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# The University in a World in Transition

*Philip Handler*

*President, National Academy of Sciences*

With an Introduction by

*Edgar F. Shannon, Jr.*

*President, University of Virginia*



The Sesquicentennial Convocation

University of Virginia

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*One hundred and fifty years ago Thomas Jefferson founded a university dedicated to "the illimitable freedom of the human mind." This act, by a son of the Enlightenment, reflected that age's boundless confidence in the capacity of human reason, the dignity of man, and the future of freedom. One hundred and fifty years later, that university marks its sesquicentennial in a time when man's scientific and technological achievements seem to have outstripped his moral and human qualities, and emerging crises bid, in the eyes of some, to threaten the very existence of the human race on this planet. Hence, the University of Virginia has called its brethren from other places to enquire into the modern relevance of ideas of the Enlightenment and man's future in a finite world.*

**A. E. D. HOWARD**

*Chairman*

*Sesquicentennial Committee*

## Welcome and Introduction

*Edgar Finley Shannon, Jr.*

**O**N BEHALF of the entire University family — the Board of Visitors, the faculty, the students, and alumni — I wish to express deep appreciation for the generous messages of greeting\* that have been brought to us this morning from the Commonwealth of Virginia and from our sister institutions in this country and abroad. To the participating representatives of these colleges, universities, and foundations, and to all the other friends of the University who have come to us from near and from far places to honor Mr. Jefferson's University on its 150th anniversary, I extend a warm welcome. We are grateful for your presence — which is indeed a reminder of the cooperative nature of education and of your good will and good wishes for the future of the University of Virginia.

And now it is my happy office to introduce as the speaker of our Sesquicentennial Convocation Dr. Philip Handler, who has attained eminence and leadership in the scientific world during thirty years as teacher and scholar in biochemistry at our neighboring institution, Duke University.

Dr. Handler, as you all know, is now President of the National Academy of Sciences and Chairman of the National Science Board, the policy-making body of the National Science Foundation. Born in New York City, he was graduated from the City College of New York at the age of 18 and took his Ph.D. at the University of Illinois at the age of 21. In that same year, 1939, he began his distinguished career in teaching and research at the Duke University Medical Center. Eleven years later, at the age of 32, he was both a full professor of biochemistry and chairman of the department.

Since 1961 Dr. Handler has held a named chair as James B. Duke Professor of Biochemistry. His best known published work, *Principles of Biochemistry*, is currently in its fourth edition. Throughout his academic career he has been occupied with major research problems on enzymes. One of these is on the most exciting frontier of scientific knowledge today and involves the origin of living organisms.

Over the past decade the work of the American Society of Biochemists and the urgent needs and tasks of such bodies as the National Institutes of Health, the National Science Foundation, and the Presi-

\* Messages from the Honorable Mills E. Godwin, Jr., Governor of Virginia, from Colin B. Mackay, of the University of New Brunswick, and from Sir John Wheeler-Bennett, of Oxford University.

dent's Science Advisory Committee have made increasing demands upon Dr. Handler's time and energy, and he has emerged as a leading national statesman and spokesman on the role of science in modern society.

During the past three years Dr. Handler has conducted on behalf of the National Academy a massive survey of the life sciences. This landmark study is a comprehensive review of the intellectual content of modern biology, an appraisal of our understanding of the nature of life. It makes fundamental recommendations on the character of future biological research in the United States.

In his new post as the 18th President of the National Academy, Dr. Handler is the worthy successor of 17 of the most illustrious names in the history of American science. One of his great predecessors as Academy President was William Barton Rogers, who was a professor in the University of Virginia for eighteen years before going to Cambridge, where he became the founder of the Massachusetts Institute of Technology.

Our Convocation speaker shares with William Barton Rogers and with the Founder of the University of Virginia a passionate concern for science and the future of man. He is a living exemplar of what Jefferson envisioned when he wrote of the "illimitable freedom of the human mind." It is indeed an honor to welcome him to these Grounds on this day.

I take the warmest personal pleasure in presenting to you Dr. Philip Handler, who will address us on the subject — "The University in a World in Transition."

# The University in a World in Transition

*Philip Handler*

**H**ow pleased Mr. Jefferson would have been to share in these ceremonies at the University of Virginia. How proud, how delighted, how disturbed – how angry he would be. Pleased and proud to see his noble handiwork, a university which has served his Commonwealth precisely as he foresaw, giving to his State its leaders for a century and a half, spreading the Enlightenment, giving tone and character to Virginia and these United States. Pleased and proud that the Constitution still stands, that the Union remains sound. He proclaimed that “Liberty is the great parent of science and of virtue; a nation will be great in both in proportion as it is free.” These United States are the living proof of these contentions. But he would be disturbed to find this Nation drifting with no sheet anchor to the wind, with diminished sense of purpose and direction. Angry to see the rule of reason challenged from both without and within our boundaries, the Nation not knowing its own mind when confronted by these challenges. How would the United States and its universities seem to Thomas Jefferson today?

