

“Humanizing the Technological Vision:
Core Learning and the Relation of the Sciences and Humanities.”

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1. INTRODUCTION:

It is an honor to address the tenth anniversary meeting of ACTC and to address the group in a conference devoted to the theme of the interface between core text education, culture and community.

In entitling my talk “Humanizing the Technological Vision: Core Learning and the Relation of the Sciences and Humanities,” my purpose is to address in a limited way one of the fragmenting forces that has resulted in a fracturing of intellectual culture in our universities and colleges, the so-called “two cultures” problem, and in a more fundamental way presents us with a culturally fragmenting force of enormous power in which the humanistic disciplines and the general humanistic concerns of people seem to be challenged and even simply trampled under by the authority of the sciences. I was struck a few years ago in engaging in discussions on the interface between science and religion in India that almost the same exact controversies that we know familiarly in the United States as a conflict of evolutionary theory and creation, were being debated in India, but in this case not between evolution and creation, but between astronomy and astrology. This impressed upon me the need to understand these issues in some broader cultural terms in which specific sciences just play the role of stand-ins for the larger issue of the clash of traditionalism and modernity.

In my talk last year I made several references to the Ernest L. Boyer report on Undergraduate education. That report, written under the sponsorship of the Carnegie foundation, proposed a reform of undergraduate education that I would characterize as primarily formed on the model of the education in the sciences. This was to emphasize research, the preparation for graduate specialization, and the encouragement of a dynamic open endedness in education. My comments on this were critical, not because I am opposed to the ideals of research or to specialized learning, or even to the forms of education that work effectively in the natural sciences. But when transported to the education in the liberal arts, I see them as corrosive, and eventually destructive.

In my talk this morning, I am concerned to continue an exploration of the relationship between the sciences and core liberal education from a different standpoint, and develop a more historical and theoretical approach to the values of core learning and the challenges of modern science and technology. The aim of my discussion is not to discuss science as a liberal art, very adequately developed in Jim Beall’s talk yesterday morning. My concern is to reflect upon the interface between general liberal education and the sciences as we typically confront them today—big science, grants-funded science, science that seeks

domination over nature and even over man. The model of science I am thinking of is not that of theoretical astronomy or mathematics, but a collection of sciences such as those we lump under the designation of “molecular biology,” sciences that may be very difficult to characterize by some unitary theoretical principles or derive from a limited set of core texts, but that have become powerful forces in contemporary science, and that when they do find expressions in print, often explicate their aims in terms of a Baconian ideal of the application of knowledge for useful ends, rather than the acquisition of contemplative wisdom. Here, the title adopted by some scholars in the area of science and technology studies, “technoscience,” seems a better designation, denoting an intimate blend of science, applied technology, and economic application that seem entangled in a system of relationships. What can core text education have to do with this kind of science?

My paper will examine this in two sections. The first will offer some reflections on the concept of liberal education, which I think needs to be clarified if we are to understand why a core text approach may be preferable to the kind of undergraduate education in the humanities which seems to be recommended by the Boyer Report.

In the second half of my paper, I will discuss some of the ways in which core text education can be applied concretely in this dialogue, the ideal of the NEH-ACTC “Bridging the Gap” project.

I approach these complex issues from training and research within the natural sciences at one point in my career, and from my thirty years of teaching within my own core text undergraduate program, the Program of Liberal Studies at Notre Dame, one of the historic great books programs that developed from the University of Chicago College program during the Robert Maynard Hutchins era. From the beginning, my own program included science and mathematics in its curriculum as part of the ideal of an education in the classical seven liberal arts—grammar, rhetoric, logic, arithmetic, astronomy, music and geometry. As a heritage of these historical roots, we continue to give attention in our curriculum to primary texts of literature, philosophy, theology, political theory, and original works in the sciences and in mathematics. But as the University in which I reside has changed remarkably around our Program in its fifty-four years of existence, the Program has had to deal with several new issues.

