

From Prometheus to Frankenstein -- the humanity of science

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My talk today responds to a pervasive attack on science, sometimes based on misunderstanding, sometimes not. The behavioral sciences, and with them the mental health professions, are special targets of these attacks. But even if you had no vested interest to share my concerns, you could not ignore it as part of the cultural milieu that shapes the psychic reactions of your patients, and of you and me too.

Speaking to an assembly of psychiatrists is an unaccustomed pleasure for me, even if not of the magnitude of a simple multiple of what I could reap in one-to-one relationships. Some of my best friends are psychiatrists, and I am quite willing to believe that what you have learned from your patients may have conferred a special share of the wisdom that we so badly need these days, to learn how scientific knowledge may have both merit and viability. Which is precisely the theme of my talk this afternoon, wherein I expect to raise questions that I hope you may be able to help answer better than I.

As this is also a memorial to Adolph Meyer, I may also have a particular privilege and responsibility to start in a more biographical vein than I might if I were dealing with my molecular-biological colleagues.

To start with, I must express what you all know, and surely share -- the events of the last week (though I had experienced them from Israel, which has its own preoccupations) are so stressful that they can, as well as should, pound at the style and content of my effort at an academic analysis. I have been short of time and composure to rearrange my thoughts in an orderly way, nor

indeed to pursue as far as I would have liked the vast literature that bears on my theme.

The humanity of science may seem a far cry from Cambodia and the breakdown of democratic decision-making in this country. The nexus is the social revolution of the current century, the style in which the final dissolution of the feudal order is to be directed. As the residual grit of hereditary privilege in our society is pulverised, will it be replaced by a new feudalism masquerading under a progressive label, as happened in every revolution in Europe? Or will we adopt an ever-more inhumane meritocracy efficiently chasing ultimate disillusionment, as seems to have been happening here? Or will all other values be erased in favor of an uncompromising egalitarianism, with noble ends, but lacking the means to sustain itself against the realities of harsh Nature or brutal men? Or can we find a pragmatic compromise of these extreme ideologies?

The human meaning of science is at the center of the conflict. Can we pursue knowledge in such a milieu? Dispassionate search for facts is coming under attack in principle, allegedly for being a denial of human nature, by the egalitarian faction. It is also under severe pressure from the establishment for being "impractical"; the corporate-military sector will happily support the search for facts, but only if its particular goals are served. Scientists need great ingenuity to thread their way through the current system, finding the means to pursue dispassionate research with the cooperation of a bureaucracy that wisely defocusses the Congress' attention from specific projects on behalf of the whole system. The more talented of us may survive the current system with only a little prostitution. A radical alternative is mass rape in the name of social ends even more narrowly prescribed, directing the scientist what to think about. Chastity is not one of today's virtues.

That science today is not quite free is beyond argument. The attack against it has exactly the same complexion as the attack against liberal democracy, for similar faults, and from similar sources.

The university is a focal point of the conflict; this is where creative science comes from. Part of the attack on science is merely incidental to the frontline confrontations on the campus. The radicals point to the university as a central resource of the power of the establishment. Professors know how powerless we are, and suggest other reasons for the targeting on academia -- this audience needs no education on the subject, and I will summarize very briefly. We are vulnerable because we stand for careful consideration of opposing, even offensive views, and therefore foster a level of dissent that every other institution would find intolerable. We have a paternal, sometimes even patronizing, relationship to our students that stands in the way of credible discipline (the "silent majority" is, nevertheless, for the time being less shrill about "getting tough" with student activism, this having been translated into military homicide). Above all, however, the campus is the recruiting ground for enlisting idealistic students -- it is where the young are, and any issue will do if it can elicit a sharp confrontation with authority, and the police brutality that is the radicals' ideological secret weapon.

The mass reaction that is now in motion may be a turning point in the protest, if it is channeled into politically effective ways of reversing the President's imperious imperialism. Already, the radicals are reacting in dismay, throwing up a hundred other issues to fractionate that effort, but their work may be being done for them. If the President does not respond, nothing less than democratic culture is at stake.

