduct that would emphasize the quest for the common good. Where I am at a loss is to find any great emphasis in all of this on a contract or social contract for science and scientists. Is something happening on your side of the Atlantic that is not known on this side? If so, I spent 12 years at Penn State without being aware of it. Or are Frodeman and Mitcham tilting at windmills?

Even if I could accept the authors' contention that a social contract is not appropriate for science, I am uncertain about the alternative they offer. How much better and in what respects is the common good a goal for science to aim for? We in the

industrialized world live in a society based on conflict–the free market economy–that is becoming more dominant as we become more globalized. With the huge increase in science graduates since World War II, there is no possibility that all or even most of them will work in the cloistered ivory towers of academia. The two largest industrial employers of scientists in the United States are probably the agricultural and pharmaceutical industries. Their prime concern is with profit. The other major employer of scientists is the military, whose prime concern is knocking the hell out of the other guy, real or imaginary. Are we to rely on politicians to referee any dispute over what constitutes the common good? Politicians' primary concern is with getting and holding on to power (witness, for example, their role in the recent attempts to rescue the occupants of the Kursk submarine).

So I am cynical, although I am not opposed to the idea of science working for the common good. Indeed, I could claim to have been working to that end for many years. However, we need to do a lot more thinking about efforts to define such a social role for science.

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Robert Frodeman and Carl Mitchum invoke Thomas Jefferson's justification for the Lewis and Clark expedition. Interestingly, the same example figures prominently in recent *Issues* articles (Fall 1999) by Gerald Holton and Gerhard Sonnert ("A Vision of Jeffersonian Science") and Lewis M. Branscomb ("The False Dichotomy: Scientific Creativity and Utility"). Whereas the latter authors argue for a transcendence of the basic/applied dichotomy in achieving a new contract between science and society, Frodeman and Mitchum advocate transcendence of the contractual relationship to pursue a joint scientific and political goal of the common good. The motivation for all these views is the evolving new relationship between science and society, for which the Jeffersonian image has great appeal in achieving an improvement over recent experience.

I suggest that there is something even more fundamental underlying these calls for new philosophical underpinnings to the science/society interaction. First, the conventional view of science has presumed its manifestations to be value-free. Good science is thought to focus on achieving enduring truths that are independent of the subjective concerns that characterize seemingly endless political debates. Second, the factual products of science are presumed to provide the objective basis for subsequent societal action. To this end, a sharp boundary between society and science is deemed necessary to ensure the objectivity of the latter. Indeed, so the argument goes, this value-free axiology implies that basic science is clearly superior to applied science.

Aristotle observed long ago that the claim to not have a metaphysics is itself a form a metaphysics. It seems to me that the great strength of science lies not in any inherent superiority of its epistemological basis, but rather in its ability to get on with progress toward truth despite obviously shaky foundations. The prognosticated benefits of the Lewis and Clark expedition are easily seen as flawed in hindsight, but the unanticipated discoveries of that adventure produced ample justification for its public support. The practice of science embodies an ethical paradox wherein its contributions to what ought to be in regard to societal action are shaped by continual reappraisal in the light of experience. This is the reason why any static contractual arrangement is flawed. Science is accomplished by human beings who are motivated by values, whether honestly admitted or hidden within unstated presumptions.

The Jeffersonian ideal democracy requires an open but messy dialogue between the trusted representatives of society and those who would explore the frontiers of knowledge on society's behalf. In contrast to modern practice, objective scientific truths are not to be invoked as the authoritative rationale for agendas pursued by competing political interests. Rather, the discoveries of a fallible but self-correcting scientific exploration need to be introduced into a reasoned debate on how best to advance humankind in the light of new opportunities. The challenge of the Jeffersonian vision is for scientists to engage the realities of their value-laden enterprise more directly with society, while the latter's representatives responsibly confront the alternative choices afforded as a consequence of scientific discoveries.

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Robert Frodeman and Carl Mitcham are absolutely right in saying that science and science policy need to move beyond the idea of a social contract with society. Their article is evidence of the increasing sophistication of scholarship and thought in the field of science and technology studies and of the value it can bring to science policy debates.

For the past two decades, we have heard a chorus of voices telling us that, in view of the end of the Cold War and the growing focus on social and economic priorities, the existing social contract between science and society is obsolete and we need to negotiate a new one to replace it. Most of this discussion is internal to the science community and stems from scientists' concerns that a decline in the priority of national (military) security means a less secure funding base for science. Few people outside the community, including the congressional appropriators who dole out federal funds to

the research community, have ever heard of such a contract or could care about such an abstract notion.

Frodeman and Mitcham help us escape from this increasingly sterile and narcissistic discourse by deconstructing the concept of the contract itself. They point out that the idea implied by the contract metaphor–that science and society are separate and distinct parties that must somehow negotiate the terms of the relationship between them–is fundamentally flawed. Science, they argue, is part of society, and scientists must view the scientific enterprise, as well as their own research, not as a quid pro quo but in terms of the common good. From this they draw a number of implications, perhaps the most significant of which is that scientists' responsibilities extend not just to explaining their work to the public but also to understanding the public's concerns about that work. This is a critical piece of advice in an era when science-based technology is advancing faster than ever and when many of these advances, from the cloning of humans and higher animals to genetic modification of foods, are stirring bitter controversies that are potentially damaging both to science and the society of which it is an integral part.

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It would be churlish to disagree with the noble sentiments expressed by Robert Frodeman and Carl Mitcham. Who would want to say that science should have a merely contractual understanding of its place in society? However, we feel that there are aspects of the social situation of science, and of its present leading tasks, that require a different approach.

First, the brief discussion of private-sector science somewhat idealizes the situation there. Those scientists are not quasi-professionals but employees, and only a privileged few among them are in a position to be "trying to articulate a common good beyond justifications of science merely in terms of economic benefit." If we consider the proportion of scientists who are either employed in industry, or on industrial contracts in academe, or on short-term research grants, then those with the freedom to follow the enlightened principles articulated here are a minority and one that may now be becoming unrepresentative of the knowledge industry as a whole.

Second, there is a negative side to science and its applications that seems insufficiently emphasized by the authors. It is, after all, science-based industry that has produced the substances and processes that are responsible for a variety of threats, including nuclear weapons, the ozone hole, global warming, and mass species extinctions. Outside the United States, the public is keenly aware that there is an arrogance among

science-based industries, as in the attempts to force genetically modified soy onto consumers in Europe and in the patenting of traditional products and even genetic material of nonwhite peoples. However, I would not wish to be considered anti-American. It is hard to imagine another country where a major industry leader could report on the perils created by the uncontrolled technical developments in which he has a part and then tell the world that these insights derive from the writings of the Unabomber. In the warnings of Bill Joy of Sun Microsystems about information technology, we find an ethical commitment of the highest order and a sense of realism that enlivens a very important debate.

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Beyond the Social Contract Myth
Science should move beyond a contractual relationship with society and join in the quest for the common good.
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