Science Ethics

BY JOHN MARBURGER
Director, Office of Science and Technology Policy, Executive Office of the President

FEATURE

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Thank you for inviting me to speak this evening. Sigma Pi Sigma is an important organization with much potential as yet untapped to serve society. Since service has been a strong aspect of my own career, I particularly admire Sigma Pi Sigma's emphasis on "Service" as one of its four themes. We need more science colleagues who are willing to learn about effective service and to take the time to serve well. One of the consequences of America's tendency to under-produce scientists is that they do not spill over into other careers where science knowledge would be useful but is not essential. So we rely on volunteers from the ranks of science researchers and students and teachers to bring technical skills and knowledge into the broader operations of society, and particularly of government. There are many opportunities to do this in Washington, and I encourage everyone to look into the variety of summer fellowships and internships that place service-minded scientists in government offices.

Michael Faraday, who was famous for his popular science lectures, said you should never begin with an apology. So I will not apologize for speaking about ethics, a field far beyond my expertise. I am comfortable with this declaration because so many others who choose to talk about ethics seem to have no more expertise than I do, so I am in good company. I will also confess at the outset that I do not think "science ethics" differs from any other kind of ethics, nor do I think there is a unique "government perspective" on ethics. But there are some things to say about ethics in its relation to both science and government, and I will try to be clear about them in my remarks.

ETHICS IN GENERAL

Like physics, ethics has a theoretical part and an experimental part—or a philosophical side and a practical side, and they ought to work together. When talking about ethics and science, the philosophical part is important because the status of truth in ethics is so completely different from truth in science. From the science perspective, ethical standards are arbitrary. That is, there is no empirical test for them. So they are neither true nor false. As a practical matter, however, ethical principles that people everywhere have adopted throughout history have certain commonalities such as the Golden Rule of treating others as you would be treated. Therefore it does make sense to speak of ethical principles that are shared, at a sufficiently abstract level, by "everyone." So universal consensus could be regarded as a basis for validating ethical principles in much the same way that empirical tests against nature are the basis for validating scientific principles. Unfortunately, while consensus might be achievable on broad ethical principles, most principles require detailed definitions for their practical application, and on these there is not universal consensus. Many people, especially in the United States, think the appropriate basis for validating ethical principles is religion. Since there are different religious traditions, the question of choosing among them becomes important, and here too the criterion of consensus would seem to fail.

I am bringing up these points at the outset because they are very basic, very serious, and all too often pushed into the background or ignored completely when scientists speak of ethics. If you take ethics seriously, then you need to take seriously the origin of ethical conflict in the absence of objective criteria for ethical principles. Later on I will talk about the deep problems these conflicts pose for a democratic society.

With this introduction, let me now speak of some ethical aspects of science. I am going to speak rather abstractly which will make my remarks heavy and boring, especially for an after-dinner speech. Most of you will have in mind some special cases to illustrate these abstract ideas. You can imagine them as I talk, as an exercise for the listener.

INTEGRITY

First, the importance of integrity. Science simply cannot exist without a very high level of confidence within the scientific community that its members represent their actions with complete honesty. I am not aware of any other human activity that is so contrived to preserve such a high standard. What makes this possible is the fact that nature, by all evidence, presents herself uniformly to all observers. That makes it possible for anyone to test the veracity of an observation. In this way nature is ultimately the judge of scientific hypotheses, and not any man or woman. I am aware that some postmodern critics of science suggest that science is a matter of social consensus, not objective appeal to nature, and this view is very misleading, but not entirely wrong.

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It is true that science is a social enterprise in the sense that a statement about nature by any one observer can only be accepted provisionally until others have confirmed it. Statements about phenomena that cannot be reproduced by others cannot contribute to science, and do not survive as science. Failure by others to reproduce data is taken within the science community as evidence of fraud or incompetence, and those who produce such data are effectively ostracized by the community. This does not prevent them from continuing to publicize their work, or to seek funding for it, but it does separate them from the community of scientific enterprise. This is harsh because it may be that those who attempted the reproducing are the ones who were incompetent. Disputes about reproducibility usually occur when the observed effects are weak and have a random component. They are only resolved scientifically when more powerful observational techniques or more data become available. I have always been surprised at how rare such disputes are among scientists. They are more common among people who attempt to use science to support a preconceived position, which is an abuse of science and tends to undermine its integrity. Unfortunately, owing to the very high prestige of science in our society, exploitation of science in this way has become common. Science, of course, is under no constraint to illuminate any particular question, even when society demands an answer. Sometimes the data are just ambiguous, and then the scientist (as a scientist) must withhold judgment.

