

A TIME OF METAMORPHOSIS

by Robert L. Sinsheimer

We are facing an identity crisis for the species, a rite of passage from life in a world we never made, to life, for better or worse, in a world of human design.

I expect that I have been invited to speak here as the spirit of buildings future. As you know, we hope to construct a phenocopy of the Baxter building—a laboratory of behavioral biology—across the mall. In fact, I am pleased to invite everyone here to its dedication—date to be announced.

When completed, these two buildings with Beckman Auditorium will form the Court of Man—a giant tuning fork to resonate with the deepest human and social vibrations. Good vibes, we hope.

I had thought of writing a little scenario in which the Caltech citizen of the future is wandering up the mall, on his way to Beckman Auditorium, to hear a lecture on the plans for the new 500 TEV (trillion electron-volt) accelerator—designed to utilize the magnetic field of the planet Jupiter—a joint project of our Divisions of Physics, Planetary Science, and the JPPL (that's the Jupiter Particle Propulsion Laboratory), when said future citizen becomes aware he is running a gauntlet. On the right he is subject to the hard-eyed scrutiny of the economists and social scientists, who view him as a sort of aberrant social molecule in an unstable excited state; while from the left he receives the covetous glances of the psychobiologists, who see him as the somewhat hapless but complex integral of his genes and his experience *and* as a potential experimental subject. Fortunately, there will still remain the humanists, who will simply accept him with eloquent affection and admiration.

But I could not continue this sanguine scenario, for in truth I do not see the future—at Caltech or elsewhere—to be any linear projection of the present. I know that a dedication is customarily an occasion for self-congratulation and euphoric prediction, and I believe it is particularly

"A Time of Metamorphosis" is adapted from a talk given at the dedication of Baxter Hall on May 10, 1971, by the chairman of Caltech's biology division.

significant that we are dedicating a hall of humanities and social sciences at a great institute of technology in this peculiar and pregnant period in history.

But there is today a growing apocalyptic mood. It becomes ever more clear that as we approach the beginning of the third millennium A.D., we are hurtling through the closing decades of a very long era, that we are caught up in the tide of an inexorable period of change in human goals and values, on a global scale, without precedent in all human history.

That we face successive waves of confrontation: between western man's persistent urge for material wealth and physical power, and the finite resources of the planet; between the familiar values—hallowed by success—that have brought us out of an age of helpless scarcity, and the strange values—tentative and awkward in their newness—appropriate to an age unchained from want. Confrontation between our increasing need for knowledge and our increasing hesitance to bear its responsibility; between the dream realized and the reality achieved, as for example *between the very human wish for immortality and the staggering consequence of its possible approximation*. Confrontation between our treasured but often rigid and egocentric conception of individual human rights and our ever increasing human interdependence. Confrontation between the rational on which our very lives must henceforth rely and the intuitive and irrational—so deeply imbedded in our nature—on which, in our impotence, we have for so long depended.

In brief, we are entering into a time of metamorphosis for man, of dissolution of the old in the creation of the new. As a result we are facing an identity crisis for the species, a rite of passage from life in a world we never made, to life, for better or worse, in a world of human design.

Man has evolved through millions of years into a creature adapted to his planet; sustained by its web of life, favored to be increasingly preeminent among its forms. Whatever mistakes man made (and surely there were many) were never collectively fatal because of the resilience of the web and the growing security of his place in it.

Now with our exponential increase in numbers and in power we have come to our Rubicon. The ancient sustaining web is tearing, and we must soon choose. We may retrench, and it will heal, at the psychic cost of profound human restraint; or we may deliberately undertake to design a new web of support—to human specifications—literally to engineer the planet for man. The cost

again will be psychic: the knowledge that we are truly on our own *and* that we are fallible. Again, a confrontation—of diffidence and daring or, some may say, of humility and hubris.

Few, if any, can foresee the shape of the civilization that will emerge from the years of turmoil. Or, more *pertinent*, what will be the role of science and technology?

For five decades this Institute has built upon the academic legacy and vision of Millikan, Noyes, and Hale, and it has built well. We have gathered here the finest concentration of scientific and technological talent on earth. We attract annually the most brilliant students from the schools and the colleges of America.

But we must not assume that the inspired vision of the founders will never need a re-vision, an adaptation to the light of the time. After 50 years, in a time with new insights and new shadows we should reexamine our course, neither shackled by success nor contemptuous of continuity. How should we prepare our students for this time of metamorphosis? It merits much thought. I would suggest now three, admittedly partial, answers:

First, to continue to do well that which we have done well—to transmit and expand scientific knowledge. Man must still have need of science and technology. The principles of quantum mechanics and thermodynamics, the theorems of Fourier and Gödel, the laws of Newton and Maxwell, the rules of valence and the genetic code—these are not about to be repealed or become obsolete.

