HIGHER EDUCATION IN AN AGE OF SPECIALIZED KNOWLEDGE
JAROSLAV PELIKAN LECTURE
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Jaroslav Pelikan is rightly hailed as the scholar's scholar. One of the leading scholars in the world on medieval intellectual history and an authority on the evolution of Christianity, he writes with great grace. His lectures are eloquent. Indeed they are gems. He is a great scholar and a great teacher. He is the living proof that great scholarship and great teaching are compatible.

I am here this evening to pay homage to my friend Professor Pelikan on the occasion of his 80th birthday. When James Billington, the keeper of our nation's memory and record, asked me to give a lecture on this august occasion, he did not specify the topic. At first, I thought perhaps I should give a lecture in the form of a commentary on Edward Gibbon's chapter on *The Origin and Doctrine of the Paulicians*, in volume 3 of his classic *The History of the Decline and Fall of the Roman Empire*. After all I had read about the impact of the Paulicians on the Armenian Church and its reaction against them. I was especially intrigued by the fact that the Paulicians of Thrace resisted the storms of persecution, maintained a secret correspondence with their Armenian brethren and gave aid and comfort to their preachers, who solicited, not without success, the infant Christian faith of the Bulgarians. Another choice of mine was to comment on the struggle between Unitarians and Trinitarians, or to speak about whether or not Islam was a logical extension of Judeo-Christianity and whether or not it arose as a result of the influence of the Mystery cults of Christianity.

(Unitarians and Muslims both believe that the New Testament is an uncertain guide to the actual events of early Christianity. Muslims regard the books of the New Testament as mainly the product of the followers of Paul of Tarsus, "who did not know Jesus.")

I felt to do this in the company of so many real experts would be a presumption. Therefore I decided to speak about AMERICAN HIGHER EDUCATION as a tribute to Professor Pelikan as an educator and an administrator.

For more than two centuries American colleges and universities have been the mainstay of our nation's progress, helping make it an economic, cultural, scientific, technological and political power. The American university is, incomparably, the most democratic in the world. It is popular in the best sense of the term, admitting and educating unprecedented numbers of men and women of every race and social class. Students from every imaginable background—and here I speak from personal experience—have found a place in this nation's incredible variety of colleges and universities, public or private, large or small, secular or sectarian. Today, there are almost 4,200 colleges and universities in our country, including some 1,700 public and private two-year institutions. Evidence of the growing centrality of higher education to American life can be seen in a few startling statistics: in the 20th century, total enrollment in institutions of higher education grew from just 4 percent of the college-age population in 1900 to more than 65 percent in the 1990s. And within two years of high school graduation, three out of four students go on for some higher education. Higher education employs more than 2.8 million people, including 590,000 full-time faculty members in what amounts to a $200+ billion enterprise.

The diversity of our higher education system gives it great strength. As Sheldon Rothblatt writes in *The Modern University and Its Discontents* (Cambridge University Press, 1997), "What makes the American case so interesting is the strong connection between American colleges and universities and the characteristics of American social life, principally its religious pluralism and ethnic diversity, its immigrant composition and its preference for market discipline interspersed with governmental efforts, many half-hearted or contradictory or unsystematic, to legislate or regulate."

Traditionally, individual institutions have emphasized different functions and have complemented each other by meeting different local, regional, national and international needs—by providing educational opportunities to a diverse population, by expanding scientific and technical knowledge, and by providing opportunities for continuing education. Rothblatt also points to this diversification as a strength, noting, "The history of American higher education is characterized by the growth of multi-purpose institutions which continue to add functions and responsibilities without disregarding older commitments. New constituencies and new tasks are absorbed comparatively readily…Market discipline has certainly contributed to the comparative openness and flexibility of American institutions as a condition of survival in the public as well as private sector."

Because American higher education seems to have the capacity to be in tune with and adjust itself to societal needs, it has responded to changing times, dispensing knowledge, training and even life skills that have provided graduates with the tools to, in essence, create the nation's future. In my opinion, the "secret weapon" behind this flexibility is the emphasis, in American colleges and universities, on the liberal arts, which—as we move into an era of complexity, of information overload and of workplaces that demand multiple skills and wide-

ranging knowledge for even entry-level positions—provide a depth of experience and understanding that once again, is exactly right for the times. We have moved beyond the age when vocationalism was the watchword and one person was trained—and taught—to do one thing. Now, everyone needs to know something about almost everything, a task that a liberal arts student is certainly prepared for!

Universities have also educated the technical, managerial and professional workforce of the United States and helped to develop generation after generation of national leaders. The unparalleled capacity of higher education institutions to carry out basic research has put the U.S. at the cutting edge of science and scholarship in the humanities and social science. Without this vast network of colleges and universities, the nation would never have achieved its current overall preeminence.

As we face higher education's challenges and consider ways to cope with them, we must remember that the university, in the West, is the result of some eight centuries of struggle, oppression, perseverance and endless refinement. The university is a living institution and change, it must. But as we make changes, we must be careful not to inadvertently undermine its foundations, muddle its architecture or reduce its priceless value to society. And we must recognize that its success is based in large part on the fact that our nation's institutions of higher education operate in an American tradition of freedom, openness, egalitarianism and equal access. Nothing must be allowed to diminish these principles.