My program now finds itself located in the context of a university culture that emphasizes research scholarship and disciplinary specialization, and we are surrounded by large science and engineering complexes, with major research groups in chemistry, physics and molecular biology. Some of you may exist in a context surrounded by mega-complexes of medical research facilities. How is general, liberal education to relate to these developments? What contributions can it potentially make to bringing together our academic cultures, and even in contributing to a larger cultural dialogue over the interaction of humane concerns and technological society?

What is Liberal Education?

To gain some historical perspective on this complex and difficult question, I shall take my perspective from Bruce Kimball’s important history of the idea of liberal education, a work that I feel should be more widely known and studied. In his survey, *Orators and*

Philosophers: A History of the Idea of Liberal Education, Kimball has built his scholarly study on a broad literature that ranges from Antiquity to modern American higher education. Kimball has utilized historical analysis as a way to dissect out two distinguishable traditions in liberal education in the west. His claim is that these have been persistent traditions, and that in some of their permutations and combinations, they are still interacting in some form today in American higher education.

One of these models is the *artes liberales* ideal, given shape particularly by Isocrates in an Attic context, but then developed particularly by the Roman Humanists, in which the aim of education was to be the formation of the moral citizen-orator, who was to be educated primarily in what were later designated as the arts of the trivium—grammar, rhetoric, logic—skills that were inculcated through the reading and study of exemplary works of the past. This is the education absorbed by such great minds of our tradition as Augustine. The rationale for reading the classics was clear and well-justified. Such works provided the student with exemplary models of reasoning, of oratory, of logical argument, and also of moral example. The scientific arts, later designated as the quadrivium—arithmetic, music, geometry and astronomy—also became part of this education in the liberal arts in late antiquity. On Kimball’s analysis, this tradition, reformed and refracted by the Renaissance humanists and educational reformers of the Reformation, still played an important role in the educational ideals of many institutions in the early American republic. One might say that it still survives into the present, at least in some dimensions, in the ideals of great books programs like my own and possibly it is expressed in the program statements of many programs represented at this conference.

The second model, traced by Kimball to the Greek philosophical tradition, and then developed more systematically in the universities of the middle ages following the recovery of the works of classical antiquity in the twelfth century, added to the education in the liberal arts the pursuit of philosophical and theological wisdom. The liberal arts were to be a preparation for this, not an end in themselves.¹ As the province of the arts faculty, they were preparatory to the training in the higher faculties of law, medicine and theology. In the later German universities, the philosophy faculty was added to these higher faculties, and this became one locus for the development of the theoretical natural sciences as disciplines in their own right.

In this educational model, the exploration of the classics of the past was to be subsumed to the creative development beyond this arts framework. A goal beyond that of the formation of the citizen orator was to be pursued—that of the philosophically enlightened individual pursuing theoretical knowledge.

On Kimball’s analysis, this philosophical model, rather than that drawn from the arts, was the one that was transmuted in the seventeenth and eighteenth centuries through the educational ideals of Bacon, Descartes, Locke and others into a philosophical ideal of education that increasingly rendered the reference to the exemplary models of antiquity irrelevant. The new education was to inculcate the new philosophy and the methods of the

¹ Bruce R. Kimball, *Orators and Philosophers: A History of the Idea of Liberal Education* (New York: Teacher’s College Press, 1986), exp. p. 228.

natural sciences. The educational ideals of Bacon, Descartes, Locke, and that of the of the French Encyclopedists were explicitly devoted to a progressive, practical form of knowledge for the improvement of human life. And by the middle of the eighteenth century, as exemplified by the great *Encyclopedie* of Diderot and D'Alembert, the rhetorical ideals of the century before were given practical embodiment by articles that told its readers actually how to apply rational science to manufacturing, to the building of apparatus, and to many other technological tasks.

