The Ethical Responsibilities of Scientists

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In the middle of the nineteenth century, a serious proposal was made to close the U.S. Patent office because all inventions of significance had been made. In light of the subsequent appearance of the telegraph, telephone, radio, television, airplanes, and computers, we now laugh at the naiveté of this proposal. A few years ago, an American journalist named John Horgan wrote a book entitled *The End of Science* (Horgan 1996). In this book, he speculated that the important questions about the nature of matter and life had been answered, and that most remaining questions about nature and mind were not susceptible to scientific answer. A century from now, the suggestion that science was at an end in the 1990s will seem equally ill informed.

To be sure, we cannot predict particular advances in science and technology. At the end of the nineteenth century, who could have anticipated such discoveries as the theory of relativity or plate tectonics; who could have anticipated quantum mechanics, the implications of Heisenberg's indeterminacy principle, and the work in particle physics carried out by Leon Lederman and others at CERN, Nevis Laboratories, Brookhaven National Laboratory, and Fermi National Accelerator Laboratory (Fermilab)? Turning from the physical to the biological world, who could have foreseen the revolution in molecular biology: the nature of genes and chromosomes and the structure of DNA, let alone the fact that we can now clone entire organisms, transform the human genetic sequence, and, if we wish, control our heredity? And now that significant progress is being made in the neural and cognitive sciences, it seems highly likely that we will continue to unravel the mysteries of thinking, problem-solving, attention, memory, and--the most elusive prize of all--the nature of consciousness.

For those who are close to science, it is hard to deny the excitement of the enterprise. So many issues and questions that were once the lot of poets and armchair philosophers, have already been answered by scientists or are at least within their grasp. As it has sometimes been put, mysteries have now become problems, and problems are susceptible to solution. And yet, it is dangerous to adopt a pollyanish view of science. Science marches on. There is no guarantee that science will naturally contribute to the good of the public or that it will be a benevolent force in the future. As Leon Lederman (1992) once commented, "In the early days of science, as we look back on it, science had devastating effects on how people lived. By devastating I don't mean negative. I mean just dramatic changes in how people lived, but it wasn't known at the time that that would happen."[2]

Science is morally neutral. It represents the best efforts of human beings to provide reliable answers to questions about which we care: Who are we? How did we come to be? What is the world made out of? Where did it come from? What will happen to it? When? (Should I scribble the date on my calendar?) What determines the regularities and the irregularities in the world? What kind of creature would ask such questions? Is that creature moral, immoral, or amoral?

But what happens as these questions are answered? Sometimes, the answers simply satisfy human curiosity--a very important goal. But at other times they lead to concrete actions--some inspiring, some dreadful. Einstein's $E=mc^2$ (admittedly by a circuitous route) stimulated many outcomes. These ranged from the use of nuclear energy to power cities…to the detonation of nuclear devices at the cost of thousands of lives in Hiroshima and Nagasaki…to the spreading of fallout following the Chernobyl disasters.

Following the discoveries of antibiotic agents, we behold the emergence of wonderful drugs that can combat dread diseases as well as the emergence of new toxic entities that prove immune to the effects of antibiotic medication.

Again, science itself cannot decide which uses to pursue, which not. These decisions are made by human beings, acting in whichever formal and informal capacities are available to them. Einstein is a good case in point. It is doubtful that he thought about applications of atomic theory when he was developing his ideas about the fundamental properties of matter and energy. When the politically attuned physicist Leo Szilard approached him in the late 1930s, it had already become apparent that nuclear energy could be harnessed to produce very powerful weapons. Einstein agreed to sign a letter to President Franklin Roosevelt and that action, in turn, led to the launching of the Manhattan Project and the building of the first atomic weapons. After the end of the Second World War, and following the detonation of nuclear devices over Japan, Einstein became a leader in the movement toward peace and eventual disarmament.

In the past scientists argued that their job is to add to permanent human knowledge and understanding, and not to make decisions about policy and action. But what forces, then, have prevented the random use, misuse, or frank abuse of technology—-the fruits of scientific progress? What has been the role of scientific leaders-- individuals like Leon Lederman, whose scientific achievements are a matter of history, but who have elected to address broader social issues?

We can identify three factors that have traditionally served as a restraint on the misapplications of science. First of all, there have been the values of the community, in particular religious values. One could in principle conduct experiments in which

prisoners are exposed to certain toxic agents. But religion counsels the sanctity of all human life. A second balancing force has been the law. In many nations, for example, prisoners are protected against unusual forms of treatment or punishment. Third, there is the sense of calling, or ethical standards, of professionals. A scientist can take the position that a contribution to knowledge should not be secured at the expense of human or animal welfare; indeed, some scientists have refused to make use of findings obtained by the Nazis as a result of immoral experiments. Or the warden of the prison may also refuse to allow his prisoners to participate in such studies, even if there are pressures to do so.