There are a number of prominent landmarks along the American university's journey to its current place of preeminence; examining them can help us understand both the great ideas

and true ideals that have shaped American higher education and continue to be its unbendable backbone. A few examples:

The first major opportunity for American higher education came in 1862, when Congress enacted the Land-Grant College Act, better known as the Morrill Act. The law was named after Justin Morrill. Before becoming a U.S. Representative and then a U.S. Senator from Vermont, Morrill had been a dry goods merchant, coming from a family that had been too poor to send him to college. The law extended the opportunity of higher education to all Americans, including such disenfranchised groups as women and minorities. In effect, the law spread higher education all over the United States. It put universities where the people were. It provided education and specialized training, and it spurred the development of both theoretical knowledge and its practical applications. The Industrial Revolution was in full swing then, and the Morrill Act helped provide the research and educated workforce that were so desperately needed in agriculture and manufacturing. Among other things, the law is credited with making the United States the world leader in agricultural production.

Under the law, states were permitted to sell large tracts of federal land and use the proceeds to endow, in perpetuity, at least one public college in every state. Since their founding, Land-Grant colleges and universities have awarded more than 20 million degrees and they now annually award degrees at the rate of about 500,000 a year, including a third of the nation's bachelor's and master's degrees and 60 percent of the doctoral degrees.

In 1863, at the height of the Civil War and a year after the passage of the Morrill Act, President Lincoln signed another piece of landmark legislation—a law that created the National Academy of Sciences. The Academy, which was established to advise Congress on

"any subject of science or art," has done that job well and expanded to include the National Research Council, the National Academy of Engineering and the Institute of Medicine. It is extraordinary to consider that even while the nation was engaged in the devastating and heart-wrenching civil conflict that could have destroyed the United States as we know it, the president and Congress were still thinking of the future and of how to expand educational opportunities for Americans.

It was not until after World War II, though, that the federal government began supporting university research in a significant way. Prior to the war, the best research was done in Europe and in corporate laboratories. To strengthen the U.S. role in science, President Franklin D. Roosevelt asked his science adviser to develop a strategy. The adviser was Vannevar Bush, a former professor at the Massachusetts Institute of Technology. His landmark report was published in 1945 and it defined our postwar national policy in science.

In his report, entitled *Science—The Endless Frontier,* Bush noted that that business and industry naturally took the lead in applied research but were deterred by marketplace considerations from conducting much basic research. Bush argued that it was the federal government's responsibility to provide adequate funds for basic research, which pioneers the frontiers of human knowledge to the benefit of society. He also wrote that the nation's universities were, by their very nature, best suited to take the lead in conducting basic research. Public funding, he said, would promote competition among researchers, and projects could be selected on their merit through a peer-review process. Bush suggested that a federal agency should oversee the program, and Congress created the National Science Foundation to do this job in 1950.

Giving universities the lead in basic research turned out to be a brilliant policy. Instead of being centralized in government laboratories—as science tended to be in other parts of the world—scientific research became decentralized in American universities. This policy spurred a tremendous diversity of investments. It also gave graduate students significant research opportunities and helped spread scientific discoveries far and wide to the benefit of industry, medicine and society as a whole.

At the end of World War II, President Roosevelt signed into law the Servicemen's Readjustment Act of 1944, better known as the "G.I. Bill of Rights." This legislation ranks in stature with the Morrill Act and is widely recognized as one of the most important acts of Congress. The law made an already democratic higher education system open in ways that were inconceivable anywhere in Europe. Among other things, it opened the doors of the best universities to men and women who had never dreamt of going to college. It also created a national fondness for university life that redounded to the advantage of the academic profession—as many who benefited from the law stayed on to teach. In 50 years, the G.I. Bill, and its legislative offspring enacted during the wars in Korea and Vietnam, resulted in the public investment of more than $60 billion in education and training for about 18 million veterans, including 8.5 million in higher education. Currently, the nation offers education benefits as an incentive for people to join the all-volunteer military forces.

In a more recent effort to promote international cooperation and security, Congress enacted the National Security Education Act of 1991, which provides scholarships for undergraduates and graduate students to study many of the less-well-known languages and cultures in key regions of the world, including some in Central Asia and the Middle East.

Another major landmark was the creation of federal loan guarantees and subsidy programs as well as outright grants for college students. In the 30 years since its founding in 1965, the Federal Family Education Loan Program has funded more than 74 million student loans worth more than $180 billion. And in the 25 years since the 1973 Pell Grant program—named after Senator Claiborne Pell— was created, more than $100 billion in grants have been awarded to an estimated 30 million postsecondary students. It is important to note that originally, Pell grants were to have been funneled directly to institutions, but with the passage of the Higher Education Act of 1972—which was influenced by the work of Clark Kerr and the Carnegie Commission on Higher Education—control of the largest share of financial aid dollars was shifted from institutions to individuals, very much in keeping with the American character.

In sum, the Land-Grant colleges, the National Academy of Sciences, the G.I. Bill and the federal investments in university research, international studies and student assistance—all of these landmark events helped American higher education flower into the most diverse and creative system in the world. As we enter the 21st century, let us also observe that the United States has democratized access to higher education and attempted to nationalize opportunity at a scale unprecedented in world history.

But in this context, we also must consider what it is that has given higher education its authority, credibility, creativity and its leadership role in our democracy. And I have an answer: it is the strength and boldness that academic freedom has brought to American education.