For those enamoured with this ideal of education, there was little role left for traditional education. David Hume, for example, in the famous passage that closed his *Enquiry* of 1748, was able to recommend a very quick sorting of his library and a new means of heating his house. Only works of mathematics and logic, or those dealing with truths of experience were needed. The rest was to be committed to the flames because they contained only sophistry and illusion.

The characteristics Kimball uses to define this Enlightenment philosophical ideal of liberal education fashioned in the eighteenth century—mitigated epistemological skepticism, the open-ended search after truth that is assumed to reach no conclusion, the toleration of all points of view, the emphasis on individual judgment—may seem desirable to many in this audience. But we can discern that, if this is the only aim of liberal education, one may ask why the humanities are even needed. Can these skills not better be cultivated by the study of the natural sciences themselves?

Kimball's survey of numerous college catalogs and program statements on liberal education in the United States from the post-Civil War period supplies substantial evidence that this "enlightenment" conception of liberal education generally replaced that of the *artes liberales*. Particularly when allied with Pragmatism, it suggested little real reason for a study of the tradition. The goal of liberal education is to "liberate" the mind, free one from prejudice, develop critical thinking, and develop the skills of writing and rhetoric. One broadens one's own historical experience by such education.

It seems, however, that for an association specifically dedicated to the development of liberal education through some kind of reading and discussion of required, and often classic texts in core courses and curricula, there needs to be some reflection on underlying rationale. If our goal is more than an effort at the recovery of the *artes liberales* tradition, or that of developing one form of Kimball's philosophical ideal, in which we find a combination of classical liberal arts and the pursuit of philosophical or theological wisdom, such as I see to be the original ideal of my own Program of studies, we must find some way of understanding more specifically how the study of core texts can accomplish goals that are not easily accomplished on other conceptions of liberal education, such as those advocated in the Boyer Report. And specifically, my concern is with the interface of liberal education with the sciences when we look in more detail at the model of education that dominates the sciences, and the differences between this and the ideals of liberal education in all but the "critical thinking" skills conception of its goal.

Interfacing with the Sciences:

How can the inclusion and even the study of foundational texts of the humanities in the curricula of science courses develop a more fruitful dialogue between these two areas of human endeavor? I should make it clear here that I am particularly concerned with courses in science and technology for non-majors in these subjects, which likely means for most of the students we actually teach. But I would also not avoid some consideration of the role of such texts in the education of those who are to be the real practitioners of science.

It is instructive to look in more detail at the model of education that is experienced by our students in their science, engineering, and pre-medical courses, and that which is particularly experienced by the major in these disciplines. Since I went through this form of education myself up to the advanced graduate level, I can speak not only in the abstract, but also autobiographically.

This is a form of education, particularly fashioned by the German and Scottish universities in the nineteenth century, that rendered education through classical texts alien to its goals. The focus is on the efficient transmission of accepted knowledge, and eventually in the German conception, the ideal of research. The late historian and philosopher of science, Thomas Kuhn, spoke authentically and, largely, autobiographically in his reflections on scientific training as an undergraduate and then as a research graduate student in experimental physics at Harvard. In an important essay entitled “The Function of Dogma in Scientific Research” that preceded his better-known *The Structure of Scientific Revolutions*, Kuhn questioned the popular view of the scientist as “an uncommitted searcher after truth, . . . the explorer of nature—the man who rejects prejudice at the threshold of the laboratory, who collects and examines bare and objective facts. . . .”² To the contrary, he characterized the scientist as one educated in a highly dogmatic system, as rigid as seminary training. As a dogmatic education, foundational questions are not to be explored—what is knowledge? What is nature? What is the warrant for scientific reasoning? Is the calculus true? It is also studiously unconcerned with its history except as an illustration of error or occasionally as a repository for a few heroic exemplar cases, such as Galileo’s confrontation with the Church. As developed in more detail in his subsequent *Structures* of 1962, scientific education is depicted as employing an educational model that is focused upon the inculcation of specific current theories, of manipulative skills, and ways of “getting the right answers” from the problems and laboratories. The intent of this education is to initiate one into an increasingly narrow inquiry into limited problems defined within the boundaries of accepted theories.