The intellectual structure of science, largely erected within our own lifetimes, has become the hallmark of our civilization, the gift which we will transmit to subsequent generations – if there are subsequent generations – fully comparable to the cathedrals of the Middle Ages and the art of the Renaissance. Science, and the technology it makes possible, are the principal instruments of human progress, as foreseen when Mr. Jefferson wrote that “If the condition of man is to be ameliorated, as we fondly hope and believe, education is to be the chief instrument in effecting it.” Hence, this university. He said that “Science liberates the ideas of those who read and reflect,” that “Science is progressive.” And so it is. Indeed, the revolution of rising expectations which we currently experience rests on the promises implicit in the success of our technological accomplishments for, as Jefferson foresaw, “Freedom is the first-born daughter of science.”

Science has burgeoned in a manner that no one would have predicted even two decades ago. That technology has transformed the world is visible all about us – sometimes painfully so. Yet, the scientific endeavor and the universities which make it possible have come to a time of reckoning.

Only in one action have the American people consciously taken a

step to assure the vigor of the national scientific enterprise, the creation of the National Science Foundation in 1950 in response to the report entitled "Science, the Endless Frontier," which looked to a distant day when annual federal expenditures for science might total \$50 million.

Twenty years later, the effort is already fortyfold that size and our country is at the forefront of all scientific frontiers. This is evident in the award of Nobel prizes, in the size and scope of our scientific literature, and in the influx of scientists from all corners of the globe to study in our laboratories, a trek which, until recently, occurred in the opposite direction.

Mr. Jefferson never visualized the federal government as the principal patron of science. Yet he did say that "The field of knowledge is a common property of mankind," and that "Any discoveries we can make will be for the benefit of this and of every other nation." No more cogent justification could be offered for the federal support of research.

Even today we do not deliberately construct a federal science budget. Rather does the federal government determine what sums to spend on defense, health, foreign aid, the struggle for international prestige, energy production, et cetera. Within the appropriation for each of these goals there is then made a determination of what fraction should be invested in research and development and, of that, how much should be utilized for basic research. Such allocations, together with the appropriation to the National Science Foundation, constitute the totality of the federal support of fundamental research, in this fiscal year about \$2.25 billion. A twice greater sum is spent for applied research and perhaps five times as much for development, largely in industrial laboratories. It is important to note that almost uniquely in our country, academic laboratories are the chosen instrument for the conduct of most of our national fundamental research effort, so that the conduct of research and graduate education are inseparable enterprises.

But this pluralistic system is in crisis. With other calls on the public purse, most federal agencies no longer find it possible to support fundamental research somewhat remote from their missions as generously as yesterday. On every university campus there is a fiscal crisis of greater or lesser proportion, the consequence of the fact that we have learned to utilize these funds to defray the costs not only of research, but of graduate and professional education. And the National Science Foundation has not been given the resources to cope. Scientists and university administrators find themselves engaged in tortuous accounting practices so that the ventures for which they are responsible may remain viable. But this is scarcely new. Every university president will identify with the experience of Mr. Jefferson as Rector of the University of Virginia, when he wrote to Joseph Cabell in 1825, "I mentioned

to you formerly our want of an anatomical hall for dissection. But if we get the \$50,000 from Congress we can charge to that, as the library fund, the \$6,000 of the building fund which we have advanced for it in books and apparatus, and retain from the former the \$6,000 due the latter, and apply so much of it as is necessary for the anatomical building. No application on the subject need therefore be made to our Legislature. Unhappily, I hear nothing about prospects before Congress." Nor, I regret to say, do I today. And there is grave danger that the enterprise so carefully erected may be dismantled in some part, with laboratory staffs reduced, students less well prepared, university budgets seriously unbalanced.

What have we had to show for our huge expenditures for research? I know of no mechanism for the conduct of a meaningful cost benefit analysis. Even if such an analysis were to rest solely on the imperative contributions of this exercise to our national security, public health, the quality of higher education, and the expansion of the economy, I still would not know how to do the reckoning. To the extent to which we have illuminated our understanding of the nature of man and the universe in which he finds himself, clearly a cost benefit analysis is without meaning. What value should be assigned to a poem by Wordsworth or a Mozart quartet? How I wish I could rest the arguments for the support of science on the sheer delight the enlightened mind can take in appreciating the elegance of the double stranded nature of deoxyribonucleic acid, the polymer of which our genes are made, in the excitement which has come with appreciation of the properties of the new heavenly bodies called quasars and pulsars or of the strange particles dislodged from atomic nuclei such as quarks and leptons, or in the chemical miracle which occurs in the development of a complex living organism from the fertilized egg. But if only the cultural benefits were involved, this Nation, through its governmental entities, would no more invest \$2 billion a year in science than it does in the support of local symphony orchestras, art museums, or community theaters, all of which are in dire straits across our country.

No—we pay this large bill because science is useful, because indeed it does constitute the platform on which we rest our national security, the international battle for men's minds, our hopes for the public health, the growth of the economy, and the quality of life. And without ever new technologies we could not conceivably maintain our national standard of living in competition with the lesser paid labor forces of the rest of the world.

