

THE FUTURE OF THE/OUR RESEARCH UNIVERSITY

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The U.S. research university is the best in the world, by any reasonable standards. Its essential innovation was to fully integrate research and undergraduate and graduate teaching, which is both intellectually and economically very effective. Nevertheless, like all institutions, the research university evolved subject to many forces, and it has weaknesses. The U.S. medical system is arguably also the best in the world. But it ignored increasing criticisms and rising costs two decades ago, and lost control. If we don't want to end up with "managed curriculum" and "E(ducation)MOs" we need to confront and analyze the criticisms and costs, and fix any parts of the system that are weak or broken.

In this essay I will examine the problems that I see as most important for my research university. Much of the analysis is general, and probably relevant for all research universities. Some is particularly focused on mine. Although the medical school and associated facilities are very important, I am not well enough informed to comment usefully about them so I will leave that to others. There are six sections. *Perspectives* provides an overview and context. *Fundings* summarizes views on why costs have been rapidly increasing, and options for increasing income, with some emphasis on how the future has to be different from the past. Funding could increase, but only if research universities do a considerably better job of explaining why it should increase. *Restructuring* tries to argue that the administrative structure of the university is one area that would particularly benefit from large-scale change. If we are to complete the transition to having science departments ranked as highly as our social science and humanities departments, it would be helpful to create a science college. If that is not done, it will be necessary to allow the sciences to have their natural culture rather than forcing them into the mold of the humanities and social sciences, and to stimulate them financially in ways similar to those that are typical at the top research universities.

The section on Curriculum is, in my view, the most important one. I argue that the main reason for the dissatisfaction with undergraduate teaching that we hear so much about recently is not any of the usually proposed causes, but rather the absence of a coherent core of content in the curriculum, and I argue as strongly as I can for a particular vision of a core curriculum for all students. Then I turn

to the Reward System of the university. To slightly paraphrase a former Dean, for every salary structure there is an appropriate faculty. The reward structure of recent decades has led to a tragedy of the commons. One way to improve the situation, a way that would have significant positive effects on undergraduate education and on university governance, is to recognize the existence of a set of "core professors" and to change how they have been rewarded. I will conclude with some *Final Remarks*. The sections will be essentially self-contained, so readers can focus on those of most interest.

PERSPECTIVES

Over two hundred years ago Benjamin Franklin thought it important to criticize undergraduate education at Harvard. Universities, particularly American ones, have changed and evolved during those two centuries. Criticisms and the need for some changes are not new. Originally American universities educated a small elite group of male students, focused on moral training in a Christian heritage, and were run by their presidents and boards of trustees with no faculty-shared governance. In the decades after the Civil War the curriculum moved toward a science-based one and the faculty increasingly controlled hiring of professors and academic issues. Early in the 20th century academic freedom emerged as an important means to ensure that knowledge and ideas could not be controlled by vested interests, and particularly to encourage innovative research and ideas. A departmental structure grew, and enrollments started to increase, with about 50,000 students of higher education after the Civil War and 350,000 by 1910, about 3% of the 18-24 age group. During and after World War I, increased interest in the world outside the U.S. led to increased study of western civilization and eventually to a much broader curriculum. By 1960 there were 3.5 million students, and in 1990 14 million. Today well over half of the 18-24 age group attend colleges and universities. Other major changes in recent decades are the greatly increased involvement of the federal government, both in research funding and in financial aid to students, and the large increase in minority student enrollment from a few percent after World War II to over a quarter today nationally and much more in some states.

The goals of the research university have not changed much over the past century. They are to develop, organize, and preserve knowledge and understanding; to transmit to students that knowledge and understanding along with learning skills; to help apply that knowledge and understanding to improve the quality of life; and to train the next generations of citizens and

leaders of society. None of these are new — for example, Thomas Jefferson spoke of the practical importance of knowledge "in the nation's service".

How well are these goals being achieved? In general very well. One way to judge that is to look at "evaluations". Polls show that public confidence in the leaders of education remains high. Support from donors is increasing. The fraction of students who start and finally graduate from research universities is higher than the comparable fraction overall. The interest of industry in hiring graduates is higher than ever. Students are eager to attend research universities.

One can also evaluate by intrinsic standards whether the goals are being achieved. Again in general the conclusions are very positive. Research productivity is high. There are increasingly many ways to transfer and apply knowledge. Nevertheless, in recent years some concerns have been voiced. Some of them are valid, and all should be taken seriously and responded to. I will address some of these concerns in what follows.

One of the important concerns is whether the cost of education today is too high. In the U.S. individual families bear most of the cost so it is indeed too high. Is this the fault of the university? In most industrialized countries it has been recognized that in the long run it is of immense benefit to society to educate and train citizens, and the costs of education are largely borne by the government, not by those getting educated. In recent decades U.S. universities have diverted large amounts of funds to provide financial aid to students. At public universities much of that money came from funds that could have been used to encourage and reward faculty, and to provide more faculty to teach undergraduates. That solution has probably reached its limit, so it will be necessary for colleges and universities to convince state Legislatures and Congress and present and future Administrations that increased support of students is essential to achieving society's goals. That is an area where research universities and those who speak for them could provide leadership.