Precisely because the sciences, and even more so, their technological extensions, are non-reflective about deeper foundations, and avoid such reflections except when forced to at times of theoretical crisis, they have been able to develop progressively and with a precise focus on the solution of soluble problems. The natural sciences have also been able to develop particularly effective forms of social organization that discipline these inquiries in specific ways. Modern science is group science. It is funded by competitive grants that must be won from agencies in refereed competitions that filter out acceptable methods and problem

² T. Kuhn, “The Function of Dogma in Scientific Research,” in: A.C. Crombie, ed. *Scientific Change* (New York: Heinemann, 1963), chp. 11.

definitions. Cutting edge research is published in papers with multiple authors in stringently refereed journals, rather than in monographs by individuals. The scientific world of a Charles Darwin or John Herschel, individuals who were able to make major scientific developments from their country estates, no longer exists. Even in the nineteenth century, this model of science was rapidly disappearing from view. Creative science was generally already moving to the research institute, the funded laboratory, or the higher faculties of the German-style university. The science we experience today is continuous with these latter forms of scientific inquiry.

The education in the humanities, the category of disciplines that in most of our institutions replaced the original concept of the *artes liberales*, following Dilthey's distinction of the *Natur* and *Geisteswissenschaften*, separated those inquiries that explore the questions of inner life, values, and meaning from those oriented to a deterministic world of natural law and causality. Here in the humanities, presumably, was to be the residence for the reflection on the great texts and the education of the whole human being through literature, poetry, history, philosophy and theology. As even the question of content has become more problematic in the humanities, the humanities, often equated now with the liberal arts, have, as I suggested in the first portion of the paper, increasingly justified their existence on the rhetoric of liberation and skills acquisition.

But if my characterization of science education is accepted, there would seem to be little opportunity or rationale in the sciences for the reading of classic sources and reflection on fundamental principles and deeper metaphysical and epistemological questions. In a famous paper of some years ago, it was even suggested, if with subtle irony, that perhaps the science student should be kept away from the history of science. To explore it would only be unsettling.³

In the past two decades, as exemplified by the growth of the field of critical "social studies" of science and technology, the relations between the sciences and humanities have become in some instances openly hostile. In an effort to defang the power of science and technology, and to display the ideological and socially-constructed nature of scientific knowledge, scholars in the 80s and 90s turned the methods of sociology, history, anthropology, post-modernist literary criticism, and critical philosophical analysis into weapons to be used against the sciences. When scientists perceived more clearly these intentions of their humanistic colleagues, the response was in some instances a broadside against the humanities, exemplified by the collaborative work by a marine biologist and mathematician, entitled *Higher Superstition: The Academic Left and its Quarrels With Science* of 1994. This was followed by the famous Alan Sokal hoax in 1996, in which a well-known, professional physicist published a completely bogus lengthy theoretical article, complete with 109 footnotes, with the impressive title "Transgressing the Boundaries: Towards a Transformative Hermeneutics of Quantum Gravity," in a respected refereed journal of the social studies of science, and at the same time published in another journal an exposé of the obvious scientific incompetence of the reviewers of his quantum gravity article.⁴

³ Stephen Brush, "Should the History of Science be Rated X? *Science* 183 (22 March, 1974), 1164-72. Brush, it should be noted, is a leading historian of modern physical science.

⁴ The original article is "Transgressing the Boundaries: Towards a Transformative Hermeneutics of Quantum Gravity," *Social Text* 46/47 (1996), 217-52; the critique is in *Lingua Franca* May, June 1996, pp. 62-64.

These kinds of hostile relations of the sciences and the humanities do not seem productive. The losers were not the scientists, but the humanists in these encounters. The Sokal hoax displayed that trained academics who claimed the right to analyze science and pronounce upon it in fact had no competence in the area.