Each of these factors remains operative but, alas, each seems reduced in force nowadays. At a time of rapid change, values are fragile and religious values may seem anachronistic. Laws remain, unless they are overturned, but often events change so quickly that the law cannot keep up--witness the confusion of the United States Congress as it attempts to deal with issues like cloning and stem cell research. And during an era when the market model has triumphed in nearly every corner of society, it is often quite difficult for individual professionals to uphold the standards of their calling. A decade and a half ago physicians in France colluded in the sale of blood that they knew to be tainted by HIV virus; it is probable that their sense of calling was not potent enough to combat financial and societal demands for the blood.

We encounter an impasse. On the one hand, science and innovation proceed apace, ever conquering new frontiers. On the other hand, the traditional restraints against wanton experimentation or abuse appear to be tenuous. Must we leave events to chance, or is there a way to pursue science in a responsible way?

Enter the ethical responsibilities of the scientist. I contend that a new covenant must be formed between the scientist and the society. Society makes it possible for scientists to proceed with their work—by the funding of science and also by cooperation in its execution. In return, I submit, scientists must take on an additional task: they must relinquish the once-justifiable claim that they have no responsibility for applications and undertake a good faith effort to make sure that the fruits of science are applied wisely, and not foolishly. They may do so principally in two ways: l) by focusing on the possible applications or misapplications of their specific research, and 2) by focusing on the relationship between the practice of science and the larger society in which it is situated.

Let me introduce an example from my own work as a cognitive psychologist. Nearly twenty years ago, I developed a new theory of intelligence, called the theory of multiple intelligences (Gardner 1983). While I thought that this theory would be of interest primarily to other psychologists, I soon discovered that it was of considerable interest to educators all over the world. Educators began to make all kinds of applications of the theory. I was intrigued and flattered by this interest. Yet, like most scientists, I felt little personal involvement in these applications. Indeed, if asked, I would have responded, "I developed the ideas and I hope that they are correct. But I have no responsibility for how they are applied—these are 'memes' that have been released into the world and they must follow their own fate."

About ten years later, I received a message from a colleague in Australia. He said, "Your multiple intelligence ideas are being used in Australia and you won't like the way that they are being used." I asked him to send me the materials and he did so. My colleague was absolutely correct. The more that I read these materials, the less I liked them. The "smoking gun" was a sheet of paper on which each of the ethnic and racial

groups in Australia was listed, together with an explicit list of the intelligences in which a particular group was putatively strong and an accompanying list of intelligences in which they were putatively weak.

This stereotyping represented a complete perversion of what I personally believed in. If I did not speak up, who would? Who should? And so, I went on television in Australia and criticized the program as *pseudo-science*. That critique, along with others, sufficed to result in the cancellation of the project.

I do not hold myself up as a moral exemplar. It was not difficult to appear on a television show in a far away country, and I was not doing work in biotechnology or rocket science. Yet, the "move" that I made in my own thinking was crucial. Rather than seeing "applications" as the business of someone else, I had come to realize that I had a responsibility to make sure that my ideas were used as constructively as possible. And indeed, ever since that time, I have devoted some of my energies to supporting educational work on multiple intelligences of which I approve, and critiquing or distancing myself from work whose uses are illegitimate or difficult to justify. And to the extent that I am able, I have also begun to work on educational reform more broadly--indeed, it is in that context that I, a social scientist, first had the privilege of meeting Leon Lederman, a Nobel Prize-winning physicist.

How can one begin to forge a new covenant between the scientist and the larger society? To my mind, the current impasse calls for greater efforts by each party to make clear its needs and its expectations. Scientists must continually be willing to educate the public about the nature of science, and what is needed for good scientific work to be done. Scientists have a right to resist foolish misunderstandings of their own enterprise

and to fight for the uncensored pursuit of knowledge. At the same time, scientists must be willing to listen carefully to the reservations of non-scientists to their work, to anticipate possible misapplications of the work, and to speak out forcefully about where they stand with respect to such reservations, uses, and misapplications.

Ordinarily, neither scientists nor the general public should block the road of inquiry. Assuming that they do not harm others, scientists must have the right to follow questions and curiosity where they lead. Occasionally, however, scientists may want to consider not doing certain studies, even though they may be personally curious about the outcomes. In the case of my own field, I myself do not condone studies about racial differences in intelligence because I think that the results of these studies are likely to be incendiary. Some biological scientists are extremely reluctant to engage in experiments of genetic engineering or cloning of human beings, not because of lack of curiosity about the results, but rather because some of the implications of this work could be very troubling—leading, for example, to serious psychological or medical problems in the subjects of these experiments.