Another important concern is undergraduate teaching. What perspective should we have on how effectively we teach undergraduates? While there is room for improvement, the situation is not as bad as it is portrayed in the media. Sometimes it is claimed that the emphasis on research is hurting the quality of undergraduate teaching. But there are about 3000 colleges and universities in the U.S., and no more than 100 could really be called research universities. Clearly, if one prefers, there are plenty of places to get an undergraduate education from professors for whom research is not a primary concern. Still, claims about lack of contact between professors and students at our research

universities should be examined. In recent decades there may have been some decrease in the amount of undergraduate teaching done by research university professors, though that trend has probably been reversed in the last few years. In fact, at the University of Michigan over 80% of all tenure and tenure-track faculty in units that offer undergraduate courses teach undergraduates. Top university researchers do teach. As Thomas Devlin of Rutgers University has pointed out, when the discovery of the top quark (a fundamental particle) at Fermi National Accelerator Lab was announced in March 1995, about 10,000 students were enrolled in courses taught by physicists who had worked on that discovery; often the students were excited to have a professor who was involved in research that was reported in the newspapers. Professors who teach and do research burn out far less frequently than those who only teach, and are likely to be enthusiastic about their field. Those who only teach necessarily fall behind in understanding frontier developments that sooner or later should be integrated into undergraduate courses, and they are less able to convey the excitement of new developments to students. In the past decade there has been increased sensitivity to the quality of undergraduate education, and a number of tactics have been used to improve undergraduate teaching. In my sections on *Curriculum* and on *Reward Structure* I will argue for two additional innovations that I think will significantly improve the undergraduate experience.

Another aspect of the undergraduate education problem for which the university is not to blame is the increasing decline of student preparedness and student engagement. The causes are not in doubt. They are both the increasing fraction of the population that attends the university, and the poorer preparation received in secondary schools. The university has been reluctant to admit and address this problem, and is not yet dealing with it in a healthy way.

University Presidents have in the past sometimes had major influence on shaping their own universities, on American higher education, and on national priorities. When they speak, they can be heard; they have a national platform. In recent decades they have had less influence — not many speak out publicly and not so often on issues deeply related to what the research university is about. What examples can we think of in recent years where university Presidents have led higher education or society rather than responding to crises? How often have university Presidents spoken out nationally to explain and defend research universities from inappropriate criticism? There are many reasons for this current absence of an effective presidential leadership voice. Some are rather mundane, but still important. University Presidents are very busy, but they should not be. Often their schedules become dominated by

proforma events, social and diplomatic obligations, and routine matters, many of which could be delegated. They should have time to reflect and discuss and plan. They get isolated, and talk mainly with administrators whose priorities are often only administrative; instead, they should have a kitchen cabinet and systematically have one-on-one interactions with appropriate people. While fundraising is an essential part of their responsibilities, as is responding to troubled situations, so is providing significant intellectual leadership for society *and* for their own university. Similar remarks apply to Provosts and to LS&A Deans.

In the past century, research universities have gained the freedom (and the associated responsibility) to investigate subjects and ideas that may come into conflict with current beliefs, or may threaten political or social or business vested interests. Society has judged that it gains more than it loses by having institutions with that freedom. But society has implicitly imposed an associated restriction - universities must not take public stands on political or ideological issues. It is acceptable, even encouraged, to educate students so they can innovate and change society, but not for the university itself to advocate political or ideological innovations. In recent years the public has sometimes perceived that universities are not being sufficiently cautious in this regard. It is a serious challenge for university Presidents and other leaders to speak out but not to be seen as politicizing the university. What can make it work is that most of all the public expects research universities to be accountable for quality education. That provides a foundation from which to speak out and provide leadership even on controversial issues.

FUNDING

Public universities get significant income from tuition, their state governments, donations, federal research funding, industrial research funding, and "service". I will not consider here income from patient care or medical expenses, assuming the medical area will balance by itself. The last category, which I broadly call "service", has not been a large source of funds for most universities; I will argue below that it should become much larger. Tuition will probably grow about as fast as inflation in the future, so I will not consider it further. All the other categories can be expanded if research universities make their case effectively. But, here as with most of the topics I focus on, little will happen if it is left to luck - significant leadership is required.

Why should the state fund the University of Michigan? Well, it educates Michigan citizens. It provides economic input to the state. How much? That is

not known. I would guess that a serious calculation would show that the University of Michigan provides a very large economic return to the state. Many factors enter. An educated citizen earns more, pays more taxes, perhaps starts a business that pays taxes and employs people. If bright young Michigan people could not receive the education they want here, perhaps they would leave the state and not return. Some bright people move here and stay, perhaps starting businesses. Political and economic leaders are trained here. There are more cultural opportunities for music, art, theater, architecture, both to raise the quality of life and to attract people. MIT has done a study that concludes that about 300,000 people work in companies started by their faculty and graduates. If any public university has done a full analysis of the benefits to their state I am unable to find it. Armed with such an analysis presented in plain English, well reported and publicized, we could argue far more effectively for increased state funding as a real investment.

An analogous approach is needed for increasing federal funding of research. Although much is said about how that funding will decrease, it is not clear that we are wise to accept that without fighting harder than we do. In the 1970s the fraction of our GNP allocated to basic research was nearly twice what it is now. Similarly, Japan and Germany allocate a larger fraction of GNP to basic research of the sort that universities do than the U.S. does. A limit on research funding is a political choice. The main reason research funding has decreased is that the Members of Congress, particularly the new ones, and the Administration, do not understand the benefits derived from such support. The problem is to get their attention. Most generally, both at the state and federal levels, a new and stronger case needs to be made for the social and economic benefits of liberal education and of funding social science and natural science research. Research universities could play a considerably greater role in affecting this situation than they have. Presidents and Deans from research universities can be heard.

More generally, the health and quality of America's institutions depends greatly on having a strong educational system. It has been argued that our national security depends as much on our educational infrastructure as on our military. But these arguments are not presented or understood widely in Washington.