At the same time, these hostile encounters do reflect on the side of the humanities a concern with the growing hegemony of the sciences, their tendency to subsume all subjects under the domain of scientific rationality, their failure to reflect on assumptions and foundations, and their tendency to become forms of human domination. The problem is with the categories in which the interface was conceived. The humanists involved have certainly developed the arts of criticism to a fine skill, but their way of entry into the dialogue lacked the kind of humility before the text and the willingness to give the sciences a properly respectful hearing that I would hope a genuine liberal education could inculcate.

The problem we face is an important one. As the Austrian psychotherapist Viktor Frankl wrote in a penetrating little essay some years ago, the fault is not with scientific reasoning or even with the effort to find reductive and naturalistic explanations of phenomena, even those in psychology. The problem is not even that of specialization of learning, that as I emphasized when speaking of education in the sciences, is a necessary goal of scientific education. The problem Frankl sees is that “specialists,” and particularly those in the sciences, “are generalizing.”⁵ We could illustrate this by the writings of any number of leading scientists who have entered the public domain, from Ernst Haeckel and Jacques Loeb at the turn of the nineteenth century, to E. O. Wilson, Stephen Weinberg, and Richard Dawkins in our own. An example I would like to speak of in more detail is the molecular biologist Francis Crick, who was featured only a week ago in the science section of the New York Times. Originally trained as an experimental physicist, he was to become the well-known collaborator of James D. Watson in the theoretical understanding of the structure of DNA for which he won the Nobel Prize. But this was only a part of a larger philosophic project that he has pursued ever since. As he put this in a public talk in 1966:

The ultimate aim of the modern movement in biology is in fact to explain *all* biology in terms of physics and chemistry. There is a very good reason for this. Since the revolution in physics [i.e. quantum mechanics] in the mid-twenties, we have had a sound theoretical basis for chemistry and the relevant parts of physics.

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It seems to me that the recent history of molecular biology has only confirmed this point of view. So far everything we have found can be explained without effort in terms of the standard bonds of chemistry.

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Thus eventually one may hope to have the whole of biology “explained” in terms of the level below it, and so on right down to the atomic level.⁶

⁵ V. E. Frankl, “Reductionism and Nihilism,” in A. Koestler and J.R. Smythies (eds.), *Beyond Reductionism* (New York: Macmillan, 1968), p. 397.

⁶ Francis Crick, *Of Molecules and Men* (Seattle, 1966), pp. 10, 11, 14.

Since then, Crick has been hard at work on reducing mind and consciousness to the determinism of molecular biology, giving his books such ambitious titles as “The Scientific Search for the Soul,” and making such claims as: “your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules.”⁷ When reading such claims, one wonders if something has not gone very much awry in our education, and in the education in the sciences. It is not just that such claims are inconvenient or threatening; they are also simply paradoxical if drawn out to their logical consequences, because they put the very claims of scientific knowledge itself at some jeopardy. If this is what thinking is, what are we to make of Crick’s claims themselves?

The problem I would like to highlight here is a problem with the outcome of the form of education in the sciences itself, the way in which it inculcates a way of seeing phenomena, and even the world in general, through one perspective. In the life sciences, for example, in which I was trained, it means to understand the living being in terms of reductive and analytic categories, and to develop methods to explain the more complex states of life by the functioning of simpler parts. With sufficient intensity of education in this model, it becomes a world-view. Hence, Crick’s self-proclaimed assault on the last citadel, consciousness, is an extension of this method now applied to reason itself. For a critical philosopher who might have read his Kant well, this all might seem very naïve and “pre-critical.” But scientists do not read Kant and simply handing them the *Critique of Pure Reason* might not shake this kind of scientific dogmatism.