In almost every scientific discipline discoveries are being made which will soon affect each of us. Allow me to mention a few instances. The chemical industry is a veritable \$40 billion a year cornucopia from which new products, originating in the laboratory, are converted to



useful technologies as plastics, polymers, paints, drugs, substitutes for wood, paper, and metal.

Solid state physics makes possible the microminiature components which lie at the heart of a growing host of electronic devices, including the digital computer. Parenthetically, we have not even begun to assimilate the computer into our national life and have only the filmiest vision of its future rôle. Each week brings new applications of the laser.

Biological findings in academic laboratories are translated into an armamentarium of new drugs developed by the pharmaceutical industry: new antibiotics, a specific therapy for Parkinsonism, improved understanding of the immune process which made possible the advent of tissue transplantation procedures, the beginnings of cancer chemotherapy. Improved understanding of plant physiology and genetics has led to useful new strains of old plant species such as those responsible for the enormous increment in harvest expected this year in Pakistan, India, the Philippines, and Mexico. If successful, hybrid wheat and hybrid rice, now almost developed, will mean as much to the future as has hybrid corn to the last three decades.

I know of no reason to think that the findings of science, tomorrow, will be any less applicable to human affairs than were the results of the scientific research of yesterday. Only the easier problems have been solved and it may well be that the best is yet to come. Accordingly, it seems rational to me to hope that we will have the wisdom to continue to grow our science/education enterprise at a rate commensurate with student enrollments and the growth of the GNP, maintaining our momentum in each major field of science. Meanwhile, however, huge problems confront us.

Surely, the most important problem before mankind is the search for a stable world peace, attainable only when we have achieved successful, mutual disarmament of the world's major powers. Would that the key to that endeavor were mutual trust, but I must suggest that it lies rather in confidence that available procedures can detect nuclear explosions. Happily, techniques for the detection of radioactivity in the atmosphere have become extremely sophisticated and, combined with modern meteorology, make possible accurate description of the size and nature of a nuclear weapon exploded anywhere on the face of the earth. Improved techniques, originally developed for earthquake seismology, can detect underground explosions with almost equal sensitivity. In this sense, science has already prepared the way for tomorrow's diplomacy.

At home, surely the matter of first priority is an acceptable termination of the war in Vietnam, which casts a pall over every aspect of our troubled society. Visitors to our shores leave us wondering whether this nation will survive. We are surely a house divided, and Abraham Lin-

coln said that "A house divided against itself cannot long endure." Yet I believe that our nation will emerge all the stronger for these days of travail. Our fortune lies in the fact that we are divided along so many cleavage planes: young against old; black against white; pro Vietnam against anti Vietnam; pro ABM versus anti ABM; pro SST versus anti SST; SDS versus fellow students and faculty; pro curricular reform versus status quo. How long the list is! Happily, the issues are so multitudinous that virtually none of these groups are congruent; none are aligned with any political or geographical entity of these United States. We are a three dimensional matrix with so many separating planes that relatively few of us are accommodated within any one pigeonhole and there is no major plane of symmetry analogous to that which divided this nation a century ago. That overriding fact should give us the time and opportunity to work out our solutions.

Progress was never easy, never without conflict. Mr. Jefferson said to the Marquis de Lafayette that "We are not to expect to be translated from despotism to liberty in a feather bed." And in a letter to W. S. Smith that "The tree of liberty must be refreshed from time to time with the blood of patriots and tyrants. It is its natural manure." Man has come a long way from his animal origins and he will continue to progress — and the issues, tomorrow as in the past, must always be sharpened by conflict.

But with respect to the population explosion, Mr. Jefferson missed the mark. In his first inaugural address he spoke of ". . . a chosen country with room enough for our descendants to the thousandth and thousandth generation . . ." and we are but eight generations since. This giant, who speaks to us across time, well understood the principle of compound interest but never thought to apply it to the growth of a living population! It may surprise you, however, that long before, Aristotle, who was concerned with the economic rather than the nutritional consequences of overpopulation, warned in "Politics" that "Neglect of an effective birth control policy is a never failing source of poverty which is, in turn, the parent of revolution and crime." Painfully, we have learned the truth of his prediction — that many of the most tragic ills of human existence find their origin in population growth. Hunger, pollution, crime, despoliation of the natural beauty of the planet, the irreversible extermination of countless species of plants and animals, overlarge, dirty, overcrowded cities with their paradoxical loneliness but invasion of privacy, continual erosion of limited natural resources, and the seething unrest which can create political instability and lead to international conflict and war — all these and more derive from the unbridled growth of human populations.

Yet it is evident that, in thirty years, spaceship Earth must support **six to seven billion humans. Minimizing that growth should be the**

overriding concern of all responsible citizens, nations, and international organizations. The minimal tools in the battle to abate this process are massive educational campaigns and the availability of cheap, effective, safe, reversible contraceptive techniques. No currently available practice totally meets these criteria. But while we get on with the necessary research, available procedures permit millions of families happily to plan with confidence while the lives of thousands of women are spared and our society is protected in some measure from the consequences of its own fecundity.