The "service" category is largely an underdeveloped one. Research universities in general, and particularly the University of Michigan, could do far more than is now being done. In 1981 federal legislation made it legal for universities to hold patent and licensing rights to discoveries made using federally funded research. The income from such licensing benefits the entire university. Some

universities have taken considerable advantage of this opportunity. The list of high tech areas includes Silicon Valley, Route 128, Research Triangle, Princeton Corridor, Silicon Hills (Austin), Medical Mile (Penn, Temple), Optics Valley (Arizona), Golden Triangle (San Diego) but not Ann Arbor. Service and outreach can take many forms. Some may bring funds in rather directly, others may initially only bring people into a broader community with the university. Alumni often regret the loss of contact after they leave; they could be offered internet access, access to books and lectures by faculty, and much more. Even services to the community that do not initially bring in funds will do so eventually via good will, positive input to state legislators, donations, etc.

In many ways this is a marketing problem — many people and businesses and state and federal government organizations want information and services that could be provided by university resources, but do not know how to find it. Perhaps an investment needs to be made in a staff of clever people who become familiar in depth with the remarkable resources available at the university, and who can be contacted by the outside world to facilitate interactions. Many service and outreach activities have begun here and at many universities in recent years and need to be encouraged and made more visible. An important book on this subject is Mary Lindenstein Walshok's *Knowledge Without Boundaries; What America's Research Universities Can Do for the Economy, the Workplace, and the Community*.

It is probably appropriate to say some cautionary words here. There is a danger of commercialization driving research, rather than intellectual goals. This is not a reason to avoid commercialization, but rather the enterprise must be structured so that intellectual quality is not sacrificed. Similarly, ethical issues and conflicts of interest could arise, and it is important to raise consciousness about these matters.

One might imagine that another way to improve the budget of the university is to spend less. Total university spending has increased rapidly in the past two decades, significantly faster than inflation. Few systematic studies seem to exist analyzing why the increase is so rapid. Perhaps the best is described in the 1996 book of Charles T. Clotfelter, *Buying the Best: Cost Escalation in Elite Higher Education*. He asks how much of the escalation is due to a priori identifiable factors. Based on data from four universities, he concludes that what the university paid for goods and services was not a major cause of escalation, nor was inefficiency or incompetence or administrative expenses. New programs and a workstation on every desk caused some escalation, but not a large part of

it. Faculty compensation increased but no more rapidly than that of other professionals, and less rapidly than total spending. Compensation of non-faculty teaching personnel increased rapidly but was not a large part of the total. Of all the identifiable factors, general financial aid to students had the most rapid growth, and was the largest single component of escalation.

Surprisingly, however, he finds that all of the above factors together caused only about half of the cost escalation. The causes of the rest were not easily identified. They were best seen as a vague pressure for expenditures that could be described as due to "unbounded aspirations", the "pursuit of excellence". As Clotfelter puts it, "Perhaps the most important conclusion that arises from the scrutiny of spending increases, however, is that a large portion of increases simply cannot be attributed easily to any identifiable cause. Such widespread expenditure growth is consistent with across-the-board commitments to quality improvements and service enhancements." The lesson is that to decrease cost escalation research universities will have to consciously limit the presently uninhibited pursuit of excellence in all possible areas. There are no non-financial pressures or mechanisms to do that, and value judgements which are normally avoided would have to be made. It is unlikely to happen, and will not happen without informed and wise and strong leadership.

RESTRUCTURING

A few years ago I was on the Budget Priorities Committee that advised the Provost (which no longer exists). In initial chats with more experienced members, the most frequent remark was about the role of the committee in the annual budget review process: "you won't believe it". They were right. It turned out that the review process was structured so that each college and school received equal time and attention, from LS&A with well over 800 professors to the schools, smaller than many LS&A departments; most of the time was spent on small parts of the budget, parts not central to the university's goals.

The administrative structure of the university evolved over a century. It could be greatly improved. Consider LS&A. Perhaps one person could eventually learn to understand the goals and values and culture of natural science departments and social science departments and humanities departments in order to administer and lead them and to maintain and improve quality and effectiveness, but only with a long learning period during which unforeseen and unfortunate consequences might occur, and perhaps some mistakes. And surely there is no hope of finding such a person every five or ten years.

At the college level a sensible restructuring that could have powerful positive consequences can easily be imagined. Probably the wisest choice would be to form an arts college, a social science college, a humanities college, and a science college, the latter three from splitting LS&A. These would be about the same size, and comparable to the engineering college. If this is too radical, the process could begin by separating off a science college.

Alternatively, if separating a science college is still too radical, it is essential to have some kind of additional layer of people *of high quality* who understand the cultures of these areas, so LS&A could be restructured at the Associate Dean level to have Associate Deans of each of these areas. Each Associate Dean would have significant substantive control.

Since I come to this discussion from physics, let me focus on the great benefits that would come from forming a science college. Before World War II Michigan had some of the top science departments in the country. From the end of World War II until the mid-1980s the University of Michigan chose not to support the natural sciences well enough to maintain top departments. No Dean of LS&A from then to now has taken the lead in upgrading the sciences. President Duderstadt took the initiative during his tenure and started to provide the resources the sciences need, particularly infrastructure, and there has been considerable improvement in their overall quality. If that momentum is maintained some science departments will be recognized as top ten ones in the foreseeable future.

Why did earlier Deans not provide the needed resources? The usual reason given was that science departments cost too much. Start up salaries are higher, research and teaching labs are expensive. But why do all the best research universities strive for top science departments and push to increase their research funding? Why does the University of Michigan take steps to increase our scientific research funding?