Our insights into the nature of matter and life, our vision of the dimmest past and the farthest space, our recognition of the continuity of life and the universality of natural law, our dawning perception of the biology of mind—these are the illuminations that science has brought to man. They extend the human horizon, and they will be an enduring part of any civilization.

But we must remember that in science to continue to do well is to continue to change and change again as the unknown unfolds and the human perspective evolves.

Second, to enlarge greatly our educative mission, to *accept a far wider role in the creation of scientific literacy*. The scientific illiteracy of the bulk of the population, in a society obviously dependent upon technology, can lead only to fear and mistrust, to apathy, to erosion of self-confidence and of self-government. In a recent literary magazine, one may read: "For the first time the forward-vaulting intelligence of our species, so intricate yet so vulnerable, a piece of systematic evolution, finds itself in front of doors it may be best to leave unopened; on pain of life."

On a dimension of good and evil, fear lies well toward the latter. And the worst fear, the impenetrable fear, is the fear of knowledge itself. This is a plague of the spirit, and we must prepare to meet it.

The fault lies with the schools, with the media, and above all with us who have the knowledge but have not been concerned with its diffusion. Fortunately, today the means exist if we are equal to the task.

In a quieter day Santayana wrote, "He who does not know history is condemned to repeat it." The analog for today should be, "He who does not comprehend technology is condemned to serve it."

And third, we will need to learn to infuse our technical education with ethical concern. Those words sound curiously old-fashioned, with images of stained glass and stagnant rhetoric. But in a time of metamorphosis new purposes and new values are needed to inspire new enterprises. To focus upon scientific excellence but neglect ethical concern is to lower the sights of humanity. Such a practice must also breed scorn and ultimate frustration for science, in the denial of its own values.

We can no longer rely upon the inherited framework of values to shelter us from the harsh burdens of decision. Science and technology have created, irreversibly, a highly interactive society. The principles governing such interaction have long been the concerns of morality, but the novelty and intensity of these interactions and the consequent depth of their impact upon each individual have grievously strained the fabric of the accepted morality. We can no longer optimize subsystems without concern for the whole. The values of the past are inadequate to the present and if undeveloped are helpless to contain the future.

If scientists wish to serve fully in the formulation of the

new age to come, if we wish to be more than the "political eunuchs" and "servile automatons" our critics decry, then we must indeed be well prepared to shoulder our share of the burdens of decision. Our students will need practice and experiment in the realization of the values implicit in their acts, in the clarification of alternatives and the calculations of consequence, in the achievement of decision and its continued reflux—and thus, in the conscious, heuristic, and humane formulation of values for a new time. Just as we educate in the laboratories of science, so I believe we should educate by exposure to and experience in the laboratories of human decision, wherein judgments of social value are made every day—in the courts and in the hospitals; in the nursery schools and in the planned parenthood clinics; in the prisons and the asylums; in the regulatory agencies and the legislatures and the executive offices.

Our values must change to match the new reality, the new freedoms and the new constraints, as we emerge, collectively, from the childhood of the race.

What I have said is not new, it is only more urgent.

To look at MIT is often to see ourselves in a somewhat distorted, but surprisingly faithful, mirror. In the recent report of the Commission on MIT Education we may read: "Despite all the changes of the past decade there remains at MIT a decided bias against humanistic learning . . . Too many faculty members and students continue to think of the humanities, the social sciences, and the arts as unimportant, irrelevant, and methodologically soft. The structure of the curriculum encourages students to relegate such studies to a minor, secondary role . . . We must encourage a broader view of learning and a deeper engagement with questions of value in the scientific and technical disciplines themselves."

Forty years ago, Albert Einstein spoke to the students on this campus. In his brief talk he said: "It is not enough that you should understand about applied science in order that your work may increase man's blessings. Concern for man himself and his fate must always form the chief interest of all technical endeavors . . . in order that the creations of our mind shall be a blessing and not a curse to mankind . . . Never forget this in the midst of your diagrams and equations."

In ancient Egypt the jagged shapes carved on the horizon were the pyramidal tombs of personal glory; in medieval Europe, the holy cathedrals of a common human hope; in the twentieth century, the skyscrapers of impersonal, corporate commerce. What forms shall shape the horizons of the future society?

At this dedication of Baxter Hall I would ask those who will dwell here always to remind us of what we in science are coming slowly to see, but they have always known: that the proper study of mankind is man—that the ultimate challenge is man—and thus that the ultimate goal of science must be to explain man as a product of nature and thereby to set him free.