It should not be thought that the population problem relates only to corners of the earth where few of us wander. Our current national growth rate is of the order of one per cent per year; a doubling time of seventy years. We now accumulate more than two million additional individuals annually, not so much by virtue of increased birth rates as by decreased death rate. That seemingly small order of growth is not tolerable over historic time. We shall surely have three hundred million Americans in the year 2000. But we already have all the variety of genotypes required for the nation in the arts, commerce, industry, government, and education. The task of finding space and building housing, schools, hospitals, roads, and parking spaces for one hundred million people is a challenge greater than any we have yet met. The impact on the quality of our national life is not pleasant to contemplate. Surely, the time has come for American business to forego population expansion as the basis for economic growth.

Family planning (which relates to the spacing of the number of children desired by each couple) will no longer suffice. The national birth rate must be reduced to the bare replacement rate and that means a dramatic break from an American ethos which was appropriate when we needed an expanding body politic to populate our expanding frontiers, and which rested on the unchallenged precepts of St. Augustine. That day is gone and we must re-examine its legacy if our progeny are to enjoy the bounties of this once beautiful land.

Associated with population growth is the urgent need to avert the catastrophe of famine. Unfortunately, populations are growing most rapidly in those nations which can least afford it. In South America and Asia, population growth exceeds the growth of the GNP; since, even now, much of the population lives at minimal subsistence levels, humanitarian considerations dictate that there can be no accumulation of the surplus capital so badly needed to bring these nations into the modern era. In several such nations population growth keeps pace with or exceeds the growth of their food supply. Caloric starvation, protein malnutrition, and acute vitamin A deficiency remain major nutritional problems but are due more to ignorance and local maldistribution than to production failures. That famine is unnecessary has

been demonstrated this year in India, Pakistan, and the Philippines. But the benefits consequent upon planting the new strains of rice and wheat accrue only to relatively large-scale planters who can also avail themselves of credit for fertilizer, seed, gasoline, and tractors while undertaking adequate irrigation. Since in these countries, to say nothing of Africa, South America, and the rest of Asia, most farming is family subsistence farming, financing with external capital from the developed nations must precede introduction of these new strains and only if both are successful will famine be averted in the most seriously affected nations.

To what extent the developed nations will be willing to tax themselves for this purpose remains to be seen — and yet the history of man on this planet may well hinge on this decision.

But the ominous predictions of Malthus, a contemporary of Mr. Jefferson, need not be vindicated. There is no prospect of worldwide famine. Indeed, since 1960 populations, worldwide, have been growing 1.7 per cent per year while the food supply increased by 3 per cent a year. Despite the population growth, were it not for a continuing increase in per capita food consumption, by 1975 there would have been an annual worldwide surplus of about 50 million tons each of wheat and rice.

The principal contributor to the “green revolution” which has expanded food production in the more fortunate areas of the globe has been the application of fertilizer. Oh! How Mr. Jefferson would have enjoyed using chemical fertilizer at Monticello! Ten dollars worth of fertilizer per acre results in an almost 50 per cent increase in yield. If you prefer, one ton of fertilizer nitrogen increases the crop by the equivalent of the basic productivity of fourteen acres of average tillable soil. Were this raw information put into practice, worldwide, the area now under cultivation could support a population more than two or three times our current numbers. Accordingly, the Malthusian gloom that doomed the world ever to know hunger and poverty has been dispelled by modern agricultural understanding and the prospect of population control.

It was precisely this kind of science Mr. Jefferson had in mind. And so, it is heartwarming to note that the scientific basis for modern agriculture arose out of that remarkable invention of American society, the agricultural colleges of the land grant schools, and thereby set the stage for the scientific revolution.

Of all current disaffections, that which affords me greatest concern in the growing belief among our young people that “science is not relevant.” Their frame of reference is the noble concept that the purpose of organized society is to provide maximal opportunity for each citizen to explore to the full his own potential. The notion is not

new—but never before could any country so aspire. Truly, it is a philosophy for the country which has everything.

Our youth see a world in which war has not yet been rejected as an instrument of national policy, in which ancient injustice persists. They are outraged that Americans are hungry in Harlem, starving in Mississippi, and dying in Vietnam. They join their elders in concern for the deterioration of the physical environment, and of the quality of American life. Associating many of these national and international tragedies with the consequences of an advanced technology, unaware of the subtle relationships between science and technology, they reject science as irrelevant to their view of the better life. This rejection is evident in proportionally decreasing enrollments in the natural sciences and it is stated explicitly by articulate student leaders on every campus.

Nor are they alone. Although our representatives in government have not yet rejected science as irrelevant, they are, nevertheless, disenchanted and disheartened. Ignoring the demonstrated potential of science for the alleviation of the ills of mankind, they join our youth in holding the scientific community responsible for the threats posed by nuclear, chemical, and biological weapons and all forms of environmental pollution. While that state of mind persists, quite apart from the financial consequences of the Vietnam war or any massive social action programs, there can be little likelihood of renewed growth of federal funding of scientific research.