To avoid being misunderstood, I am not questioning the use of analytic and reductive methods in the sciences. There is no question that such methods have been, and remain, highly successful. We owe most of the great advances in medicine and biology to the application of this methodology. The problem is the almost invisible slide that we see operative in the writings of a scientist like Crick, a slide that moves from an efficient methodology that is instilled more by doing than by reflection in the educational process, into a constitutive metaphysics, and even to a metaphysics of the human person. This is where the deeper problem seems to lie.

Bridging the Gap:

In view of the real differences in the models of education in the humanities and sciences, I do think a real gap lies between the sciences and the humanistic disciplines that is deeper than we might recognize. The problem is in how to bridge it or even remove it without engaging in a quixotic critique of the sciences.

I will acknowledge that there are several ways one might envision opening up a deeper dialogue between the sciences and humanities. One might concentrate on the study of scientific methodology and the philosophy of science in order to create a more critical awareness of the assumptions of the sciences. Another might be to have humanists and scientists “team-teach” courses together, drawing on the different perspectives of each. But

⁷ Quoted in Margaret Wertheim, “After the Double Helix: Unraveling the Mysteries of the State of Being,” *New York Times* April 13, 2004, p. D3.

the approach of the ACTC/NEH Bridging the Gap project has taken the route of doing this through the study of primary sources. This also includes the creation of laboratory experiences, and the discussion of effective pedagogical methods. It also involves readings from works from both the traditional humanities and the sciences. Why use this approach?

To approach the sciences in this way is to accomplish two goals. First, it brings to the attention of the humanists the difficulty and complexity of inquiry into nature, even when carried out at a fairly elementary level of laboratory experience. To “see” the phenomena under consideration requires the acquisition of skill and practice.

For the scientists in the group, it means to encounter scientific texts in all their unvarnished complexity. While this kind of approach may be familiar to those of us in the humanities, especially those committed to reading the tradition and its sources, this is not familiar territory for the scientists for the reasons alluded to earlier.

When we enter a scientific text from the past, one discovers that what is supposed to be there is in fact not necessarily to be found at all. One finds in a work like Harvey’s treatise on the circulation of the blood not the laying out of an obvious set of truths about the body, but a whole set of theoretical leaps and even empirically unwarranted assumptions. The text must try to accomplish through the art of rhetoric what it cannot demonstrate scientifically. The text is written for an audience that must be convinced to abandon the reasonable and traditionally sanctioned for a new theory that seems unable to explain why the blood circulates so rapidly, or why it changes color in the lungs. As one sees so artfully in the case of Galileo, the effort at persuasion may even take the form of ridicule and satire, as we see poor Simplicio tangled up in one paradox after another by Salviati.

Similarly, the reader of Mendel’s classic paper on plant hybridization is startled to find that Mendel himself seems to find his laws of inheritance ambiguous, and there is no notion of a “gene” in evidence. Reading Darwin’s *Origin* reveals that is Darwin not a “neo-Darwinian” in our sense, nor is one offered much in the way of compelling data. Instead one reads a text that is only offered as an abstract of a promised text that was in fact never published. One learns that the consensus of molecular biologists and geneticists until around 1950 was that the protein in the chromosome, and not the DNA, held the key to genetic inheritance. One finds in moving in the other direction that major works of literature may emerge from reflections on the sciences, as we see in Dante’s great epic, or in the works of Goethe and Tennyson.

Perhaps the most important function of such study of science through its textual sources is that science, as much as literature or philosophy, is seen as a human activity. It has assumptions that can be examined. This is not to belittle the sciences, nor to engage in debunking. It is only to remind both the scientists and the humanists that the sciences offer us limited, restrained, and highly refined perspectives on the world, on life, and on human beings. For the scientist it can help reveal the assumptions behind the skilled way of seeing that their education has instilled in them, and perhaps learn from this the need for caution in moving from scientific inquiry to totalizing pronouncements on the issues of concern in the complex world of the humanities. We can see from history the many ways in which the sciences, and particularly the life sciences, can go awry when they make scientific theory into ideology. Race theory, eugenics, the urge to dominate life for utilitarian ends, can easily emerge from a