Academic freedom was not a gift, of course. It emerged slowly with the university, in Europe during the Middle Ages. Scholars enjoyed a certain amount of intellectual freedom in those early days, but we all know the cautionary tales of Galileo and others who suffered for sharing their ideas. When knowledge challenged theology or ideology, it was often manipulated or suppressed by church or state. But as religious beliefs diversified, with Protestantism, in particular, a right to follow one's own conscience and intellectual freedom gained ground.

Academic freedom has become an accepted democratic value, but it is not always well understood or fully appreciated—and that makes it vulnerable. In his book, *The Story of American Freedom,* Eric Foner writes: "Americans have sometimes believed they enjoy the greatest freedom of all—freedom from history…But if history teaches anything, it is that the definitions of freedom and of the community entitled to enjoy it are never fixed or final."

Today, as competing ideologies ramp up their attacks on each other and vie for prominence on the world stage, it is critically important that American institutions of higher education continue to provide not only a safe place for dialogue, but a place where debate is welcome and where even warring voices can be heard and acknowledged. A suppressed opinion, I believe, is worse than an offensive one. Academic freedom—the cornerstone of our American universities—is also what nourishes the nation's freedom of speech. As Hubert Humphrey said, "Freedom is hammered out on the anvil of discussion, dissent, and debate." If that's true—and I believe it is—then there is no more powerful hammer in the American arsenal than our diverse, accessible and glorious system of higher education.

That's the good news.

The bad news is that mass higher education is not living up to its promise. One of the starkest measures of this failure is that 60 percent of students in community colleges and 40 percent of students in four-year colleges leave school without completing their degrees.[i] These drop-out rates have drawn public attention to a wide variety of related problems, ranging from failures in our K-12 system to the rising cost of higher education.

Today, I'd like to highlight what I believe to be one other major failure of our higher education. In our rapid expansion of higher education, it has, to a significant degree, come to serve as a job readiness program, and sometimes not a very effective or efficient one at that, as drop-out rates and studies suggest. Generally speaking, higher education has lost sight of its primary mission: developing an educated and cultured citizenry to participate in and lead our democracy. This mission includes stirring students' intellectual curiosity, passion and ambition, as well as providing them with a good sense of ethics, history, science and culture—in other words, a good sense about the difference between making a living and actually living, between means and ends, and between individual rights and collective responsibilities. In this way, higher education must support the idealism and altruism of young people as they continue quests for fulfilling vocations. As Ellen Condliffe Lagemann writes, "The word vocation implies having a calling: knowing who one is, what one believes, what one values, and where one stands in the world… Granting, then, that a sense of vocation develops over time, it is still not unreasonable to suggest that one purpose of a college education, and a central purpose of liberal education, should be to nurture an initial sense of vocation."[ii]

Anyone who has spent time in a college classroom knows that is what students want from higher education. For most, college is a time for self-discovery, for developing passionate interests and trying to weave them into a meaningful career amid the looming pressures of the job market. Studies bear this out: in 1999, the Mellman Group surveyed college students under 31 years old and found that 80 percent said it is "very important" for them to find work that "will make a difference in people's lives." In 2002, the national survey of 282,000 freshmen done at UCLA found that the top reason for going to college was to "learn more about things that interest me." The next four reasons, offered by between 66 percent and 72 percent of freshmen, dealt with earning a living, starting careers and–please note—gaining "a general education and appreciation of ideas."[iii]

Unfortunately, and to the world's loss, there is strong evidence that higher education is not well designed to nurture this idealism. There are a great many reasons for this. I would like to focus on one of the fundamental problems, and start by citing a recent report on higher education that was produced by a blue-ribbon panel of educators and business leaders under the auspices of the Association of American Colleges and Universities.[iv] The national panel, chaired by Judith Ramaley at the National Sciences Foundation, called in 2002 for "a dramatic reorganization of undergraduate education."[v] One of the national panel's many important findings was that in this age of mass higher education our colleges and universities are falling back on an outdated factory model of education—only in this case, the assembly line is more like a chaotic maze where students try to pick up something useful as they search for the exit and the degree needed to find a decent job.

The report, entitled *Greater Expectations,* noted that today's students, much like students in the 1950s, fulfill general education requirements, take specialized courses in a

major and fill out their schedule with some electives. Although catalogs euphemistically describe this as a "curriculum," the national panel said it is rarely more than a collection of courses, devoid of planning, context and coherence. The panel said, moreover, that nothing had changed since 1985, when another association study concluded: "As for what passes as a college curriculum, almost anything goes."[vi] This is obviously no way to nurture or guide young people as they struggle with the meaning of life and ponder their role in society.

Underlying the fragmented curriculum is the utter fragmentation of knowledge itself on our campuses, the national panel reported in 2002. Higher education has atomized knowledge by dividing it into disciplines, sub-disciplines and sub-sub-sub-disciplines—"even though," as the national panel reported, "scholarship, learning and life have no such artificial boundaries." This trend, of course, has deep roots in simpler times and smaller colleges. But the trend has accelerated, breaking up our expanding knowledge base into smaller and smaller unconnected fragments of academic specialization even as the world looks to higher education for help in integrating and synthesizing the exponential increase in information. Higher education's structuring of knowledge, which has hardened into an academic bureaucracy, makes it administratively difficult for students to integrate knowledge in a multidisciplinary, interdisciplinary or transdisciplinary way.