Our disenchanted youth exercise their right to dissent, but all too frequently abuse that blessed American privilege, which was defended by Mr. Jefferson throughout his life. He was speaking of religion when he said that “no provision in our Constitution ought to be dearer to man than that which protects the rights of conscience against the enterprises of the civil authority.” One can only gasp at the magnanimity of one who, after perhaps the most vicious political battle in our history, could proclaim that “If there be any among us who would wish to dissolve this Union or to change its republican form, let them stand undisturbed as monuments of the safety with which error of opinion may be tolerated where reason is left free to combat it.” Was it with premonition of today’s problems that he said that “The article of discipline is the most difficult in American education. Premature ideas of independence, too little repressed by parents, beget a spirit of insubordination which is the great obstacle to science with us, a principal cause of its decay.”

With what remarkable foresight did Jefferson write to John Adams, “Our postrevolutionary youth are born under happier stars than you and I were. They acquire all learning in their mother’s womb and bring it into the world ready made. The information of books is no longer necessary and all knowledge which is not innate is in contempt or neglect at least.”

As I view our young people sometimes occupying buildings, shoutings imprecations, denying the platform to those with whom they disagree, clear about what they dislike, willing to tear down that which has so carefully been erected yet with no image of what shall take its place, they seem to be guided into anarchy by the words of T. S. Eliot:

Oh dark dark dark. They all go into the dark,  
the captains, merchants, bankers, eminent men of letters  
the generous patrons of art, the statesmen and the rulers  
distinguished civil servants, chairmen of many committees  
industrial lords, and petty contractors, all go into the dark.

But if they will not heed Mr. Jefferson, I could wish that they would listen instead to the voice of Dylan Thomas, more nearly of their own generation:

Do not go gentle into that good night . . .  
Rage, rage against the dying of the light.

Let them indeed rage but let them rage positively, constructively, and to good purpose.

Understand that I would not minimize the problems of the day or the seriousness of our young dissenters. Our laws *are* insufficient guide. The line between permissible and unacceptable forms of dissent is conditioned by the values and social standards of the time — and these are in flux. Clearly, to take over the university president's office remains out of bounds, but when students may properly hold a counter demonstration or protest rally on the campus lawn is certainly moot. This nation's ability to deflect the rising tide of discontent into constructive channels will depend on our willingness to requite the legitimate grievances of the disaffected parts of our society for whom the youth speak. Every channel must be kept open for the orderly voicing of dissent and the airing of grievances. Reform in so many areas of national life is overdue that the dissatisfaction and resentment boiling beneath the surface will surely erupt. Government and academic authorities need adhere strictly to the letter and spirit of Constitutional guarantees of free speech and assembly — lest we pay a dreadful price.

Unless the idealism of youth, the principal ingredient of dissent, is harnessed to the purposes of society, its ferocious energy will be exploited by extremists and demagogues and this nation will surely suffer. It is clear that this country will never again return to earlier, easier attitudes and values. American life can never be the same. Burke said that "A state without the means of some change does without the means of its conservation." Our Constitution has demonstrated that it provides those means — and, make no mistake, they will be employed.

I grant with our students that science alone is an insufficient handle on the future. But I know no one who ever thought it was. This country has never had a coherent science policy. The remarkable burgeoning of science and even more remarkable support of science by the federal government for the last two decades are almost an historical accident. It was brought about, in some part, by the Old Left, born of the Depression, who came to maturity in a day when national concern was necessarily with the most material aspects of national survival: defense, full employment, provision of food and shelter, alleviation of disease, and economic growth.

The imminence and actuality of World War II rescued us from the Depression, from which we emerged stronger, more affluent, and even more numerous than before. In the years since, the remarkable prosperity, shared by perhaps four-fifths of our citizenry, has been in no small measure the consequence of an economy of waste with huge expenditures for the national security and, more recently, for the effort in space. Ironically this course has assured full employment and radically changed the life-styles of the American people, for most of whom life is more comfortable than at any time in the previous history of any nation. This situation, seemingly deplored by our young, was not predicted by any school of economic thought.

The remarkable national transformation from 1929 to 1969 was the consequence of the operation of the agricultural and scientific revolutions. With those revolutions came unplanned, unforeseen, and undesirable consequences — deterioration of the environment and large-scale translocation of a considerable fraction of our national population. The latter accelerated the deterioration and marked overcrowding of our major centers of population, our first taste of the consequences of overpopulation, at least one aspect of which was ruefully foreseen by Mr. Jefferson in a letter to James Madison — “When the people get piled upon one another in large cities as in Europe, they will become corrupt as in Europe.”

Nevertheless yesterday’s new technologies engendered a great leap forward for civilization. Technology is responsible not only for our material well-being but for the new Enlightenment. Our seemingly new-found heightened concern for the welfare of our fellow man is in large measure engendered by the great wealth which will not permit us, in good conscience, to ignore long recognized but ignored disparities and by the fact that the illiterate and uneducated, once an economic asset as a pool of unskilled labor, are no longer so needed. Their meager salaries have been replaced by an expensive, dehumanizing welfare system and crime in the streets.