So, Rome is burning. But fiddling is the only vocation I know.

If I had yours, I might speak more profoundly about the irrational roots

of the attack on Science. For most of my life and career, I have offered an irrational defense of science, that is, of rational inquiry, on the grounds that man is the rational animal; hence the pursuit of knowledge is an absolute good that may not be tampered with on any account. Man is also many other things besides rational, and other values may have an equal claim to the absolutely good. For example, a human life may be accounted as infinitely valuable for its own sake, or the welfare of the species may be assigned this role. These axioms correspond roughly, not necessarily logically, to the three main categories of social organization (merit, equality, caste) alluded to earlier. Merit might also encompass functions other than rational. They are usually in competition; when they clash head-on we have trouble.

Many found their consciences seared by Hiroshima. Being just 20, and more importantly, finding the atomic bomb rather remote from my own field of science, I could eventually take a more detached view than is currently popular -- that we hardly know how to assess the full impact of the bomb on human values. The world with it seems frightful -- would it have turned out any better without, or rather with the latent if unrealized possibility of its development? Having seen Hiroshima, and with the bomb over our heads, we may forget that nuclear weapons have been the instrument of a trivial fraction of the killing of the century -- so far, Scientists have insisted that the Bomb has made war obsolete, but this is a metaphor for the total mobilization of a nation's resources in military conflict, by whatever instrument. Scientists can well say, "if the social system just knew how to manage it, atomic energy would be an unmitigated blessing. What a pity our moral skills have not caught up with our scientific ones!"

On this view, science is often a scapegoat for other wrongs of the social order. The advocate would say that we must condemn the man who pulls the trigger,

rather than the inventor of gunpowder. Yet ... if there were no guns, life might be better. The contrafactual universe may be a tolerable escapism, a utopia where military threats are gone together with war and poverty in the untrammelled exuberance of human joy and love. The factual one is for most of us quite intolerable.

There are, however, limits that anyone would have to concede to this doctrine, of the moral neutrality of the instrument. Our existing milieu may be faulted, but there are forces that might be introduced by science that would strain the best ordered society that we could imagine. Thus, I refer in my abstract to the public hydrogen bomb -- mainly as a metaphor, though one whose physical realizability by the next century is not excludable, regardless of any policy that a single nation might enforce. (Nor do I intend to advertise any of my own speculations about how to build one.)

This metaphor opens the door to an examination of the possible rational complaints about the shadow side of human knowledge, its potential for grave harm to other values even in an ideal social milieu. From this, it is a short step to the actual program of this discourse. Abandoning defensive polemics, let us look at the world as it is rather than as it ought to be. Let us then seek a rational evaluation and classification of the kinds of human injury that might follow from the further introduction of scientific knowledge into the existential (rather than an ideal) framework. Our conclusions must not be held as accusatory, for in every case it will be the combination of human frailty with human knowledge that must be faulted. This approach is an effort at defining and solving problems, which I therefore label liberal, in distinction to reactionary defensiveness, on the one side, or radical polarization of ideologies, on the other.

Biographically, I was led to this by a consideration of the potential impact of new findings in molecular biology -- the enzymatic synthesis of DNA, the transfer of genetic information from cell to cell, and so on -- were they to be applied to human affairs. My overall conclusions have been that the potential stresses were manageable, or at least reducible to the kinds of problems we already have from other sources. On optimistic assumptions about a free society, I could even see important benefits from what has journalistically been described as "genetic engineering".

However, one eventuality filled me with despair, namely the exploitation of molecular biology for military purposes, in biological weaponry.

My concern about BW of course included the revulsion shared by most life scientists about the homicidal use of science, especially their own science. This has been escalated beyond rational discussion by the moral faults of the particular war in which U.S. military power is now deployed. But I had, if that is possible, an even deeper anxiety -- that BW, though developed by military research as if it were merely another weapon, is in fact a unique one -- potentially the functional equivalent of the public hydrogen bomb.