Personally, I am concerned that mass higher education is heading toward what I call the Home Depot approach to education, where there is no differentiation between consumption and digestion, between information and learning and no guidance—or even questioning—about what it means to be an educated and cultured person. I do not believe the nation can afford to let higher education become an academic superstore, a vast collection

of courses, stacked up like sinks and lumber for do-it-yourselfers to try to assemble on their own into a meaningful whole.

This trend has serious ramifications for our nation. After all, Thomas Jefferson once described America as an idea—as a "crusade against ignorance." He fervently believed that a nation can not be ignorant and free. There are those of us today who are still optimists and who believe that societies become more democratic as people become more literate, numerate and knowledgeable. Our ability to generate, organize, distribute, and use knowledge more effectively is beneficial for our respective societies. Political empowerment and economic opportunity stem from the same root: the spread of knowledge. Understanding the nature of knowledge, its unity, its varieties, its limitations and its uses and abuses is necessary not only for the success of higher education and sciences but the fabric and texture of our democratic societies, as well. This is especially true now when so many questions are being raised about the ascendancy of mass society, technological anonymity, perceived loss of ideals of nature, cultures, personality, and the loss of a sense of place in a world that increasingly lacks human-scale.

Reforming higher education is, therefore, critical to our success as a democracy. It is a Herculean task, but one that "is long overdue," as the national panel stated last year. To date, our colleges and universities have largely avoided reform by sidestepping accountability for their students' and graduates' success and by resting on their laurels. It is my purpose today to honor and respect those laurels while also calling for higher education reforms that are needed to reconstruct the unity of knowledge.

Saying that higher education must promote unity in knowledge may initially sound esoteric, especially to some outside the academy, but it is really just shorthand for saying that the complexity of the world requires us to have a better understanding of the relationships and connections between economics and sociology, law and psychology, business and history, physics and medicine, anthropology and political science—namely, all fields that intersect and overlap.

One way to overcome fragmentation is called general system theory. It was conceived a half-century ago by Ludwig von Bertalanffy, a theoretical biologist who applied system methodology to psychology and the social sciences. What he wrote back then still sounds fresh today: "Our civilization seems to be suffering from a second curse of Babel: just as the human race builds a tower of knowledge that reaches to the heavens, we are stricken by a malady in which we find ourselves attempting to communicate with each other in countless tongues of scientific specialization… There is this hope, I cannot promise you whether or when it will be realized, that the mechanistic paradigm, with all its implications in science as well as in society and our own private life, will be replaced by an organismic or systems paradigm that will offer new pathways for our presently schizophrenic and self-destructive civilization." [vii]

General system theory is based on the idea that complex problems are best addressed as systemic inquiries, engaging many disciplines and many kinds of experts—who coordinate and synthesize information from the very beginning, and not as a final step.

As a society, we tend to pay lip service to the complexity of problems—and then continue to gamble on simplistic solutions, such as building prisons to solve the crime and

drug problems. But as Bela H. Banathy, a systems theorist, writes: "A technical problem of transportation, such as the building of a freeway, becomes a land-use problem, linked with economic, environmental, conservation, ethical, and political issues. Can we really draw a boundary? When we ask to improve a situation, particularly if it is a public one, we find ourselves facing not a problem, but a cluster of problems… It is difficult to pinpoint individual problems and propose individual solutions. Each problem is related to every other problem, each apparent solution to a problem may aggravate or interfere with others; and none of these problems can be tackled using linear or sequential methods."[viii]

Why has systemic thinking been slow to catch on, even though the pitfalls of specialization have long been discussed? It was, you may recall, the phenomenon of the modern specialist that prompted Dostoevsky to lament in *The Brothers Karamazov* about the scholars who "… have only analyzed the parts and overlooked the whole and, indeed, their blindness is marvelous!" In the same vein, José Ortega y Gasset, in his *Revolt of the Masses,* as early as in the 1930's, decried the "barbarism of specialization." He noted that though there were more scientists, scholars and professionals, there were fewer "cultivated" men and women who could integrate the achievements of civilization—as in using music to solve a physics problem, or vice versa.

One reason for this shortage of multitalented people is that the university, which was to embody the universe of knowledge, has become an intellectual multiversity. Of course, the process of both growth and fragmentation of knowledge has been underway since the 17th century, but it has snowballed in the last hundred years. The scope and the intensity of specialization is such that scholars and scientists have great difficulty in keeping up with the important yet overwhelming amount of scholarly literature of their sub-specialties, not to

mention their general disciplines. Even the traditional historical humanistic disciplines have become less and less viable as communities of discourse. As Wayne Booth put it wistfully in his 1987 Reyerson Lecture:

"Centuries have passed since the fateful moment, was it in the 18th Century, or the late 17th Century, when the last of the Leonardo da Vincis could hope to cover the cognitive map…since that fatal moment…everyone has been reduced to knowing only one or two countries on the intellectual globe…[in the universities] we are smitten in our pride…when for one reason or another, we discover just what a pitifully small corner of the cognitive world we live in… The knowledge explosion left us ignorant of vast fields of knowledge that every educated man or woman ought to have known."

Today, the faculties of our universities are confronted with the difficult choices of balancing analysis and synthesis, methodology and the relevant value of course content—and thus placing more and more responsibility on the students to form the synthesis. In our universities, the triumph of the "monograph" or "scientific investigation" over synthesis has fractured the "commonwealth of learning" and undermined our sense of commitment to the grand end of synthesis, general understanding and integration of knowledge.