But what handle do we have on the vast problems of poverty, pollution, population, and the rest? By what means shall we make a better

tomorrow? I know of none but the wise application of yet more technology rooted in the science already available and that to be developed in the years to come, examining carefully all conceivable consequences of each new technology before its introduction into society. Those who scoff offer no alternative.

That notion is so obvious it is difficult to understand why it has been rejected by the idealistic young or their non-scientist elders. The technological challenges of tomorrow are imperative and enormous; the rewards of successfully meeting those challenges will be equally great. Tomorrow we must do better than simply avoid our problems or patch them — we must create a human environment. To do so we will need new types of research centers in which aggregations of natural scientists, engineers, ecologists, city planners, highway planners, physicians, agronomists, and behavioral scientists can work in concert. It is to be hoped that such institutions will be brought into being on university campuses, staffed by some of their finest scientists. After such institutions provide the necessary planning, the chief obstacles to their implementation will be legal and political. Overcoming those may well prove more difficult than will devising the technological solutions. The task is to construct a truly human environment and we do not know what that should be like. The manifestations of malaise in the cities — crime, neuroses, ulcer, hypertension — may well be the response of man to an essentially non-human environment, analogous to the stereotyped pacing of a polar bear in the zoo — his response to a non-bearlike environment. It is only a few generations, in the evolutionary sense, since our ancestors, whose genetics were much like ours, achieved domination over all other species. But they were free-roving creatures who could not conceivably have adapted to Watts, Bedford-Stuyvesant, or even Richmond. We need to learn more about optimal population density, the influence of architecture on behavior, where to put roads, airports, shops, schools, churches, museums, and theaters and to test these hypotheses by building experimental cities and towns.

Before confrontation with that next one-hundred million Americans, it is time to plan our entry into the twenty-first century. To do so will require a vast research enterprise. A host of problems, large and small, claim our attention: improved communication, transportation within and between cities, substitutes for the non-degradable containers which litter our countryside, species-specific pesticides, a completely overhauled education system, how to live with narcotics, particularly marijuana, the closet approach yet to the “soma” of Huxley’s “Brave New World” — problems without end.

The diseases which beset man still claim their toll and since the possibilities of genetic engineering must be put aside to a rather remote future and the principles of prevention of noninfectious disease remain



obscure, only an improved armamentarium of drugs offers immediate hope. But in most cases the design of such drugs must await greater insight and understanding of disease in molecular terms. Acceptable low-cost housing is a self-evident national need; again, the technical problems of materials and construction techniques are probably more tractable than the social problems of land use, labor practices, acceptance and utilization, the behavioral patterns of human communities, and so forth. And our students say that science is not relevant!

Nor would I discount the social benefit which comes to a community with the very performance of the research endeavor. Creative scientific research is one of the very purposes of our society akin to imaginative scholarship in the humanities and innovation in the arts. Surely, no other course available to this civilization is as hopeful as the continuing subtle interplay of science and developing technology.

No guarantee of success may be offered. But if we forswear more science, surely there can be no beautiful clean cities, no new foodstuffs, no new cures for disease, no new means of mass transportation, no means to salvage our once beautiful landscape, no control but nature's own brutal feedback to level off human populations.

No systems analysis indicates the proper magnitude of the national annual investment in research. As our students tell us, we have not established priorities among our national goals. Patently, attainment of each will require substantial new understanding obtainable only by further research. But how much research — and what kind? The scientific community has repeatedly avoided requests to establish scientific priorities; by default, these have been set by the political apparatus. This course was without serious penalty as long as appropriations for all areas of science continued to rise. Now, however, formulation of those priorities is unavoidable. In seeking incremental funds, the academic and scientific communities must convince the nation of the logic of their choices among many options. Which of the large projects now before us for funding deserve the highest priority? Are there scientific areas where the societal return is predictably greater or sooner than others? What level of research is necessary to maintain the quality of teaching in a university? What is the justification for doing any more? Should any restricted research be conducted on campus and, if not there, where? The scientific community owes it to the Nation to respond, not out of parochial disciplinary interest but by thoughtful evaluation of the possibilities inherent in each area of science both for the enrichment of our intellectual life and for the material benefit of our fellow citizens.

The question is not, therefore, whether man can live with technology; the question is whether man can learn to live with himself. **Toynbee said that "twentieth-century man will not be remembered for**

having invented the atomic bomb, but for having dared to think that, through science, he can achieve the good life."

But what is the good life? Who are its custodians? In Stockholm, recently, at a symposium on "The Place of Value in a World of Fact," Arthur Koestler accused scientific teaching of leading to a sense of the ultimate meaninglessness of life. He contended that this is the necessary consequence of the reductionism by which is man reduced to nothing but a complex biochemical mechanism that energizes his brain which is merely a large computer with tremendous storage facilities for retaining information. He found intolerable the notions that biological evolution is naught but random mutations preserved by natural selection and mental development the consequence of simple random tries preserved by reinforcement. The scientists present objected vigorously but, in truth, they offered no genuine alternative and perhaps protested overmuch.