It is of course more complicated. The culture of a good science department is greatly different from that of social science or humanities departments in many ways. In humanities and social sciences the interests of undergraduates and of faculty overlap considerably even if the faculty has a much more sophisticated understanding, but that is not so in the natural sciences. The situation is most extreme in physics. Most physics that is taught to undergraduates has been fully understood for decades or centuries and is no longer a subject of active research, so physicists do not get ideas from questions by undergraduates, or have their research affected. One cannot discuss and debate the concepts. The goal is to quickly understand them and to get on to the modern ones. On the

other hand, scientists normally work very closely with graduate students, on a daily basis. Many people in other fields have told me that their contact with students is very different. The library is extremely important for scholars in the humanities, but less important for scientists, particularly because of the intrinsic difference that scientists study the natural world rather than material created by people and stored in archives, and also because scientists work more from literature available on the internet. In another direction, recently a science department was stopped from hiring an available high quality technical support person they badly needed, because the person's salary would have been higher than the arbitrary limit set to save money in similar appointments by people in LS&A who did not value such support. It simply does not make sense to try to apply the same set of criteria to science departments and to the other departments in LS&A.

Another example is the problems and opportunities associated with retirement. Today a significant fraction of scientists remain very active in research well into their 70s. In order to do that they need to retain control of their offices and labs, they need to be able to have graduate students, to be Principal Investigators on grants, and to have a voice in the formation of policies that affect them. At some universities (particularly Berkeley, partly because of the University of California effort to encourage retirement of senior professors to save money) new categories have been established to encourage qualified retiring faculty to stay active, and to encourage faculty to go to part-time teaching perhaps for several years before retirement. Federal agencies have requirements for the status of Principal Investigators and may not allow fully retired professors to have their own grants. At Michigan, both LS&A and the Graduate School have been uninterested in providing such opportunities in spite of several efforts to get them to. At Berkeley a new category of faculty was created, Professors in the Graduate School (PiGS).

One of the most astonishing ways that the culture of scientific research is punished by LS&A concerns research leaves (not including sabbaticals). Scientists take research leaves relatively frequently, perhaps to go run an experiment at a national or international laboratory, or to collaborate with a colleague elsewhere, or even stay in Ann Arbor but work full time on a project that requires long uninterrupted hands-on time to succeed. The college seizes the salary money thus released, and does not let the person going on leave or even his or her department decide how the money should be spent. As it is, the department can request ("plead" as one involved person put it) that a visitor be brought in, and the request may or may not, often not, be granted. If it is granted often the delay essentially eliminates the possibility that a valuable

visitor can actually come. This provides a significant disincentive to the normal behavior of scientists, and reduces their resources. Under a science college people would be encouraged to bring visitors with such money to teach interesting courses and/or to complement research activities. No one will pursue such creative efforts, perhaps even bringing talented people who may eventually be hired, when they have to identify the opportunities, propose them, and then often have them turned down, all for money that was originally theirs. Control of science departmental budgets needs to be in the hands of people who encourage the behavior appropriate to good science. Similar issues arise concerning authorized positions that are not filled at the first opportunity, even for good reasons, senior people who could move to half-time teaching, and so on.

Another major area is the use of indirect cost funds to stimulate research in the sciences rather than to tax them as is presently done. One of the reasons the social sciences are very strong here is a long-standing policy associated, with ISR, involving creative use and return of indirect cost funds.

It is widely agreed in the sciences that having a science college or at least a Dean or Associate Dean who understood the culture of the sciences would be extremely beneficial to increasing the quality of the sciences in many ways. Are there any reasons to be concerned about the consequences of forming a science college? Sometimes it is argued that having science, humanities, and social science departments in one college promotes broader exposure to all areas for students, or promotes interactions among faculty. In practice I am not able to find examples of that happening. Most faculty interdisciplinary interactions occur because of a shared interest and often cross existing college lines. There is no reason why students cannot cross college lines in programs (assuming we do not construct artificial barriers or allow financial management to have such effects), and they often do. New concentrations aimed at helping to educate new kinds of professionals could emerge across colleges easily; discussions are going on in my department on how to create such concentrations, and the identifiable obstacles do not seem to be related to college structure.

It would be exciting for the University of Michigan to enter the 21st century with a college system designed to facilitate being a great research university instead of trying to deal with a clumsy and inhibiting system that we inherited from a different era. It is not possible to describe the University of Michigan as

a great research university unless both the physical and biological sciences are world class.

CORE CURRICULUM

Why is there so much dissatisfaction with the undergraduate experience? As I said earlier, the indicators suggest that the situation is probably not as bad as the media likes to claim. Partly people don't know the history so they assume a (non-existent) golden age. Partly we have gone from educating a small elite to a large middle class, so of course we do not do so well. Nevertheless, there is considerable discontent too, and it is pretty clear we could do better or at least try to. Several innovations have recently been discussed. Adding the opportunity to do research for every under-graduate who wants to will certainly add to the quality of undergraduate education. It is important to learn that all knowledge emerges from disciplined human activities, not from books. Giving all undergrads the opportunity to take courses in smaller groups that stick together, a living, learning situation, is extremely desirable. It has served education well at the best private universities for centuries, and should be given a high priority.

After discussing the undergraduate experience many times from many perspectives (once a student, teacher, father of children who experienced the system, students I have had and known, friends and their student children, concerned educator) I have come to feel that two major problems are responsible for a good deal of the discomfort with the quality of the undergraduate experience. The more important one is that students can and often do go through their undergraduate years without "learning anything", to quote one of them. (The second one is considered in the next section.) Of course they take courses, but they do not get a sense of coherence. There is no core. I was long puzzled by the common complaint that students do not encounter professors. They do. Encountering a professor is no guarantee of learning something. The real plea, I think, is for a core of knowledge and understanding they are not getting. Only with a core can one make sense of a broad education.