In an insightful essay, entitled "Models of the Education Man," William Bouwsma wrote, "Specialization, instead of uniting human beings into a general community of values and discourse, by necessity has divided them into small and exclusive categories/coteries, narrow in outlook and interest." This, in turn, tends to isolate and alienate human beings. "Social relations…are reduced to political relations, to the interplay of competitive and often

antagonistic groups. Specialized education makes our students into instruments to serve the specialized needs of a society of specialists."

Bouwsma also noted that "…the idea of an educated man has been deeply affected by the 'knowledge revolution' out of which has emerged the conception of education as preparation for research. He continued, "As long as knowledge was limited, relatively simple, and not very technical, education could be fairly eclectic. Although it regularly emphasized the formation of character, it could attempt at the same time to discipline the mental faculties, provide a common culture and supply a minimum of substantive knowledge. Yet, obviously, the sheer bulk of the knowledge now deemed necessary for an educated man has been squeezed out of education, and for the most part, even out of our understanding of it… One result has been a broad decline in the idea of a general education, which for all practical purposes has become little more than a nostalgic memory. Indeed the body of requisite knowledge has become so vast that no one can hope to master more than a small segment of it. So in the popular mind, an educated man is now some kind of specialist: and in a sense we no longer have a single conception of the educated man, but as many conceptions as there are learned specialties."

Nowhere is this trend better reflected than in our evolving concept of literacy. It, too, has lost its unity. It, too, has been fragmented. According to the *Oxford Unabridged Dictionary*, "literacy" is the quality or state of being literate, or possessing education, especially the ability to read and write. Today, however, there is a profusion of required literacies; we have proponents of technological literacy, civic literacy, mathematical literacy, geographical literacy, scientific literacy, ethical literacy, artistic literacy, cultural literacy, analytical literacy, and so on. My favorite one is "managerial literacy." According to *The*

New York Times, this particular literacy includes 1,200 terms and concepts. We are told that if you are conversant with at least eighty percent of them you can confidently engage in "meaningful conversations with other experienced managers."

Erik Erikson once remarked that human beings are the "teaching species," and the corollary is that we are also the learning species. And it is clear from the literacy boom that we have never before had so much to learn. Learning to learn, then, has become one of the most important lifelong skills that education, especially higher education, can give students. And yet, paradoxically, higher education continues to provide an antiquated model for acquiring fragments of knowledge rather than modeling a lifelong process for integrated learning and systemic thinking. On this point, we should recall B.F. Skinner's wise observation that "education is what survives after what has been learnt has been forgotten."

What must survive a student's higher education today is a facility for life-long learning. Consider how steep the learning curve has become in the professional workplace. Knowledge has become so ephemeral that management experts have tried to get a handle on the educational challenge by using a yardstick they call the "half-life of knowledge." This is the amount of time it takes for half of one's professional knowledge to become obsolete. I've seen estimates that, overall, the half-life of knowledge is somewhere between four and seven years. For technical fields, it is much less; half of what software developers know now, for example, will likely be irrelevant in just 18 months.[ix] As Maryanne Rouse has written, "We used to think of the long run as ten to fifteen years; in many technology-dependent industries the long run may now be six months or less. And while the pace of knowledge-creation is accelerating, the half-life of knowledge becomes shorter each year. What this means for us is that concepts are far more important than facts and the ability to

analyze and synthesize has much greater value than the ability to memorize. In short, school may be multiple choice but real life is all essay."[x]

In real life, then, the skills of synthesis and systemic thinking are not just luxuries, they are invaluable. We are, after all, living through an Information Revolution, which parallels the Industrial Revolution in its impact and far-reaching consequences. Information—of all varieties, all levels of priority and all without much context—is bombarding us from all directions all the time.

T.S. Eliot, in a commentary on Dante's Inferno, could have been describing aspects of modern life when he wrote to the effect that hell is a place where nothing connects with nothing.[xi] Elsewhere, he also asked two important questions: "Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?"[xii]

To portray the challenge of coping with the info-glut, I must burden you with some more info.:

- In 2000, the world was annually generating 2 exabytes of data, or two quintillion bytes of information, which was equivalent to about 250 books for every man, woman and child on earth. Two exabytes is quite a lot of data, especially when you consider that since the beginning of history, humanity has only created six times that amount of information, or a total of 12 exabytes. But the way data was snowballing in 2000, researchers at the University of Berkeley estimated that the next 12 exabytes of data would be created in 2.5 years, or by sometime this summer.[xiii]

- Although the total amount of collected information is now doubling every two or three years, we are unable to use 90 to 95 percent of the information that's currently available.[xiv] Anyone who uses an Internet search engine has a feel for this. In less than one-quarter of a second, for example, Google.com will give you hyperlinks to 2.3 million web sites pertinent to the term "Information Revolution."[xv]

In his book *Information Anxiety,* Richard Saul Wurman notes that all this information is tantalizing, but very frustrating. He writes: "We are like a thirsty person who has been condemned to use a thimble to drink from a fire hydrant."[xvi]

Of course, the same information technologies that have been the driving force behind the explosion of information, growth of knowledge and its fragmentation, also present us with profoundly integrative tools for meeting the challenge of that fragmentation. When we are not shuddering at the challenge of coping with the info-glut, we must marvel at the way the world's store of information is increasingly at our fingertips, thanks to such advances as voice recognition software and translation software that automatically translates one language into another. Information scientists—our high-tech librarians—are also making greater uses of artificial intelligence to automate information management tasks, including "data mining," the practice of having a computer continuously monitor and filter information according to set parameters.