This is a good place to emphasize that statements scientists make in the course of doing science do not necessarily constitute scientific knowledge. Nor do individual data or observational facts comprise scientific knowledge. In science, facts do not speak for themselves. They have to be integrated into a conceptual framework that gives significance to the facts. Recall the "scientific method" that every school child learns: The implications of a hypothesis are compared with nature and the hypothesis is subsequently altered if there is a mismatch. Science is a process that produces a sequence of hypotheses that are increasingly consistent with what we see in nature. It is instructive to state this in the negative: Science produces a sequence of hypotheses each one of which is hopefully less wrong than the one preceding. This dynamic aspect has to be kept in mind when judging the quality or integrity of science.

Ethical status of science

The necessary internal integrity of science is not relevant to the ancient question of whether the science enterprise itself is ethical. Anyone who studies Western culture knows there is a tradition of deep suspicion toward the mere possession of knowledge, extending back at least to the Old Testament account of Adam and Eve and the Tree of Knowledge. Judaism, Christianity, and Islam all drink from this same biblical source. Asian cultures have their own somewhat different versions of this attitude. In Chinese culture, for example, Confucian scholars disapproved of nature studies as diverting attention from human issues. The Confucians would have agreed with Alexander Pope: "Know then thyself, presume not God to scan; The proper study of Mankind is Man."

Deep suspicion of science persists in modern culture, provoked in the first place by differences between inferences from systematic observations of nature and traditional teaching. The trial of Galileo, and the conflict between geological evidence and some interpretations of sacred scriptures are examples. A second and in my opinion deeper source of anti-science is a widely shared intuition that scientific knowledge inevitably leads to human behavior that has bad consequences. This is the Faustian dilemma. I think it is not necessary to sign away your soul to the devil to gain knowledge, but you may have to sign it over to your thesis advisor. From the discovery of tools for waging war, to the dislocation of older ways of life, and the alteration of the environment, the fruits of knowledge have had side effects that many judge to be bad. Of course they have had good side effects too, such as a dramatic enhancement of the quality and span of human life. Knowledge is the ultimate dual-use human capability.

This mistrust of science is part of a broader anti-intellectual suspicion that it is just not fair for someone to advance their interests by cleverness rather than by hard work. It is mostly balanced by an equally deep-seated respect most people have for someone who dispassionately searches for truth. No law of nature requires intuitions to be compatible. And no amount of analysis will resolve the dissonance between an essentially romantic view of right behavior and one that tries to be consistent with the facts of life. For my own part, as you would expect from a professional scientist, I regard the pursuit of knowledge through the methods of science as ethically neutral, not an activity that in itself can be labeled good or bad. In carrying out this activity, however, one does encounter ethical issues.

Ethics in the conduct of science

The practical ethical issues in science do not lie in the science itself, but in its conduct and in its application. These are no different from other ethical issues: Lying, stealing, and hurting others are bad. Doing unto others as you would have them do unto you, is good. There is not much more to say, except that the terms "lying," "stealing," "hurting," and "others" all need to be defined. Do "others" include animals, for example? All animals, or just some? Is a human embryo ever an "other"? Is a blastocyst an "other"? Is a little hurting justified to gain knowledge? If so, when is it justified? How much hurting? Is making a drug without permission from the owner of its patent in order to save lives stealing? If so, is it nevertheless justified? Under what circumstances? These, fortunately or unfortunately, are not scientific questions.

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They are ethical questions, and their answers are debated by people who are experts in ethics. I am not an expert in ethics, so my answers tend to be simple-minded. When it comes to experiments on humans, our society provides general guidelines. We believe individuals have rights of self-determination. I believe that before you do anything to a person, you have to ask them whether they want it done. If they don't, you don't do it. If for some reason they can't tell you, then you have to go to their immediate families for guidance.