Why do U.S. high school students do so badly compared to the rest of the world on tests? Comparative studies suggest that our students do not spend less time on a given subject, or that we are educating a larger fraction of the population. Rather, it is an "unfocused curriculum" that encourages U.S. teachers to cover too much in an incoherent way. Many subjects do not make sense unless they are related to a fundamental core. We also emphasize "learning skills" more than other countries, forgetting that learning must be built on a foundation of content. These observations apply to undergraduate education as well as to American high schools. At least anecdotally, not only the content of the curriculum is weak, but also its rigor. Distribution requirements are notoriously easy to satisfy.

I have come to think that there is a unique core that we should aim to teach, that society expects us to teach, and to which many students would be receptive. It has four parts: Rights and Values, Arts and Literature, The Natural World, and Understanding Ourselves and Our Society. Before the reader reacts negatively to the idea of a core curriculum because of past controversies (probably it would be better to have a different name), I emphasize that what I am arguing for is different from any example I know of at other universities, both in content and approach. It does not use Great Books or other approaches that have raised alarms. I hope the reader will examine these suggestions somewhat impartially.

Rights and Values

There are a number of rights and values that are very important to us, and almost every American would agree on what they are. A list of them would include political freedom, democracy, rule of law, freedom of speech, freedom of the press and media, freedom of inquiry, religious toleration, separation of church and state, universal human rights, women's rights, property rights, equality of opportunity, a civil society, a tolerant society. Once upon a time, less than 3000 years ago, none of these rights existed! How did we come to have them? Today many people still do not have them, but in fact there has been a steady increase in the number of people who do for two to three centuries. To defend these rights and to extend them to everyone who does not yet have them we must understand them and the battles that have been fought

to obtain them. These rights are achievements of which we should be very proud^{3/4} it could have happened that we had none of them. Every student should have a one-semester course in the origin and history of these rights. Their parents and the society that supports universities want them to have such a course. Understanding these rights and their origins gives coherence to much of what is learned in other courses and a deeper understanding of how society works.

There would be practical problems, obviously, in implementing such a course (and also those discussed below). There might be opposition to implementing it from areas that are less involved. There will be problems in finding people to teach it. Nevertheless, after a year or so of setting up helpful material to be made available to anyone teaching it, I would guess that a large number of faculty could successfully teach such a course. I do not think core courses should be taught with sections led by graduate students. If we are serious about improving the undergraduate experience we can solve these problems. The basic way is simply exponential growth, with two or three classes the first semester, four to six the second, eight or more the next, and so on. A possible way to proceed would be to initiate the core program in a (modified) honors program. It would be exciting to develop and implement such a course.

There could also be intellectual problems in that different professors might emphasize different rights, and there is not always complete agreement on the history of such rights. Diversity of ideas is seldom a problem. To guarantee intellectual rigor some monitoring and leadership would probably be essential.

The citizens of Athens used to gather together in their amphitheaters occasionally to watch reenactments of their myths about the origins of their cities and their system of justice and governance, in order to remind themselves and to teach the young their values and responsibilities. Today the responsibility of teaching citizens an understanding of our core rights and values has, in part, been given to the colleges and universities. Teaching the history of rights and values should be as uncontroversial as any approach could be.

Arts and Literature

The college years are also ones to broaden students' opportunities and to give them a foundation for their adult lives. Many of them have never experienced many forms of culture. The initial steps are the most difficult. Once we encounter poetry, or opera, or abstract painting, or Asian art, or other forms of creative expression, we may find they excite us. An important dimension can be added to our lives. Once we leave college we often enter a narrower world and it becomes harder to expand it. Each student should take at least a one semester general course covering the arts and literature broadly, with such topics as fiction, theater, poetry, history of art, dance, classical music, opera, architecture, crafts, and more.

Some will immediately object that selecting and compressing the world's cultural achievements into a semester is impossible $\frac{3}{4}$ better not to try. But the point of such a course is to cross the barriers to beginning. Once the student enters an area it is immensely easier to take the next steps on their own than it would be to begin. The goal is not to make them sophisticated but to give them the initial introduction as a foundation for the rest of their lives.

From the practical point of view this is probably the easiest of the courses I am proposing. It could be taught by different people from the relevant areas, each giving one or a few lectures (for which they and their unit get teaching credit). Planning this course would be fun and not difficult so long as the basic goal was kept in mind.

The Natural World

Four centuries ago no aspect of the natural world was understood. Today we know that the natural universe is governed by a few very general laws of nature that we can understand, that lightening and earth-quakes are not punishment for our sins, that the sun will rise tomorrow whether we pray for it to rise or not, that inanimate objects and the stars are made of the same atoms we are, that the laws of nature are the same throughout the observed universe, that all we can see is made of just three elementary particles, that everything that happens in the natural world is a manifestation of one of the four forces (gravitational, electromagnetic, weak, and strong), that the universe began as a hot gas of

particles about twelve billion years ago and has been expanding since, that all living things on earth share the same genetic building blocks, that life on earth began with simple self-replicating forms and evolved to the forms we see today, that diseases are caused by bacteria, viruses, and breakdown of genes, that most life on earth occurs in complicated ecosystems, that our landscape and mountains and oceans and climate are steadily changing and have been for billions of years.