Technology is allowing us to radically modify the space-time constraints of the channels linking persons together. Computer communication and electronic communication networks provide new tools and opportunities for the scholarly community to share resources. Thus, the process of assimilating new information technologies can, in the right

setting, help us think hard and deeply about the nature of knowledge and even about our mission in higher education. Furthermore, the new technologies and their deployment at the university offer great opportunities for making connections among disciplines.

But progress in using technology to integrate disciplines on campus has been disappointingly slow—and unless we can help students do a better job synthesizing and systematizing information, our society faces many dangers. In his book *1984,* George Orwell describes a world in which information was denied, true knowledge was denied and propaganda was substituted for both. In the 21st century, citizens could be denied knowledge by inundating them with mountains of raw data. Advances in technology may also deceive us into thinking that whatever is not in the computer or data bank does not exist. But life did not begin with a computer. Colleges and universities must teach not only what we can know, but also what the limitations of our knowledge are and what we do not know. It goes way back to the Socratic notion that true knowledge is to know what you know, but also to know what you don't know. So while the computer allows us to access more information, faster and in a more usable form, we must keep in mind Neil Postman's caution: "The computer cannot provide an organizing moral framework. It cannot tell us what questions are worth asking."[xvii]

I believe higher education must raise such questions and guide students in synthesizing responses, if not answers. Failing to do so is a missed opportunity of staggering dimensions. For history shows that humanity has a craving for wholeness. And when people do not know how to question deeply, to separate fact from fiction, to integrate knowledge and to give coherence and meaning to life, they can feel a deeply unsettling emptiness in their lives. Sometimes, that vacuum is filled by esoteric ideas, cults and extremist programs.

Which are very appealing because they provide answers for absolutely everything. Extremists, as you know, are not wishy-washy people. Sadly, converts to fanaticism are willing to abdicate thousands of years of humanity's quest for harmony.

In the last hundred years, we have seen this hunger for wholeness manipulated by radical ideologies and militant theologies. Often, they practice hatred and intolerance while proclaiming superiority and exclusivity. Albert Einstein was one who noted the insanity of all this. He said that although "a human being is part of the whole… He experiences himself, his thoughts and feelings, as something separated from the rest…a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest us. Our task must be to free ourselves from this prison by widening our circle of compassion to embrace all living creatures and the whole of nature in its beauty. Nobody is able to achieve this completely, but the striving for such achievement is, in itself, a part of the liberation and a foundation for inner security."[xviii]

Before elaborating further on the challenge of reunifying knowledge in higher education, I want to assure you that I do not underestimate the systemic nature of the challenge of reform, especially in the context of the Information Revolution and the nearly universal access to higher education that puts all kinds of strains on our institutions. Colleges and students already face the enormous societal expectations and demands. By graduation, students are expected to be informed about such issues as our nation's history, democratic society, global economy, international relations, computer technology and, for many, to be prepared for graduate study in medicine, law, business, art, architecture or technical schools.

All this in four years!

Actually, students have much less time, when you consider several complicating factors. Because many high schools don't do their jobs, 53 percent of college students require remedial courses. Colleges, moreover, do not have four years to provide an integrated education because 58 percent of students attend two or more institutions of higher education. At the same time, most students have family or work responsibilities—in 1999, 74 percent of full-time students worked while attending college and nearly half of them worked at least 25 hours a week. Unfortunately, students who have to work their way through college compromise their education, and many of these student workers say that holding a job hurts their grades, limits class schedules and choice of courses. By one estimate, "college students typically spend less than half the time on their studies than the faculty expects."[xix]

Clearly, systemic reforms are needed, especially now that we have a mass higher education system that compliments our secondary, elementary and pre-school programs. We have to re-evaluate this entire system of education for what it is: an 18-year learning continuum that prepares citizens for a life of learning. We must address the issues of general education, unnecessary and wasteful duplication, and the coherence and integrity of our curricula.

Reform of higher education, I believe, must focus on a revival of the liberal arts. Paradoxically, liberal education is in decline just when we need it the most. I am speaking of the growth of technical and pre-professional studies at the expense of humanities and social studies. In 1970, 50 percent of the baccalaureate degrees awarded were in a liberal arts discipline, including the sciences.[xx] By 1995, that percentage had shrunk to about 40 percent,

and about 60 percent of the degrees were in pre-professional or technical fields. The largest number of BA's granted in the 1990's were in business.[xxi] Furthermore, I do not believe there is enough communication between people in the technical and pre-professional schools and those in the liberal arts schools; for the most part, they exist in separate worlds on campus, in complete intellectual isolation.

The decline in liberal arts and in its perceived relevance, I believe, is largely a result of the way colleges and universities have marginalized liberal arts by fragmenting the curriculum, and worst of all, severing most connections between the arts and sciences. The university's lack of a meaningful liberal arts curriculum understandably sends many anxious students into the safer harbors of study that lead directly to positions in the job market. Writing about the decline of liberal arts and general education in the last three decades, the biologist and Pulitzer-prize winning author Edward O. Wilson observes: "With rare exceptions American universities and colleges have dissolved their curriculum into a slurry of minor disciplines and specialized courses. While the average number of undergraduate courses per institution doubled, the percentage of mandatory courses in general education dropped by more than half. Science was sequestered in the same period; as I wrote, in 1997, only a third of universities and colleges require students to take at least one course in the natural sciences."[xxii]

We must remind ourselves that the value of a liberal arts education, and education in general, is to enhance men's and women's powers of rational analysis, intellectual procession and independent judgment. And, in particular, education should encourage a mental adaptability, a characteristic which men and women sorely need, especially now in an era of rapid change.

