

President Rosenbaum, members of the Board of Trustees, members of the faculty, students, staff, friends and relations, and admirers of Tom Rosenbaum, among whom I consider myself to be one of the foremost. We are gathered here in one of the world's greatest sites of scientific and technological investigation and teaching to celebrate the inauguration of an extremely talented scientist and administrator as its president and to look forward confidently to the Institute's continuing contributions to the advancement of learning, especially in science and technology. And before you stands a musicologist. This may have prompted you to ask, perhaps recalling a famous recording by Tina Turner, "What's musicology got to do with it?"

This may, in turn, have caused some of you to think immediately of C. P. Snow's account of "the two cultures" and to have put me in the "other" one. I would like, however, to interrogate Snow's account briefly, for I believe that the phrase "the two cultures" has done us all a terrible disservice by taking on a life of its own rather independent of what Snow actually said, now more than 50 years ago. He began with a concern for the disparity between the rich and the poor of the world, which certainly sounds familiar in our own time, and he had originally thought to title his celebrated lecture "The Rich and the Poor." He believed that the poor of the world could not help but notice the disparity between themselves and the rich of the developed world and that they would, in due course, seek to rectify it forcibly unless, perhaps out of self-interest more than anything, the rich themselves undertook to right the balance. The imbalance could not endure, he thought, beyond the year 2000. This much, of course, he got wrong.

Snow was convinced that scientists and engineers could cure the ills of the world's poor if only they were given the charge and the freedom to do so but that the "other" culture, the culture of the "literary intellectuals," as he called them, was preventing the culture of scientists and engineers from doing so. This had to do with the fact that many in the British government at the time were Cambridge graduates in the humanities and social sciences. We have not had to worry about this in our own country, of course, because we have never had enough "literary intellectuals" in government to do any harm or any good either way. Naturally, the "literary intellectuals" applied the full force of their literary gifts to rejoinders. Others of Snow's views are also shocking at this remove.

What we have been left with, in any case, is the phrase "the two cultures," which has come to mean that scientists and engineers constitute a culture wholly different from the culture of humanists, social scientists, and artists and that there is little or no communication between the two. My

own view is that, properly understood, there is only one culture—that scientists and humanists share this culture—and that the sooner we all come to recognize this and act on it, the better the nation and the world will be.

The danger that we face as a nation is that we are systematically disinvesting in our *intellectual* infrastructure across the board and at every level. Higher education is demonstrably the single most successful business the United States has ever engaged in, and yet we persevere in dismantling it, running the risk that it will remain increasingly the province of the rich rather than the right of the citizenry as a whole. This is not just about the inadequacy of funding for scientific research. It is also about our knowledge of other cultures and geographies and of history, the mistakes of which we are all too eager to repeat. However mighty our weaponry, we really should not wait until we decide to go to war somewhere before discovering that we don't have enough people who can read the local newspapers there, let alone understand what is actually being said in the streets there.

Science and technology have been relatively successful at moments in wrapping themselves in the cloak of the national defense and other instrumental arguments. But we should ever remember the immortal words of Robert Wilson, the founding director of the Fermi National Accelerator Laboratory, who, when asked in testimony before Congress whether this big and expensive machine would contribute to the national defense, said “no, except to make the nation worth defending.” The biomedical sciences have been relatively successful in commanding increased funding on the claim that a variety of diseases will be eradicated, and people will live longer, without, however, asking who might, in fact, get to live longer and what, in the end, makes life worth living. The humanities and the arts, too, have wheeled up their own instrumental arguments, usually having to do with contributions to local economies and the gross domestic product without, however, thinking about and insisting on why people for all of human history have made art in the first place.

The nation's problem is not principally that we spend too much money on the wrong things and not enough money on the right things. The nation's problem is much deeper. It is that not enough of our people possess that turn of mind that underlies what scientists and engineers and humanists and artists actually do and why they do it. The best of them all do what they do because they can't help it. As a great scientist remarked recently, they just have to know. A. R. Ammons, a great American poet of the last century, diagnoses the problem in our society in one of his “Really Short Poems” as follows:

Ideas pass through
Most heads
Without taking on
Any substance or
Leaving any trace.

Rather than defending separately the terrain of one or the other of the supposed two cultures, we must vigorously advocate the nurturing in every citizen of that turn of mind that unites them. We should not content ourselves with a sort of two-state solution, each state living within its borders and with a modest amount of international trade and rare skirmishes along the border. Every child comes into the world hardwired with curiosity and her faithful companion imagination. The problem is that much about our national life then sets about to beat this out of them. Given that every human being has the capability, as Martha Nussbaum puts it, of exercising their creative intelligence, it is a violation of human rights to deny them that exercise. It is indeed a crime. This is precisely the crime that is being created daily by much of our consumerist culture in league with very many school districts that rip arts and culture and real science out of the schooling of our children. If our citizenry, to say nothing of the members of Congress in particular, shared broadly a commitment to the exercise of our individual curiosity and imagination, then both of the so-called cultures would flourish, and we would not be inclined to distinguish them. In the bargain, the national defense would be more sensible, and the gross domestic product would increase and be distributed in more sensible and just ways.

But let us think for a bit about what lies deeper than the instrumental arguments that our nation's practical turn of mind often has recourse to. Let us think a bit about the nature of the life of the mind in whatever pursuit and what characterizes it. Here again, A. R. Ammons, in his poem *Garbage*, has an apt description. It is about the ways in which making art and life and, I would say science, are all of a piece.