Why are non-scientists disturbed by science? Surely the problem is not abuses of nature by technology; we never have done as well. Nor is it abuse of our fellow man; concern for our fellows has never been more acute. If science is troubling, it is because many are permanently humiliated by lack of understanding of science and its tools; it is because of real or imagined abuses of power for which science is held accountable. Most importantly, as Nietzsche stated it, "All sciences today work for the destruction of man's self-respect." He meant that we stand revealed as a speck in the cosmos, a fleeting moment in time, a random event in earth's history. Kant also admitted his concern that man is but a stranger in a cosmos where he has no appointed or necessary place. If that is all we are, life is not tolerable and the bases of our ethics lie in shambles. But, whether random event or created in the image of the Almighty, man knows love and beauty; he wrote Hamlet, the Psalms of David, and the St. Matthew Passion, painted The Night Watch, built Monticello, the Taj Mahal, and the Lincoln Memorial, and breathed life into the stone of Michelangelo's Moses. And so, somehow, something more than the sum of his parts, he is worth preserving.

Nor would I have him desist from inquiry. Mr. Jefferson said, "There is no truth on earth which I fear to be known." A scientist can recognize no higher credo.

It is the humanists who are or should be the repository of values; theirs is the task of explaining why life is worth living. Unhappily literature and the arts, as taught on campus, have been found wanting not only by the young but by the very practitioners of the humanistic disciplines, their own severest critics. Yet the humanities should offer greater insight into the problems of our times, foster awareness of the continuing tradition of our civilization and the forces which have

molded us; they must be the watchful guardians of the experience of our race in an anthropological sense. Surely it is for the humanities to inculcate a thirst for beauty, an appetite for life.

I submit that they have failed. Once I equated the humanities with philosophy, understanding of man in the past and in the present. But practitioners of the humanities too often display their involvement with the petty or subtle and fail to convey to the student a sense of beauty or the joy of literature. Meanwhile, their philosopher colleagues retreat into study of linguistics or symbolic logic. I could wish they would leave logic to the scientists and make passion their own. A computer analysis of Milton may intrigue the pseudoscientific scholar but it does not enrich his student or illuminate yesterday or today for him. If it be true that Dante, Shakespeare, and Sophocles are as valid today as they were yesterday, and will be tomorrow, let this be shown. If one can construct a rational ethic, if there be a platform on which one can discuss values and morals, let this be known. Yet, in my hearing it is, rather, the scientists and engineers who challenge the morality of their own actions. But science itself, which so dominates our culture, is amoral, not immoral. Its wise application must rest on a morality which only humanists can establish. Adlai Stevenson said, "I pray that the imagination that we unlock for defense and arms and outerspace may be unlocked as well for grace and beauty in our daily lives. As an economy we need it, as a society we shall perish without it." And John Kennedy wrote, "There are many kinds of courage but perhaps the rarest courage of all and the skill to pursue it, which is given to very few men, is the courage to wage a silent battle to illuminate the nature of man and the world in which we live." To illuminate the nature of man. That must be the essence and inherent strength of humanistic scholarship.

When Mr. Jefferson introduced his Bill for the Diffusion of Knowledge, which led to the creation of this great institution, he spoke of it as "a keystone of the arch of government." Later, he listed the disciplines which should comprise university education. The history of the University is ample testimony to the validity of that early prescription, but the institution he founded has acquired a responsibility far beyond any vision of his day. He said that "knowledge is power" but could not have foreseen the remarkable truth of that assertion in the twentieth century or the unique rôle of the university not only in the transmission but in the generation of new knowledge. If today and tomorrow our universities are successful, so too will be our society; should they fail, we fail. But success will require substantial change from the past. The old disciplinary names, dear to the organizational structure of the university, have lost their meaning as the universe, from molecule to man to society to the cosmos, becomes understandable

as a single continuum. New alignments, new juxtapositions of information and concepts, new insights are required. No problem of our society can uniquely be engaged by the practitioners of a single classical discipline. Academic and societal success, tomorrow, can only be attained by the commingling of what, yesterday, we called disciplines, sorting out what is truly relevant, truly valuable, truly meaningful. The university must learn to do so while there is still time — if there is still time.

The brain of man has not increased significantly since his Cro-Magnon ancestor, perhaps not for many millennia before. When, one day, man accepts responsibility for his newly acknowledged power to control his own genetic destiny, his decisions must be based on value judgments rooted in certainty of the values toward whose realization he is to strive.

Man's view of himself has undergone many changes. From a unique position in the universe, the Copernican revolution reduced him to an inhabitant of one of many planets. From a unique position among organisms, the Darwinian revolution assigned him a place among the millions of other species which evolved from a primitive ancestor. Yet man has overcome the limitations of his origin. He controls the vast energies of the atomic nucleus, moves across his planet at speeds barely below escape velocity but can escape when he so wills, communicates with his fellows at the speed of light, extends the powers of his brain with those of the digital computer, and determines the numbers and genetic constitution of virtually all other living species. Now he can guide his own evolution. In him, wonderfully, nature has reached beyond the hard regularities of physical phenomena. Homo sapiens, the creation of nature, has transcended her. From a product of circumstances, he has risen to responsibility. Soon he will be Man. May he then behave so!