A proper and balanced education is not a passive act nor an end in itself. It is important not only to be able to engage in new ideas, but also to be willing to make public declarations of one's convictions and one's commitments—and then be able to translate them into written words and actions. For education must make us more than well-ordered puppets in the passing show, making gestures with no sense of the significance of the human drama, moved only by the strings that tie to material things.

We must remember that education must make students familiar with the best our culture has taught, said, and done—as well as the dead ends and aberrations that clutter our history. It must help us understand the sweep of our culture, the achievements, the problems, the solutions and the failures that mark our history. This kind of knowledge is critical to our understanding of who and what we are. A proper education must serve as a tool of enlightenment. It can be an instrument for enhancing individual as well as collective self-determination. It can provide liberation from political, economic and social ills. It can help us understand the American polity—which is no small task in our pluralistic and multicultural society that allows the unique to participate in the universal without dissolving in it. Finally, this kind of education serves as the vehicle of American democracy as well as its engine, providing a powerful way to tackle our country's unfinished agenda. After all, education promises every sort of advancement to those who, on the basis of their sex or race or age or disability, have not been able to partake in the benefits of our society.

We must also remind ourselves that a liberal education is needed to integrate learning and provide balance—otherwise students will graduate into a world in which dependence on experts of every kind will be even more common than it is today. With that trend comes an

even greater temptation to abdicate judgment in favor of expert opinion. Unless we help our students acquire their own identity, they will end up not just dependent on experts but at the mercy of experts—or worse, at the mercy of charlatans posing as experts.

As a people, we need to understand where we were, where we are and where we are going. Without liberal arts to provide a context for technical training, young people can not be expected to understand the general nature and structure of our society, the role of the university, academic freedom or the importance of values—all of this will have no ethical, moral or societal context.

The challenge for higher education, then, is not the choice between pure research and practical application but, rather, the integrating and resynthesizing of compartmentalized knowledge. On campus, we must create an intellectual climate that encourages the bridging of boundaries between academic specialties. This means encouraging faculty and students to make connections among seemingly disparate disciplines, discoveries, events and trends and integrating the knowledge in ways that benefit the commonwealth of learning. The Nobel Prize committee recognized the importance of interdisciplinary scholarship in 1992 when it gave the economics prize to Gary S. Becker at the University of Chicago for "having extended the domain of economic theory to aspects of human behavior which had previously been dealt with—if at all—by other social science disciplines such as sociology, demography and criminology."[xxiii]

To accommodate that kind of interdisciplinary creativity, the college learning environment must become more open and flexible. After all, some of the most promising areas of research and creativity are interdisciplinary not only in the physical and natural

sciences but in the social sciences, the humanities and the arts, as well. We have to develop creative multi-disciplinary, interdisciplinary and transdisciplinary approaches in our liberal arts curricula in order to provide intellectual coherence. Colleges and universities must develop strategies for enabling their faculty members, who are steeped in different disciplines, to also have opportunities for this interdisciplinary and multidisciplinary work—as they continue their own life-long learning.

Team teaching, for example, is one obvious way to provide students with thematic study of interwoven scientific, historical and literary ideas. Team teaching can also provide multiple and comparative perspectives and expertise. In both instances, students gain knowledge of multiple disciplines as well as their interconnectedness. Within disciplines, of course, teaching should encourage students to draw knowledge together from many sources. Writing on this theme in 1956, Edwin E. Aubrey said: "The student should be educated to think of relations: the relations of an event to its historical background; the relation of a statement to its implications or to its presuppositions, so that it can be logically examined; the relation of facts to each other in the creation of a structure of knowledge, transforming raw data into understanding; the relation of new ideas to established knowledge so as to test them or to modify one's preconceptions. Such relational thinking is a rigorous discipline and needs to be insisted upon if the student is really to become an educated person."[xxiv]

A reform agenda must also include the creation of a balance between specialists and generalists. Although we live in an age of extraordinary specialization and fragmentation of knowledge, it is clear that we can not abandon specializations or sub-specializations or sub-sub-specializations. After all, the division of labor has greatly advanced the cause of

civilization. Specialization is an instrument of progress. Complexity, by necessity, requires specialization.

So we need specialists. But for greater understanding, we also need generalists, trained in the humanities, sciences and social sciences. The challenge is to provide synthesis and systemic perspectives. We need to create a common discourse, a common vocabulary among the various disciplines. Unfortunately, generalists are not held in high regard on campus or in our society unless they are big names, or else because they became generalists after first earning credibility as specialists.

And since our society *respects* specialists and *suspects* generalists, perhaps the way to solve the shortage of generalists is by creating a new specialty in synthesis and systems—much as José Ortega y Gasset proposed in his 1944 book, *The Mission of the University.* He wrote: "The need to create sound synthesis and systemization of knowledge…will call out a kind of scientific genius which hitherto has existed only as an aberration: the genius of integration. Of necessity this means specialization, as all creative effort does, but this time, the [person] will be specializing in the construction of the whole."[xxv]

Today, I've outlined a daunting challenge for higher education, one that calls on institutions of higher education to develop and enunciate a clear philosophy of education. Colleges and universities must address the reunification of knowledge, the process and nature of life-long learning in our fast-paced times, and, most ambitiously, they must join other institutions in addressing the continuities and discontinuities of knowledge within our entire pre-K-16 educational system.