If one believes that my claim has merit—-if one believes that scientists should become more deeply involved in ethical considerations—-how might scientists act upon that belief? This is the question I have been pondering with my close colleagues Mihaly Csikszentmihalyi of the University of Chicago and William Damon of Stanford University. We are trying to understand how leading practitioners--individuals doing "cutting edge work"--deal with the various invitations and pressures in their domain. We have been observing and interviewing scientists and professionals in other domains, such as journalism, theater, and philanthropy. We want to know how their present work situation appears to such individuals *in the trenches*; and we want to identify individuals

and institutions that have succeeded in melding innovative work with a sense of responsibility for the implications and applications of that work. (Gardner, Csikszentmihaly, and Damon 2001)

While it is too early to report the results of this work in any detail, I can mention a few tentative findings and the way in which we are currently conceptualizing the issue. To begin with, professionals are not naïve about their situation. They are aware of the great pressures on them and the hegemony of the market model at the turn of the millennium. They want to be ethical persons in their professional and private lives and they recognize that there are pressures that make it difficult for them always to do *the right thing* and to avoid crossing dangerous lines.

Yet clear differences can be observed in how successful these innovative individuals are in maintaining an ethical sense. Not surprisingly, early training and values are important, and that includes a religious affiliation in many senses. The opportunity to work in the laboratory of an ethical scientist, or to have other close colleagues with impressive values, is an equally important formative factor. We speak about vertical support--the opportunity to work with a senior *good worker*--and horizontal support--the opportunity to be surrounded by peers who also strive to carry out good work.

Once one has begun one's career in earnest, a creative individual is aided by two factors. The first one is a strong sense of internal principles—lines that one will not cross, no matter what. If a scientist says—and believes—that he will never put his name on a paper unless he has reviewed all of the data himself, that virtually eliminates the likelihood that he will be an accessory to the reporting of fraudulent data. The second factor is a realization that the profession does not have to be accepted the way that it is

today; as a human agent, one can work toward changing that domain. Suppose, for example, that it has become routine practice, in the writing of grants, for the head of a laboratory to propose work that has in fact already been carried out. A scientist can decide henceforth not to do so and work with colleagues to change the procedures in the domain. And indeed, the installation of a process where senior scholars apply for support by describing work that has been completed, rather than work that might be done in the future, would represent a significant alteration in the customary practices of a domain.

Similar examples can be gleaned with reference to the applications of one's work. One can decide, for example, that all of one's work is in the public domain and thus refuse to patent any findings. Here an internal principle gains out over the desire for personal profit. Or one can move toward the expansion of science so that it takes into account the public interest. One way to do it would be for every laboratory voluntarily to set up an advisory committee, consisting of knowledgeable individuals from other domains and laboratories. This advisory group would inform itself about the work of the lab, critique it when appropriate, and make suggestions about benevolent and possibly malevolent uses of findings.

Crucial in the pursuit of good work is the presence of individuals who embody good work in a given domain. We call such individuals *trustees* because they devote significant efforts to the preservation of the domain, not for personal gain, but rather in the best, most disinterested sense of that term. I cannot speak knowledgeably about Leon Lederman's contributions to particle physics but I can vouch for his generous gifts to the education of young Americans in the areas of science. During recent years, few if any top flight scientists have devoted as much attention to the ways in which Americans learn about science. Leon Lederman has done this in an institutional way-- by

reconceptualizing the science curriculum in secondary school and by playing an instrumental role in the founding of bellwether institutions, like the Illinois Mathematics and Science Academy (IMSA) in Aurora and the Teachers Academy for Mathematics and Sciences (TAMS) in Chicago. And he has done it as well in a personal way, spending countless hours working directly with young people--those who are disadvantaged as well as those who are privileged-- and introducing them firsthand to the excitement and the joys of active participation in the scientific enterprise. In these and other ways, Leon Lederman is a prototypical *trustee*, an exemplary *good worker*, who contributes directly to individuals and institutions and who inspires others to do so as well.

In the end, in my view, every individual has a set of four responsibilities. The first responsibility is to one's self—one's own goals, values, and needs—both selfish and selfless. The second responsibility is to those about one—one's family, friends, and daily colleagues. The third responsibility is to one's calling—the principles that regulate one's profession—in this case, what it means to be a research scientist. The fourth responsibility is to the wider world—to individuals one does not know, to the safety and sanctity of the planet, and to those who will inherit the world in the future. By dedicating himself to the education of young individuals, Leon Lederman embodies the famous sentence of Henry Adams: "A teacher affects eternity; he can never tell where his influence stops."

Whether sage or scientist, lawyer or layperson, all of us must negotiate our way amongst these strong and sometimes competing responsibilities; we are helped by religion, ethics, friends, and colleagues, but in the end we must do the balancing ourselves. Personal responsibility cannot be delegated to someone else. Those who have the special privilege of conducting science have a special obligation to be reflective about

these competing responsibilities. And in a day when scientists have a strong handle on the nature of matter, sources of energy, the structure of life, and the means for creating and changing life, these responsibilities are awesome. Much greater mindfulness about this situation has become a necessity if we are to pass on to our progeny a world that is worth inhabiting.[2]

ENDNOTES

1.The quotation is from an interview that Leon Lederman gave at the "Winding your Way through DNA" symposium, University of California at San Francisco 1992. A partial transcript is available at http://www.accessexcellence.com/AB/CC/lederman.html.

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BIOSKETCH

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