All these things we know have been learned using the method of science, which is basically the effort to understand the natural world by making informed guesses about how it works, and then testing these guesses by observation and experiment, discarding what does not work. All students should have a course in which they learn how science has helped us understand the natural world and led us to the above knowledge (and much more). They should understand the difference between research-in-progress, where the guesses and testing are still going on, and the knowledge we have acquired, such as the results listed above, which will not change. They should understand some of the history of how we learned those things, and the cultural contexts that led science to blossom in some cultures and to wither in others. They need to know those things because many want to, because every educated person should, because to be effective citizens in the modern world an understanding of how science works and the knowledge resulting from doing science are very helpful, and because possessing scientific literacy is important for many people for their careers — in a survey of personnel directors from a variety of companies nearly all said that science literacy (defined as the ability to understand newspaper articles about science) would soon be a requirement for all entry-level jobs. They should understand the differences between science and technology. Most important, all students should understand these things because learning them has been one of the great achievements of humans.

An important issue is the distressing acceptance of pseudoscience today, by all measures a larger acceptance than earlier in the century. Surveys suggest well over half of college students and supposedly educated people accept that such phenomena occur as part of the natural world, and that there is no improvement from before to after university education. I think the main reason is that increasingly our world is full of scientific results and high tech devices

and effects whose workings most of us do not understand. They seem magical. So where should the line be drawn? People don't separate the WWW or global satellite positioning or medical imaging from astrology or ESP. It is important that people learn the basic understanding of science needed to grasp that some things are impossible, and that many ideas are inconsistent with the basic laws of nature. It is important to have an educated sense of reality if we are to make our institutions work to maintain and improve the quality of life.

I know that such a course can be developed and taught to any student because I have done it for the physical science part. The important results of science, all the big questions and our remarkable progress in understanding them, and how science works, can be explained well enough to students without a background in science and with only simple high school math. I think integrating the biological perspective would not be too hard, and I have been discussing doing that in a jointly taught course with an evolutionary biologist. If we do that we might call it "From before the big bang to the evolution of intelligent students". Practical problems with establishing such a course for many students can be solved. Again, doubling the number yearly or perhaps every semester is feasible and over a few years leads to the needed size.

Understanding Ourselves and Society

There should also be a one semester course on this topic, introducing students to ideas about human psychology, from Freud to PET scans, and about how societies and cultures work, and particularly about how knowledge is gained in these areas. With a foundation here a student would understand future developments much better and could remain informed. I can elaborate on this if desired.

A Core Curriculum?

Would it be possible to implement a core curriculum? Because it would involve some colleges and departments more than others, most departments and colleges may oppose it. Appointing a committee to decide whether to have a core curriculum and what should be in it would probably guarantee that nothing would happen, as would letting the issue be decided outside the central administration. The core curriculum I have described is small compared to

some others, less than a fifth of what some universities offer. It could be only four one-semester courses (though the abysmal knowledge most students have of the sciences suggests a two-semester course may be desirable here). If it were enlarged to include more subjects to please everyone it would become unmanageable, and leave too little time for concentrations, and probably fail. On the other hand, every student should be able to write well and to present arguments clearly both in writing and orally. All core courses can be formulated so as to improve students' skills in these areas.

Administratively, how could one proceed to implement a core curriculum? Obviously it is too complicated to do for all students at once. It seems that one could begin with some small groups, such as the Residential College, the Women in Science and Engineering program, a modified Honors Program, and perhaps others. Once the initial curriculum were taught successfully it could be expanded systematically. The Honors program may represent an opportunity. Michigan is a large public university. Most of the students are not here to become researchers or scholars. The Honors program could become a way of selecting those who have qualifications and interests and motivations that position them to respond well to a core curriculum. The way the Honors program is presently structured may not be appropriate to such a plan, so either a major remodeling or a new program may be needed.

Are there valid reasons why relatively few universities have a serious core curriculum? Sometimes it is argued that core surveys are less "rigorous" than departmental courses. There is no reason for core courses to be less intellectually rigorous if care is taken. They obviously provide less material in each area, which could be regarded as being superficial. But students can take additional courses in the areas that excite them. For example, the core science should be taken by all science majors too. For a part of the course they will cover material they get in more depth in their concentration, but there they do not get a historical or cultural context or much science outside of their specialization. More generally, few students have ever encountered most of the content of a good core course. Such courses reveal to them the wonderful achievements of many people over many centuries that increase our understanding of ourselves and our world, that help us achieve our full

potentials, and that help us learn how to take responsibility for making a better world.

In some of the debates on core curricula people have argued that because of the knowledge explosion in recent decades the range of subjects to be taught is much larger, and no one can judge what knowledge is important, or that the content of the core curriculum can be seen as arbitrary. That is simply wrong. The point of the core is that it is a foundation from which the rest can be studied. No one would question freedom of speech, or democracy, as appropriate for a course in rights and values. They are not arbitrary choices. No one would question learning that inanimate objects and the stars and we are made of the same atoms and how we know that, or how we know that life on earth evolved, are part of a core science course. Most of the content of the core courses I have described will be easy to agree on. For the rest there will be some variation, and even that can be a benefit because students can choose focuses that interest them.

Another occasional argument against a core curriculum is that much of it should be taught at the secondary level. It is time to stop making that argument — it is simply not happening, and will not. Further, the core curriculum I am arguing for is deeper than any secondary approaches. In many cases only high quality professors have the knowledge and understanding to teach core ideas and insights to inexperienced students.

Note that the core curriculum I have argued for is not devoted to great books. Trying to agree on what the great books are has polarized curriculum debates unnecessarily, and is indeed somewhat arbitrary. We do not need to get into that. Much of the debate in any case is about values, so if we focus on the rights and values that attract people of all cultures we can proceed. The debate will reemerge at a more detailed level as we try to decide how the course is taught, but once the basic goals are in place there are probably several valid ways to proceed.