In closing, I would like to say that while we must overhaul higher education, we must also treat it with the respect that is due to a national treasure. After all, for more than two centuries American colleges and universities have been the backbone of our nation's progress, helping make it an economic, cultural, scientific, technological and political power. Not coincidentally, America also became an educational power. The excellence of the American university is reflected in the fact that the largest share of foreign students who choose to study abroad come here.[xxvi] Henry Rosovsky, the economist and educator, estimates that between two-thirds and three-quarters of the world's best universities are located in the United States—he asks, "What other sector of the economy can make a similar statement?…In higher education, 'made in America' is still the finest label."

Referring to that label, Rosovsky cautions: "My only advice is to add 'handle with care.'"[xxvii]

Thank you very much.

[ii] Drop-out rate at four-year institutions comes from Clifford Adelman, *Answers in the Tool Box: Academic Integrity, Attendance Patterns, and Bachelor's Degree Attainment* (Washington, D.C.: U.S. Government Printing Office, p. vii. Drop-out rate for community colleges comes from ACT; see http://www.act.org/news/releases/2001/charts4.html. Statistics as cited by National Panel Report, op. cit., p. 11.

[ii] Ellen Condliffe Lagemann, "The Challenge of Liberal Education: Past, Present, and Future," Keynote Address, Annual Meeting of the Association of American Colleges and Universities, Seattle, Washington, January 23, 2003.

[iii]Megan Rooney, "Freshmen Show Rising Political Awareness and Changing Social Views," January 31, 2003, pp. A35-37, The Chronicle of Higher Education, http://chronicle.com/students

[iv]National Panel Report, op. cit.

[v] Ibid., p. vii.

[vi] American Association of Colleges and Universities, *Integrity in the College Curriculum,* p. 2, Washington, D.C., 1985 as cited by the National Panel Report, op. cit., p. 16.

[vii] Mark Davidson, *Uncommon Sense, the Life and Thoughts of Ludwig con Bertalanffy* (Boston: Houghton Mifflin, 1983) pp. 184 as quoted by Thomas Mandel, "Is there a General System," International Society for the Systems Sciences, http://www.isss.org/primer/data.gensystm./htm

[viii]Bela H. Banathy, "The Evolution of Systems Inquiry, Part 2" International Society for the Systems Sciences, http://www.isss.org/primer/data/004evsys.htm

[ix] Various estimates on the half-life of knowledge. See Karl M. Kapp and Carrie McKeague, "Blended Learning for Compliance Training Success, 2002," p. 2. at http://www.eduneering.com/press/articles/kapp_mckeague_white_paper.pdf. See also speech by Radm (NS)

Teo Chee Hean, Minister for Education, at that NIE Teachers Investiture, July 4, 2001, in Singapore, http://www1.moe.edu.sg/speeches/2001/sp04072001a.htm.

[x] Maryanne Rouse, "Teaching Philosophy," College of Business Administration, University of South Florida, http://www.coba.usf.edu/departments/management/faculty/rouse/teach.htm
[xi] T.S. Eliot, *Murder in the Cathedral,* (London: Faber and Faber Ltd., 1943.) p. 71.
[xii] T.S. Eliot, *The Rock: A Pageant Play,* (London: Faber and Faber Ltd., 1934), part I, p. 7.
[xiii] Peter Lyman and Hal R. Varian, "How Much Information," 2000, School of Information Management and Systems at the University of California at Berkeley http://www.sims.berkeley.edu/how-much-info
[xiv] Richard Saul Wurman, *Information Anxiety,* (New York: Doubleday, 1989).
[xv] See Google.com, lycos.com or altavista.com.
[xvi] Wurman, op. cit., p. 36.
[xvii] Neil Postman, "Informing Ourselves to Death," (Speech given at a meeting of the German Informatics Society on October 11, 1990 in Stuttgart.)
[xviii] Albert Einstein, *Ideas and Opinions* (New York, Crown Publishers, 1954) as quoted by Mandel, op. cit., at International Society for the Systems Sciences, http://www.isss.org/primer/data/gensystm.htm
[xix] National Panel Report, op. cit., p x.
[xx] Carol M. Barker, "Liberal Arts Education for a Global Society," *2000 Carnegie Challenge,* Carnegie Corporation of New York, p. 4.
[xxi] Ibid., p. 4.
[xxii] Edward O. Wilson, *Consilience: The Unity of Knowledge* (New York: Vintage Books, 1999). P. 13.
[xxiii] Wilson, ibid., p. 220.
[xxiv] Edwin E. Aubrey, "Humanistic Teaching and the Place of Ethical and Religious Values in Higher Education," The Educational Survey of the University of Pennsylvania, September, 1956.
[xxv] José Ortega y Gasset: *The Mission of the University,* 1944.
[xxvi] Institute of International Education, http://www/iie/org/fulbright/posts/guide/intro4.htm#1. See also National Center for Policy Analysis, "Foreign Students Studying in the U.S.," at http://www/ncpa.org/pi/edu/pd120798e.html and also information on the Educational Testing Service Network's web site: http://www/ets/org/usiarprt.html
[xxvii] Henry Rosovky, "Highest Education," *The New Republic*, July 13-20, 1987, pages 13-14.