When it comes to doing things to animals, I am not as sure. I want to take advice from people who know more about animals than I do. I prefer that surgeons practice on animals before trying out their techniques on humans. I am certainly more distressed at the loss of a human life than an animal life. I believe medical research using animals is preferable to human suffering.

All these beliefs and statements about right and wrong are arbitrary judgments or prejudices that I have. They do not come from science. Ultimately, we simply have to decide for ourselves where we get our ethical principles from, and what they should be. For many people, religion provides this guidance. Philosophers have attempted to identify principles based on pragmatism, or utilitarianism, or other bases, but in the final analysis, and in contrast with science, the choice is ours to make.

Regarding the conduct of science, is there ever any ethical reason to restrict it? Society routinely restricts the practice of science by requiring that its conduct adhere to society's ethical standards. Vivisection of humans has never been accepted, and of animals, rarely. Hurting people or breaking laws for the convenience of an experiment is forbidden. What if the experiment might lead to a life-saving new therapy? This creates an ethical, not a scientific, dilemma. Is society ready to sanction the destruction of one life to save many? It does so in war under carefully defined circumstances. It condones and even praises voluntary risk-taking in pursuit of pure knowledge without any guarantee of practical return. During the past century Western societies grew steadily less tolerant of experimentation on persons without their knowledge, and today we have elaborate processes to ensure that human subjects are fully informed about the risks and purposes of proposed procedures.

Government and Ethics

While it is true that ethical principles are arbitrary, it is not true that we are completely free to choose whatever ethical principles we like. You can try, but some choices have unpleasant consequences. I am, after all, not the only one who believes that stealing is bad, and so if you decide stealing is good, my friends and I will try to prevent you from doing it. Your choice of principles to govern your behavior is constrained by the society you live in. That is what "law" is all about, and the enforcement of laws, among other things, is a function of government.

Governments enforce a set of laws that the society which supports them has produced, and breaking them entails risk of statutory reprisal, including fines, jail, or execution. Softer social mechanisms come to bear on behavior for which less consensus exists. It seems to me that the big ethical issues in national politics today turn on the question of how much consensus must exist on an ethical principle before its enforcement becomes a responsibility of the state. How large must a minority be before tax funds collected from all ought to be denied to uses that the minority finds reprehensible as a point of ethics? Does it need to be 50 percent? How about 30 percent? How about 10 percent? I do not have any special insight into these questions, and my positions on them are no more valid than yours. But they are very real questions that elected officials must wrestle with, and in my experience most of them do take such questions seriously. These are the questions of ethics and the role of government that lie at the core of the stem-cell controversy, an issue that has very little to do with science, as far as I can tell.

Laws of course can and usually do change in response to changing ideas of right and wrong in society. Whatever we may like to think about the unchanging values of the past, human values have in fact evolved continually throughout the course of history in a direction that we would identify today as liberal. Ideas about human rights, slavery, the role of women, peasants, the disabled, the mentally ill, protection of the innocent, democracy itself, have all changed enormously since the canons of the world's great religions were established. Hegel was so impressed with this trend that he made it a principle of history.

In our country it is difficult to avoid invoking religion in discussions about ethics because so many Americans turn to religion for ethical guidance. America is fortunate in having been conceived, in part, as a haven of religious tolerance. Consequently there is a predisposition in American government to accommodate different religions and therefore different ethical systems (but not too different, as for example in the case of plural marriages.) This is only feasible if government restricts the ethical domain in which it functions to that high level upon which broad consensus can be achieved. Such restraint appears to be contrary to human nature, and national leaders have often found it necessary to remind us how important a spirit of tolerance is to the survival of the American idea. George Washington himself, before there was even a Constitution, declared in a famous letter to the colonies that among the things essential to the very existence of the United States as an independent power is "The prevalence of that pacific and friendly Disposition, among the People of the United States, which will induce them to forget their local prejudices and policies, to make those mutual concessions which are requisite to the general prosperity, and in some instances, to sacrifice their individual advantages to the interest of the Community."