scientific reason that fails to reflect on its ultimate assumptions and on the limitations of its own educational model. Through an education in the great texts of both the sciences and the humane disciplines, our two cultures can see more clearly the claims of both, and the wisdom in both. I would hope those in the humanistic side can discover the great drive for truth, the willingness to be patient with excruciating detail, the long hours of intense and frustrating research that may be required for even a minor breakthrough in the sciences. We might then be more aware why scientists may become unhappy when this effort is seemingly dismissed by humanists in the name of critical literary theory or analyses of science that do not understand its inner workings and the details of its theories.

Scientists might, on the other hand, be made more willing through the study of sources to reflect on their enterprise, on the difference between methods and metaphysics, on the problems of epistemology that may be entailed in their work, on the role of the art of rhetoric and its use in science. Ideally it will be a means of introducing some deeper humility in the scientific quest, and a recognition of the claims of other perspectives. This seems especially important for the life sciences today that seem to many of us poised to usher in Aldous Huxley's *Brave New World*.

Mention of Huxley's biological dystopia in which life has been reduced to a commodity for scientific manipulation leads me to my closing reflection. At the roots of the modern scientific age, we find a historic overlap of two figures who offer us some different perspectives on what the new world might bring. To Shakespeare, whose famous lines from the *Tempest* (1623) "O brave new world, that hath such people in't" provided the title for Huxley's biological dystopia, it meant a new world that to some extent had been disenchanting. Prospero's magical arts had been put away. At the same time, to Miranda's eyes, it revealed a "beauteous mankind". For Francis Bacon, the prophet of deep transformation of the arts of the quadrivium into applied and useful knowledge dedicated to human advancement, the brave new world was one oriented to a future of applied technology and the domination of nature. Writing only three years before the first publication of Shakespeare's final play, he envisioned how organized inquiry and a new logic of induction would result in the rational control of nature. Bacon's novel conception of science, exemplified by his House of Solomon depicted in the *New Atlantis* of 1627, displayed some of the differences that were to emerge between the classic sciences of the quadrivium, aimed at moral improvement through contemplation, and a science that was to gain a "the knowledge of Causes and secret motions of things; and the enlarging of the bounds of Human Empire, to the effecting of all things possible."⁸

But since Bacon has often been blamed for attitudes for which I think he is not responsible, we must see that his project was restrained by limits. It was only intended to regain knowledge originally in possession of mankind. It was not to go beyond this into the pursuit of an unlimited Promethean domination of nature. As Bacon puts this, the new knowledge was neither

⁸ Francis Bacon, *New Atlantis*, in Francis Bacon, *Selected Philosophical Works*, ed. R. Sargent (Indianapolis: Hackett, 1999), p. 261.

for the pleasure of the mind, or for contention, or for superiority to others, or for profit, or fame, or power, or any of these inferior things, but for the benefit and use of life, and that they perfect and govern it in charity. For it was from lust of power that the angels fell, from lust of knowledge that man fell...⁹

This original Baconian project of the pursuit of a limited knowledge that recognized divine constraints was, to be sure, altered in the eighteenth century into a Baconianism with these limits removed. Science and its wedding with technology, that in the science of the great *Encyclopédie* of Diderot and D'Alembert first revealed itself as a truly possible goal, was the key to a presumably unlimited future that would also require educational reform that would make the sciences paramount.

As we stand at 250 years distance from this ambitious project of the French Enlightenment, we see more clearly the ambiguity in this, the possibility that this unrestrained Baconian drive to a mastery of nature could bring us into Huxley's rather than Shakespeare's Brave New World. The sustained reflection on the sciences, which a core text approach should encourage, may help us preserve Miranda's "beauteous mankind" from the domination of technique.

⁹ Bacon, "The Great Instauration," in Sargent, *Philosophical Works*, p. 75.