With a wisdom that I wish could again be tapped, President Nixon assimilated these and related arguments into his policy decision last November to renounce biological warfare research and to seek international agreements to control it everywhere. The Russians may eventually respond in kind -- they have not so far -- and if so may set in motion a vital social defense in time to fend the universal germ bomb. This probably would not have been feasible but for the overriding balance of nuclear terror that regulates the geopolitical system.

Having assimilated this example, and after some general remarks, I will attempt a provisional taxonomy of the ways in which scientific advance might be

dangerous; then I will briefly review some selected examples to see how they fit into the classification.

I will not pursue the important distinction between science and technology, between abstract knowledge and its practical application, except to stress the obvious, that between the two is almost invariably the most practical target for whatever social control we should exact. It is obviously very difficult, and the more in a free society, to prevent the discovery of and access to knowledge. Knowing what "not to know" would be the most difficult and self-defeating task of all. Furthermore, our most grievous problems come from incomplete, hence unbalanced knowledge. Science is an essential precondition of modern technology, and both partake of the analytical pursuit of solutions to well-defined, albeit different classes of problems, by generally similar techniques.

Before discussing the fruits of science, bitter and sweet, I should also point out that the institution of science, i.e., the process of research, is also under attack. Some think it a wasteful diversion of material resources better spent on more urgent challenges -- but basic science takes less than .2% of the GNP; or about two weeks worth of its average incremental growth, disregarding the net return of science to that growth. To put it differently, the whole scientific enterprise, past, present and future, will have cost no more than the present month's worth of economic recession.

Less ethereal is that doctrinal complaint that science is necessarily coupled to expertise. It generates experts, regarded as a plague in their own right, and thus establishes an inegalitarian stratification on the basis of competence: undeniably some people will "know" more than others, and this may be in conflict with the egalitarian dogma. (Some also entertain a fear I do not share, that scientific investigation may justify a caste system by demonstrating

unalterable biological differences among racial groups in their very capacity to participate in scientific work. This is a different issue, to which I will return later as an example of stress on vital myths.)

The argument is self-defeating. If each soul is infinitely valuable, so be it. When the time comes that we have established a reasonable floor of guaranteed income, I would welcome a return to the labor market that penalized the scientist relative to other professionals, even more than it does today, just because he enjoyed his work so much for its own sake. (I realize this is a dangerous subject, for its potential analogies with the economics of your own profession.) Academic science has^a vested interest in inequality of income, but only a minor one, that any good scientist would readily exchange for the success of his theories and the efficacy of his advice.

None of the schemes for the classification of "technopathy", the diseases of knowledge, that I have been able to devise so far is particularly satisfactory. Most of the existing literature is too polemical for analytical utility; I may have overlooked some crucial contributions, and would welcome instruction. For a start, we postpone fascinating futurisms and ask, who has now been hurt by science, and in what way.

Man's greatest problems complexly interwoven, are war, poverty, disease, environmental pollution, overpopulation, and cultural frustration -- the dwarfing of his soul. Science has made magnificent contributions against disease, and of course aggravated over-population at least for an interval. It has been applied to wipe out poverty (through technical-industrial development) but so unevenly as to aggravate class and national differences. Mass communication in the form of commercial television is indicted by some of your colleagues as our worst social evil, spawning all others; it competes with the telephone and the printed page as paradoxes of enlightenment and frustration. I believe that science has

had an insignificant bearing on the net suffering of war; which is to say that no benefit has come from its potential promise for mitigating the apical problem of human survival, nor its psychic and cultural roots. Perhaps war is worse today than ever, but less on account of the atomic bomb than of the mass media that entrain a whole population for docile acquiescence in total conflict. (on the other hand, free communications have displayed the evils of wars so far away we would otherwise ignore them.) Environmental pollution is not unique to technological societies -- witness the bacteriology of the Ganges and the dung-burning fumes of any Casbah; but here it is surely witness to a disharmony of knowledge and an irrational allocation of resources.