...art makes shape, order, meaning,
purpose where there was none, or none discernible,

none derivable: life, too, if it is to have meaning,
must be made meaningful; if it is to

have purpose, its purpose must be divined, invented,
manifested, held to. . . .

The essential activity of the artist, the scientist, the humanist, the entrepreneur is to make shape, order, meaning, purpose where there was none, or none discernible. In whatever our professional pursuit, we confront large amounts of, let's call it data, and we endeavor to find in it or make in it meaning, to give it significant form, where there was none before, or none discernible. And that is, of course, what we also do as we try to make our own lives—to confront the chaos of the world and try to make it meaningful, make it have purpose, and then cling to that purpose.

Education, then, beginning in the cradle and certainly through higher education in whatever discipline, must be about strengthening what is fundamentally the artistic impulse to make shape, order, meaning, purpose where there was none, or none discernible.

Of course, each discipline brings its own tools to this task. Here the danger is only that we may overvalue a limited set of tools, perhaps the tools that produce results that seem to be immune from contrary opinion. There are fewer such tools than one might think, even in the domain of quantitative tools, which can sometimes be applied to produce false conclusions. But not everything of consequence yields to such tools, and we must not allow them to blind us to other kinds of analysis and meaning. On this topic I recommend a passage in John Maynard Keynes's *General Theory of Employment, Interest, and Money*. He writes, "the statement that Queen Victoria was a better queen but not a happier woman than Queen Elizabeth" is "a proposition not without meaning and not without interest, but unsuitable as material for the differential calculus." One might even say that many of the most important things in life are not suitable material for the differential calculus and related tools. This is true in education at all levels, where the current fashion for outcomes and assessments runs the risk of smothering what might be most important about the educational experience for teachers and students alike. Education cannot be allowed to be only about finding a job and about how much money a job pays.

Students and parents in pursuit of a job, no matter what job, should be reminded of the words of another great writer, George Eliot. In *Silas Marner* (a book that many of us were obliged to read as sophomores in high school, when we had not the vaguest possibility of understanding it) she writes, "Every man's work, pursued steadily, tends in this way to become an end in itself, and so to bridge over the loveless chasms of his life." Of Silas's life and the lesson that might be drawn from it she writes:

His life had reduced itself to the functions of weaving and hoarding, without any contemplation of an end towards which the functions tended. The same sort of process has perhaps been

undergone by wiser men, when they have been cut off from faith and love—only, instead of a loom and a heap of guineas, they have had some erudite research, some ingenious project, or some well-knit theory.

Even university professors might reread these lines once in a while.

Finally, let me say a bit about how we might—or might not—go about constructing an education for the young and for ourselves in later life. Among the controversies besetting education at all levels in recent years has been the claim that a proper curriculum has been dismantled and that the young are not learning what they ought to learn. (Simultaneously, in the current debate over the Common Core standards, there is the claim that what students ought to learn can only be determined individually by each of the many thousands of school districts in the country.) Here we ought to apply at least in some degree the principles that we should apply in saying what kinds of research ought to be pursued in universities and at the taxpayer's expense. Curiosity matters a lot, and who is to say where it might lead in ways that a curriculum bound by the past and restricted to a single culture will be very unlikely to lead.

Boswell's *Life of Johnson* describes an extreme but instructive case that parents and guidance counselors might usefully bear in mind. When Samuel Johnson was not yet 20 and had already mastered Latin and Greek and a great deal else, he stayed home from school for a couple of years, spending the time, he said, in idleness and much to his father's consternation. But he read avidly, not from the prescribed list of books that he would have read had he stayed in school but the books to which his curiosity and sometimes mere chance led him. When he arrived at Oxford thereafter, his tutor said that Johnson was the best-prepared student he had ever encountered. This might be thought to be the free-range approach to education. Indeed, Boswell makes the analogy explicit. Long before there was Whole Foods, he writes: "The flesh of animals, who feed exclusively, is allowed to have a higher flavor than that of those who are cooped up. May there not be the same difference between men who read as their taste prompts and men who are confined in cells and colleges to stated tasks." This is, of course, not to be recommended for everyone, and I do not recommend that Caltech market itself as offering a free-range education. But I do recommend to its students that, *after* doing what the faculty tells you to do, you should, perhaps with the aid of a good book not on any syllabus, let your mind and spirit wander beyond familiar confines. And do not forget Johnson's own view, expressed in the dedication to his first published work of translation: "A generous and elevated mind is distinguished by nothing more certainly than an eminent degree of curiosity; nor is that curiosity ever more agreeably

or usefully employed, than in examining the laws and customs of foreign nations.”

Caltech will continue to produce extraordinary learning for its students and for the world. It will do so best when it cultivates curiosity and imagination in all of its undertakings and when those undertakings take account of the importance of making a life and not just a living—a life that is fulfilling, often thrilling, and that takes account of the rights of, and one’s responsibilities to, all of humankind. In this you will be led by the example of a president who of, course, is able to leap over tall buildings in a single bound in addition to being faster than a speeding bullet and more powerful than a locomotive but who also lives the life of a committed and thoughtful scientist, with a love for and taste in the humanities and the arts, and who, unlike so many university presidents, knows how to listen as well as to opine. Good luck and Godspeed to you all.

California Institute of Technology

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