A core curriculum is not the only way to improve the coherence of the curriculum. The recently introduced theme semesters can be very good, and very effective, and should continue and grow, as should interdisciplinary

courses. All of these are not substitutes for a core curriculum but independently valuable ways to provide a liberal education. Perhaps it should be emphasized that any research university that establishes an innovative core curriculum would get extensive national recognition for its efforts to provide a quality undergraduate education, and would attract higher quality undergraduate students. Michigan does very poorly at attracting National Merit Scholars, as do most universities without meaningful core curricula.

Henry Rosovsky, a wise and respected Dean at Harvard, in his book "The University, A User's Manual", suggested a "standard for a liberal education in our time". I would modify his standard a little to give the following. An educated person must be able to think and write clearly and effectively. An educated person should have a grasp of how we gain knowledge and understanding of ourselves, our society, and our universe — both the methods and the results. An educated American should not be ignorant of other cultures and times; they should grasp the historical forces that have shaped the present and those that will shape the future. An educated person should have some understanding of moral and ethical questions. An educated person should understand the importance of the rule of law. An educated person should have achieved depth in some field of knowledge. An educated person should be able to enrich the quality of his or her life with cultural opportunities humans have developed over many centuries. Our present undergraduate curriculum allows such an education, but modifying it to include a core curriculum of the sort I have argued for would make such an education *likely*.

REWARD SYSTEM

It is frequently and correctly observed that faculty will not long continue doing something such as undergraduate teaching when it is less rewarding relative to otherwise equally worthwhile activities such as research or service. More generally, an imperfect reward system has evolved, and it distorts much that goes on at the university. The present system encourages significant unfairness, often hurts morale, and has negative effects on achieving the goals of the university. A useful analogy is the U.S. tax system that could discourage pollution and waste but does not. The university could retain more good people, strengthen loyalty, and save money by preventing adversarial offers.

One trend of the past decade or two that has large but subtle bad effects on the university is the way rewards have become associated with administration.

Research and teaching have been relatively diminished. One aspect of this is the rapid increase of administrative salaries relative to professorial salaries. The trend is broader, involving a large variety of temporary administrative positions. Those who do administration receive extra rewards, often regardless of how well they do. Those who do research or teaching even very well do not. Few faculty feel that the contribution of administrators to the well being and improvement of the university justifies the relative rewards. While the impact on faculty morale is clear, probably the main damage to the university comes from the large number of the best qualified people who have come to view administrative service as a chore. This is a major change in the culture of the university, and needs attention. The solution is not simply that professors should provide more unrewarded services.

As I have served on university advisory committees and talked with colleagues at my own university and elsewhere, I have become convinced that another important cause of increased difficulties for the research university in the past decade is a problem that I have not seen discussed before; I call it the "Core Professor" problem. I will first describe the problem, and then discuss the implications that are the real reason I bring it up.

Every good university has a set of professors who are its major intellectual resource. Most of these professors are committed to teaching both undergraduates and graduate students. Most of them are productive researchers with international reputations. Often they are in their 50s but some are younger or older. Some were hired as bright young assistant professors and lived up to their promise. Some came as full professors, "stars"; typically they did important work earlier that made them attractive to hire. The fraction of such people in a given department varies considerably, and is not easy for an outsider to estimate, but I guess it averages 10-20%. These are the "Core Profs". They contribute to the excellence and reputation of any university much more than would be indicated by their numbers.

The Core Profs are almost always excited about their research, their teaching, their writing, and other aspects of intellectual and educational life. They work hard and seldom have enough time to teach all they want or do all the research they want or write the books they want or give all the talks they are invited to

give or contribute as much as they could to university, national, and international activities. Many of the Core Profs are carrying out ambitious research programs that are having or will have major impact. They are usually effective and often popular teachers.

Over two decades ago, most universities began to change the way they valued and rewarded the Core Profs, decreasing their recognition in the university and rewards relative to those of younger faculty, or to people brought in at the same level even though those new appointments were rarely really better or more accomplished than the Core Profs, or to faculty hired in non-traditional roles.

It is easy to understand the dynamics that lead to a relative devaluing of the Core Profs. During times of financial pressure every administrator needs to justify every new appointment in glowing terms, while it is harder to rave about someone who has been around for some time. The achievements of an administrator are more easily measured by new things than by ongoing important contributions of faculty. In general, there is no one to speak up for the Core Profs, and their own voices can be dismissed as self-serving.

Some Core Profs respond by accepting outside offers, and some solicit outside offers and use them to get increased rewards; although one may deplore an environment where administrators need an outside offer to justify rewards, one can understand why it exists even though it should not. Many Core Profs are not willing to solicit offers. Many have other values or situations that dominate, such as a working spouse or a well-functioning research group or a rich and rewarding life where they are. Some rewards are not economic ones. In some fields outside offers are simply rare (*e.g.*, where each professor can teach a majority of the courses offered by the department); Core Profs in such fields do not have the option of leaving for a comparable institution. A number of factors such as these limit the effectiveness of "market mechanisms" in dealing with the inequities described above, though administrators often raise the marketplace analogy as their first response in discussions about Core Profs. Of course, the university is not and should not be mainly a marketplace; other values and qualities should play a major role in determining what is appreciated and rewarded. Indeed, fairness may be as important as the actual rewards. For

every person who gets an outside offer, I am confident there are several of equal quality and accomplishments and value to the university who do not.