These examples suggest one framework of technopathy, according to the group whose welfare motivates a particular technological development.

- 1) This may be entirely neutral in motive (pure science), and its effects are then diffused and emerge throughout the whole structure, or may have important ideological impacts, as in the classical confrontations of science and religion.
- 2) It is often at the service of special class interests, and then may enhance the power of corporate industry, or of a government or government in general vis-a-vis the individual through economic controls or police surveillance, or generally of the already rich over the poor. Or a local technological fluctuation might upset an established balance of power. I struggle for any recent example -- Nazi Germany came close, and would have been on the mark had it made a serious effort at nuclear weaponry, or been a year ahead with its own "secret weapons". American power partakes of this, but with many other inputs that make our technological development more predictable.

The scientific input is an example of the corruption of power. When a society is sufficiently corrupt, its establishment (if it rationally pursues

its own interests) will promote special branches of applied technology. It may even be wise enough to promote basic research as well, both for the general upgrading of basic knowledge, and even more importantly as a training ground for its technical specialists. Then, all scientific work makes some contribution to the established order -- except for the organized skepticism that accompanies dispassionate research.

Indeed, this is the characterization of contemporary America, by the doctrinaire Left, which has generated so much tension among the intelligentsia. The preeminent class interest is the military-industrial complex.

Can this be brought under effective political control so that we pursue not absolute but realistic military security, without destroying the cultural integrity that underlies any real security? I still believe it can, and at least would rather try than resort to a radical cure whose cost in blood might outweigh even that of the disease, and whose eventual outcome is likely to be as paradoxical as the principal revolutions of Europe. Some liberal scientists have already given up, and argue for the abandonment of science. But there is just a short gap between that and the full abrogation of the social contract, the most effective form of which, I say in all sincerity, may be emigration, to any land whose culture gives better latitude for creative effort.

3) A great deal of technology is intended for widespread welfare, whether directly through basic health research, or indirectly through industrial or agricultural efficiency. Most of our environmental degradation has come from a mixture of exploitation and ignorance, both of which are countered by further scientific study as well as organized political reaction.

The preponderance of technopathic effects arises from the sub-optimization, the solution of the wrong problem, so that ignored side effects outweigh the benefits. The basic principles of environmental rights have become well established in this country, only recently. Much degradation is simple theivery, stealing a common good for private benefit, and "there ought to be a law." With the established momentum of political action, I believe there will be many laws, and I do not see environmental problems as a major, long range impediment to the general welfare. However, a significant fraction - - perhaps 10 or 20% of the national product may have to be converted, or the bookkeeping properly rearranged to account for natural resources as capital assets, to reshape an industrial society. As the real cost of this emerges, we can foresee conflicts of priorities -- whether every item of environmental conservation takes higher priority than schools, urban redevelopment, and so on. The best answer, in my view, is sustained economic growth of a new kind, namely a high technology, low-polluting category whose gains can then be reinvested in social welfare. This in turn requires a heavy investment in academic

research, ideally funded by a reconversion of military expenditures.

The assessment of technological benefits is itself a new art, being actively pushed through the efforts of men like Congressman Daddario.

Some of us are still battling the abuses of the industrial revolution, when modernization eroded human values through wage slavery and the assembly line. Today, personal services are the major (and ever-increasing) fraction of the national product; still the difficult problem of the post-industrial society are the disposition of leisure, and the establishment of satisfying roles for talents outside the confines of high-technological efficiency. We do not know whether a culture can survive such affluence -- the underlying anxiety of the opponents of work-relieving welfare schemes. The combination of obtuse government and idle hands is unbearable. The trashed windows on the campuses are a consequence of the mismanagement of science, and scientists may be faulted for their impotence more than their malevolence.