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TOLERANCE

The idea that people should "sacrifice their individual advantages to the interest of the Community" is a very ancient ethical principle that seems rooted in instinctive behavior observed even among animals. Biologists have struggled to understand how such behavior might have evolved, because it seems to require awareness of the implications of individual action that is beyond the conceptual reach of non-human species. It is not so easy even for humans, as Washington's plea suggests.

I will conclude with some personal opinions on this question. All institutions owe it to society to enforce the rules against lying, stealing, and hurting people. And they certainly should provide opportunities for each new generation to learn about the difficulty of applying these rules to what the existentialists called "border situations." If I could focus on one ethical topic deserving of more attention, it would be the concept of tolerance which Washington framed so passionately in his appeal.

Tolerance is a difficult concept. Need for it arises in interactions among people with different standards of behavior, or different social customs. The differences may be inconsequential, as in manner of dress or speech, or they may create real hazards for the parties, as in the differing interests of the American colonies that prevented them from agreeing on the structure of a federal government.

I am more concerned about tolerance at the individual level, where the ethical treatment of others demands that we know something about the meaning of their behavior - whether it be words, or dress, or social customs - within their own culture. In our ignorance we leap to wrong conclusions about what others intend, and defend ourselves from imagined onslaughts.

The ethics of tolerance goes beyond simply understanding other people's customs. Tolerance demands a behavioral response, a modification of our own inclinations in response to an encounter with someone different. Knowing and respecting that difference is not enough. The ethical imperative is for us to do something constructive in a sphere of action that includes both parties. Such actions are necessarily against the grain of our own particular traditions. To our cultural comrades, they look like capitulations, which is what makes them so difficult to carry off. Tolerance, therefore, like many other ethical actions, requires courage.

This is indeed heavy stuff, and now that I am at the end of my talk, I will apologize for it. But ethical issues are deep and need to be taken seriously. I congratulate the organizers of this Sigma Pi Sigma conference for putting ethics on the agenda. We need more forums where ethical issues are raised and discussed and thoughtfully considered. I thank you for giving me an opportunity for contributing to the discourse.

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JOHN H. MARBURGER, III

John Marburger grew up in Maryland near Washington D.C., earned his BA in physics from Princeton University in 1962, and the PhD in applied physics from Stanford University in 1967. Before his appointment in the Executive Office of the President, he served as Director of Brookhaven National Laboratory from 1998, and as the third President of the State University of New York at Stony Brook (1980-1994). He came to Long Island in 1980 from the University of Southern California where he had been a Professor of Physics and Electrical Engineering, serving as Physics Department Chairman and Dean of the College of Letters, Arts and Sciences in the 1970s. In the fall of 1994 he returned to the faculty at Stony Brook, teaching and doing research in optical science as a University Professor. Three years later he became President of Brookhaven Science Associates, a partnership between the university and Battelle Memorial Institute that competed for and won the contract to operate Brookhaven National Laboratory.

While at the University of Southern California, Marburger contributed to the rapidly growing field of nonlinear optics, a subject created by the invention of the laser in 1960. He developed theory for various laser phenomena and was a co-founder of the University of Southern California's Center for Laser Studies. His teaching activities included "Frontiers of Electronics," a series of educational programs on CBS television.

Marburger's presidency at Stony Brook coincided with the opening and growth of University Hospital and the development of the biological sciences as a major strength of the university. During the 1980s, federally sponsored scientific research at Stony Brook grew to exceed that of any other public university in the northeastern United States. During his presidency, Marburger served on numerous boards and committees, including chairmanship of the governor's commission on the Shoreham Nuclear Power facility, and chairmanship of the 80 campus "Universities Research Association," which operates Fermi National Accelerator Laboratory near Chicago. He served as a trustee of Princeton University and many other organizations. He also chaired the highly successful 1991-1992 Long Island United Way campaign. As a public-spirited scientist-administrator, he is credited with bringing an open, reasoned approach to contentious issues where science intersects with the needs and concerns of society. His strong leadership of Brookhaven National Laboratory following a series of environmental and management crises is widely acknowledged