**Note: Dr. Philip Handler's Convocation Address, "The University in a World in Transition," published herein, is one of the Sesquicentennial year addresses that is also being published by the University in the *Virginia Quarterly Review*. The texts of all the public addresses and lectures by visiting scholars during the anniversary year have been placed in a Sesquicentennial Archive in the Alderman Library, where copies can be made for interested persons.**

## Sesquicentennial Calendar of Events, 1969

### *January 19*

Charter Day Dinner  
Concert—The Hague Philharmonic

### *January 23*

Dinner—Newcomen Society in North America  
Address by President Shannon  
Hotel Pierre, New York City

### *February 17*

Presentation of Jean Anouilh's *Antigone*  
Le Treteau de Paris

### *March 7-8*

Symposium: "The United States in World Affairs: The Next Decade"  
Woodrow Wilson Department of Government and Foreign Affairs

### *March 11-15*

#### SESQUICENTENNIAL VISITING SCHOLARS

#### "The Dynamics of Information"

Frederick B. Thompson  
*Professor of Philosophy and Applied Science*  
*California Institute of Technology*

#### "The Artist: Prophet or Victim?"

William C. Seitz  
*Professor of Fine Arts*  
*Director of Rose Art Museum*  
*Brandeis University*

#### "Creativity in an Automated Society"

Panel featuring Professors Seitz and Thompson

### *March 14*

Concert—Haydn's *The Seasons*  
University Glee Club and Department of Music

### *April 10-11*

Symposium: "Advances in Liquid State Theory"  
Department of Chemical Engineering

*April 10-12*

**Symposium: "Mass-production Justice and the Constitutional Ideal"**  
**School of Law**

*April 11-12*

**Southeastern Renaissance Conference**  
**Department of English**

*April 14*

**FOUNDER'S DAY**

**Morning: Three Symposia on "The University in Public Service"**  
**"The Future of the University in Education for Public Service"**  
**"University Research and the Public Interest"**  
**"The University and the Urban Crisis"**

**Afternoon: Academic Procession, Founder's Day Address**

**"The Idea of a University"**  
**The Honorable Esmond Wright**  
***Professor of Modern History, University of Glasgow***  
***Member of Parliament***  
***Graduate of University of Virginia***

*April 16-30*

**SESQUICENTENNIAL VISITING SCHOLAR**

**Robert Lowell, Poet**

*June 17-19*

**Symposium: "Global Systems Dynamics"**  
**Division of Biomedical Engineering**

*September 23-27*

**SESQUICENTENNIAL VISITING SCHOLARS**

**"The Political Hero in America—His Fate and His Future"**

**Mrs. Fawn Brodie**  
***Senior Lecturer in History***  
***University of California at Los Angeles***

**"Economic Freedom in an Interdependent World"**

**Peter Jay**  
***Economics Editor***  
***The Times, London***

**"The Future of Political and Intellectual Freedom: Reflections of a Lawyer"**

**Herbert Wechsler**  
***Harlan Fiske Stone Professor of Constitutional Law***  
***Columbia University***

**"The Future of Political and Intellectual Freedom"**  
Panel featuring Mrs. Brodie and Messrs. Jay and Wechsler

*October 2-3*

**Symposium: "Geological Models"**  
Corcoran and Rogers Department of Geology

*October 7-9*

**Fourth Astrometric Conference**  
Department of Astronomy

*October 8-11*

**Symposium: "Allegiance and Hostility: Man's Mammalian Heritage"**  
Graduate School of Business Administration

*October 17-18*

**COMMONWEALTH WEEKEND**

Honoring Legislature and State Officials

*October 19-21*

**SESQUICENTENNIAL CONVOCATION**

**Sunday:** Registration of Delegates, Reception at Monticello

**Monday Morning:** Three Symposia on "Modern Man and the Enlightenment"

**"The Enlightenment: Fossil or Force?"**

Peter Gay

*Professor of Comparative European Intellectual History*  
*Yale University*

**"Mass Society and the Values of the Enlightenment"**

Raymond Aron

*Faculté des Lettres*  
*University of Paris*

**"The Enlightenment and the Perils of Prophecy"**

Daniel Boorstin

*Director*

*National Museum of History and Technology*

**Monday Afternoon:** Two Symposia on "Modern Man and the Finite World"

**"The Genetic Future of Man"**

Philip M. Hauser

*Director*

*Population Research and Training Center*  
*The University of Chicago*



**"The Future of the City"**

Athelstan Spilhaus

*President-Elect*

*American Association for the Advancement of Science*

**Monday Evening: Convocation Dinner, Concert by the Boston  
Symphony Orchestra**

**Tuesday Morning: Academic Procession, Convocation Address**

**"The University in a World in Transition"**

Philip Handler

*President*

*National Academy of Sciences*

**October 23-25**

**Meeting of American Society of Aesthetics  
Department of English**