Another radical view is offered by the counter-cultural anti-technologists, like Ellul and Roszack. They invert the argument, and regard capitalism as a derivative evil of scientific technocracy, the preeminence of an objective world view. Their suggestion that rational decision dominates government is ludicrous to anyone who has ever tried to get any policy through the bureaucracy. Roszack's semantics are to label as technocratic every evil of the social order -- including, for example, the substitution of Playboy for affection. If we could find a common language, we might find

quite a core of agreement, but his remarks have almost nothing to do with the realities of science.

4) For logical completeness, a fourth category of abuse should be mentioned-- the wilful development of techniques having no positive benefit to the sponsor, but destructive of others. This is psychopathology in the tradition of the mad scientist -- and you are better equipped than I am to recite examples, if there are any, or to dissect this component from more complex behavior. In my experience, science has some workers who correspond in part to the public image of aloof disinterest, but many more who are quite decent human beings. If there is anything odd about the scientific community I know (the natural scientists) it may be its relative poverty of really evil men. It is, I think, difficult to work within the rigors of the scientific method, and still manipulate people (or serve them) to an excess of evil or good.

This classification, based on welfare, implies some linear scale of value and therefore leaves out some of the most perplexing side-effects of scientific knowledge: the confrontation of orthogonal values. Ignorance and powerlessness are often the insulators that allow mutually incompatible myths to be sustained. The lifeboat problem is one of the typical dilemmas: if the many can be saved by the sacrifice of the one, "WHO SHALL DECIDE". Our social system is ill-equipped to make such decisions and many of us resent the necessity of sharpening our moral faculties in areas that had been left to God. In the conduct of war, the nation-state has overridden every

other institution, and our statesmen do indeed play God, and must every day. However, the same Church that has dug in hard, and demanded many personal sacrifices in the name of the inviolability of the fetus, offers no resistance whatever to selective service that obliges a man to kill and risk being killed for a community value that he and many others may profoundly question.

My ostensible purpose in this remark is to wipe away the illusion that man can escape playing God. But science may be faulted for creating or exposing direct responsibilities for the management of life. The social order must set humane bounds to "lifeboat" decisions, to protect both the agent and the acted upon.

The most urgent stress is in the style of dying, which is increasingly a matter of active decision -- "when to pull the plug" as you well know. Further advances in biomedical engineering will broaden the scope of that capability -- we may soon be at the point where ~~no~~one may die without an explicit decision that the value of prolonging life is outweighed by its costs -- and these costs will also burgeon for that same technology. If, then we are to have the benefits of life-saving, we must also develop the social framework -- part of the new social contract -- in which such decisions are made with general public acceptance and understanding.

Conceptually similar issues will arise with such technologies as weather modification, hurrican deflection and earthquake-prevention (by preemptive shocks!), and already in compulsory vaccination programs.

The general area of genetic engineering is bedevilled by another problem -- the newborn cannot be consulted about his own quality, But then the style of infant nutrition and the education of the young is also left to a tentative combination of parental freedom and community bounds. I suggest that the same approach be adopted for choices about the quality of offspring. The technology for this is gradually emerging (for example through the prenatal diagnosis and rejection of severely defective fetuses) and it is unlikely that any evils will get out of social control before they can be managed in a free society. A totalitarian one will, of course, sink into even deeper trouble with such technologies.

I also suggest that knowledgeable scientists act more responsibly about announcing the imminence of such advances. The public, unless correctly informed, may well mistake some advance in principle with its technological fulfillment, although 30 years may be necessary to fill the gap. So I do think it is time to think, not panic, about such problems.

Some technologies are potential instruments for frightful moral abuses. I could start with Promethean fire, and conclude with a Frankensteinian monster, Boris Karloff version, with brain-lodged electrodes. But in all seriousness I would point to the handgun as the biomedical instrument that most urgently needs social control in contemporary society.

We have not learned how to manage that, and until we can the outlook for the continued abuse of science in an imperfect society is indeed gloomy.