I want to emphasize the important and little recognized implications of what I have described above. As time goes on and the Core Profs continue to be unfairly treated, their loyalty to the university erodes. Since they have many activities competing for their time and efforts, their emphasis shifts, and they begin to withdraw from the activities of the university in many ways. Time spent on writing, or more quality time spent with their families is rewarding, as is time spent on national and international activities or consulting. In the research world merit is seldom unrewarded to the extent it is in the university. They may teach more advanced courses and fewer undergraduate courses. They may spend less time grading problems or papers in undergraduate courses, and less time seeing undergraduates outside of class. They invite students to their homes less often. The combined impact of these actions and related ones is large. I believe that the negative effects on undergraduate education because of Core Profs disengaging from the system are one of the important causes of the general sense that the quality of the undergraduate experience has really decreased. It should be emphasized that the effects on undergraduate education come not only from less undergraduate teaching by Core Profs, but perhaps more importantly, from many indirect effects such as those listed above.

While most Core Profs do not take other jobs, they "leave the university" in other ways. The Core Profs increasingly just say "no" to local committees and requests to help. This is one of the major and most insidious impacts, because they are replaced by less experienced and effective people, and the quality of advice and input and governance decreases. Many of the Core Profs know distinguished people in their discipline from around the world, and in the past they have brought such people to their university. That takes a lot of time and effort. They see such people anyhow in their travels, so they stop bringing them to the university. That hurts younger scholars and students and the quality of education. They spend increasing amounts of time away from the university. They may participate less actively in recruiting. Another extremely insidious effect is that younger talented faculty do not miss the point that at their institution they can expect to be treated less well as soon as they lose leverage, and they plan and act accordingly.

I see all of the above things happening. It is important to understand that the Core Profs are not behaving selfishly, and that this is not a moral question as far as their behavior is concerned. They remain very active and productive, positive and hard-working. It is only that their mix of activities is changing. They do many things they love to do: their research, writing, visiting other institutions, teaching grad students, spending time with their families, and more. There is never enough time to do all these things. Often they are not particularly conscious of the shift in activities until asked. Not all Core Profs do all of the above things, of course. But the majority of Core Profs are behaving to a significant extent as described above.

When I discuss the Core Prof problem with colleagues at my university or elsewhere, almost all recognize it. Sometimes I encounter misunderstandings. I am not talking about the so-called "salary compression" problem. That is essentially the problem that because a given percentage raise costs more dollars for a senior person, and because merit raises cost more dollars for a senior person, the salaries of senior people tend to get compressed together and toward the lower end. That of course exacerbates the Core Prof problem, but the salary compression problem applies to almost all full professors, while the Core Prof problem applies to a subset and has a disproportionate impact on the university. Similarly, I am not referring to the "loyalty tax" imposed on many who serve responsibly and who often are taken advantage of when they accept additional responsibilities. Salary compression and the "loyalty tax" are real and serious problems and need solving, but in my view are less important for the university than the Core Prof problem.

Given the difficult pressures the university is under today, how could this situation be improved? I believe a number of innovative solutions could be found. Generally Deans and Chairs are motivated to implement short-term solutions, and feel required to have well-documented justification for any actions. It is not easy to document the Core Prof problem because Core Profs remain very active, and their shifts in focus and time are not easily measured. They may not be the department members most valued by department Chairs who want a smoothly running department. Any effective effort to alleviate the problem must be merit-based. These points imply that

initiative and leadership probably needs to come from the central administration. Someone needs to be responsible for improving the situation.

How can their rewards be increased? The situation is very subtle here, partly because not all the important rewards are economic. Clearly raises should be an important component in some cases. The costs may be lower than a naive reaction suggests. For many Core Profs, learning that their salary would be increased 10-20% (in addition to normal raises) over 3 years (say) would have about the same impact on their attitudes as would the same net increase in one year; the principle is as important as the principal. And a number of more creative rewards could be found that would go a long way to eliminating the problem. Some Core Profs could be given a named chair that carried the honor plus a supplemental stipend attached that could be used for books, travel, computers, hiring assistance, etc. One saving from non-salary rewards is the absence of benefits. There may well be a large number of donors who would contribute enough to support a chair such as those described above; the cost is of course very small compared to that of an endowed chair. This is a situation where innovative methods could work well because it is in many cases the need for fairness and recognition that is important, though often enough money to bring the Core Prof rewards up to a certain level would be required. In general, broader appreciation of those who contribute importantly could go a long way. People have a good sense of fairness; administrators need to ask if rewards and incentives are fair and are pulling us all in the directions that are best for the university.

My recognition of the Core Prof problem, and my perception of its impact on the university, is based on anecdotal evidence rather than systematic study. I can't prove it is happening, or important. But since I first became aware of the effect some years ago I have been asking about it, and the consistency of the response has convinced me the problem is widespread and the impacts are real. The Core Prof problem needs attention and solution because of its effects on the general quality of our universities, particularly effects on the undergraduate experience.

FINAL REMARKS

Even though the research university is basically healthy, and basically teaches well, I have tried to argue that there are several areas where improvement is important. The medical analogy is useful, I think — even though basically the medical industry is healthy and effective, it did not take concerns seriously enough as they arose two decades ago and generate its own solutions, and it lost control. I have tried to argue that for the research university some essential improvements needed are a particular small core curriculum, an administrative restructuring particularly at the college level including the introduction of more autonomy for sciences and probably others, and some significant tinkering with the reward system. Most of the forces at work will lead most Deans and Chairs to resist most of the innovations discussed here. Not much will happen unless central administration leadership takes charge and commits resources. The university is an Aristotelian world rather than a Newtonian one: every change stops unless it is continuously pushed.

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