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My presence this evening at Indiana University gives me a great sense of nostalgia. Not only am I among a group of mathematicians, many of whom have been friends for decades; but I also have wonderful memories of visits to this campus, doing research and writing papers with one of my best friends and closest associates, Glenn Schober. Tragically, Glenn died of cancer a few years ago at the height of his very impressive career.

Glenn excelled as a researcher and as a teacher of undergraduates, and he brought an impressive sense of commitment to both endeavors. As we think about refocusing the work of mathematics departments, we can learn a lot from the example he set.

In shaping my remarks this evening, I am mindful that you've had a full and intense day, followed by a wonderful reception and dinner . . . and that you face *another* series of meetings tomorrow. Recalling George Bernard Shaw's admonition under similar circumstances – that "the subject is not exhausted, but we are" – I will keep my remarks brief enough to allow time, if anyone is so moved, to respond to or question what I say.

Before I begin, however, I want to offer a disclaimer. As much as I still love mathematics and the company of mathematicians, I have long been removed from the world you live and work in on a daily basis. I did serve as a TA this past term in a self-paced, computer-based calculus course, and it was a wonderful experience. Indeed, the 50 minutes I spent in the classroom was often the highlight of my day. But that experience notwithstanding, I fear that any substantive observations I might make are things those of you on the front line have already thought about . . . and either dismissed or implemented.

Let me start by congratulating the organizers of this very impressive session and the Task Force members who prepared the book, ***Towards Excellence: Leading a Doctoral Mathematics Department in the 21st Century.*** I am deeply impressed by the book's content and the directions it sets. I believe there is much wisdom in it for chairs of other disciplines as well, and I hope this book will be widely circulated throughout academia, not just in mathematics departments. I certainly intend to disseminate it at Ohio State University.

If I have a quibble with the book, it's with its opening premise, which suggests that the primary objective is to fill the coffers of mathematics departments. Now obviously that's an important pragmatic objective for any department chair worth her or his salt. I do wish, however, that the book had at least posited the notion that its recommendations were important because of their intrinsic merit . . . and that if we do these things and do them well, there is reason to believe that our budgets will stabilize, perhaps even grow. This quibble aside, I think the advice and the examples of best practices found in the book are squarely on the mark.

In particular, I admire the Task Force's forthright statement about the centrality of quality instruction, especially at the undergraduate level, as a cornerstone of a successful

department – even at research-intensive universities. To be honest, I was surprised – pleased but surprised – by the book's sense of urgency, one might even say passion, about the need for much greater attention to undergraduates and the undergraduate curriculum. Such emphasis is as refreshing as it is necessary.

Let me also say that Chapter 3, **What We Learned,** provides an excellent summary of the changing nature of higher education generally. In just a moment, I want to focus on a few of the findings of this chapter and offer my own perspectives on them.

In a similar vein, I believe Chapter 4, **Our Advice,** provides a very effective blueprint for building a successful department in today's environment. It's clear that the Task Force listened well to deans and others outside of mathematics departments, took seriously the criticisms they heard and provided a prescription to treat many, if not most of the ills facing mathematics departments today.

Towards Excellence is a revolutionary document. The plan of action it offers leads to a radically different department than the kind in which I was educated and which I inhabited during my active days as a mathematician. When I began my career in the mid-1960s, some colleagues bragged that they prepared for their undergraduate class while walking from their offices to the lecture halls. If the truth be known, on occasion I was probably among those braggarts.

What has caused this shift? Why in only a few short decades have we moved from a culture where undergraduate education was almost an afterthought to one where a group of respected leaders in our discipline offer a clarion call for a new departmental paradigm, one that places undergraduate education at the very center of departmental concerns? Are the reasons for this call for significant change temporal? Are these leaders pushing us towards fads that will burn brightly for a few years and then fizzle, enabling us to return to the (quote) "good old days?"

My unqualified response to both questions is an emphatic no! These proposed changes are, at least in large part, a wise reflection of fundamental societal changes, driven in part by economic forces that have radically altered our nation's socio-economic ethos. As creations of society, our universities – and higher education generally – cannot help but be influenced by the forces at work in the larger societal context within which we operate. As always, these forces will change over time, but the change will be evolutionary and on the time scale of decades, not years.

Those few of you, relatively speaking, who grew up professionally in the Sixties, as I did, will recall a fervency, if not outright paranoia, about our competitive position vis a vis the Soviet Union. For those of you too young to recall the event, it is difficult to convey the impact that Sputnik had on the American psyche. With the launch of this Soviet space vehicle, our nation became convinced that we had lost our scientific dominance. This was unacceptable to the American people, and enormous sums were invested to reestablish our scientific preeminence.

Maybe some of you were beneficiaries, as I was, of the National Defense Education Act, which gave thousands of Americans the opportunity to get a Ph.D. fully funded by the federal government. The sine qua non of national policy leaders, indeed the entire body politic back then, was to build the research capability of our major universities and national laboratories. Fortunately, the nation either had or borrowed the money necessary to press forward with this goal.

All this led to a university culture where, as noted in an AAHE essay, **Making Place for the New American Scholar,** R. Eugene Rice:

1. Research was the central professional endeavor and focus of academic life;
2. The quality of professional activity was determined almost exclusively by external formal peer review;
3. Knowledge could be pursued for its own sake, usually amply supported by the federal government;
4. Research was discipline-based, with greater and greater emphasis on increased specialization; and
5. Faculty loyalty was directed away from the university and toward disciplines and subspecialties.

To be honest, my generation grew up in an era and with a set of priorities unlike anything higher education had known in its previous history and is unlikely ever to see again.

But in addition, other *social* dynamics were at work. The Sixties was an era of large government programs aimed at building Lyndon Johnson's Great Society. It was the era when, for good reason, affirmative action reached full flower and wide acceptance. It was an era of government supported and government sponsored entitlement, large, well-funded social programs and rapidly rising government spending. In such an environment, oversight, accountability and assessment are not primary concerns. This was the larger socio-economic dynamic that guided the development of our universities through the Sixties and Seventies and well into the Eighties.

I make no claim to being a social historian, but I think the forces I just described, losing energy through the Eighties, met their demise in the nation's economic downturn at the beginning of this decade. Ironically, the final blow was a development with a "Sputnik"-like effect. For several years our economy was in near free fall and the Japanese economy was booming – leading to a national malaise that in many ways mirrored the perceived loss our scientific competitiveness to the Russians. Experts began writing that Western economic dominance, and most especially *U.S.* economic dominance, had come to an end. A new economic order had replaced it, they said, led by Japan and emerging nations on the Pacific Rim.

Some of you may have read **The Reckoning**, David Halberstam's chronicle on the rise of the Japanese auto industry and the concurrent decline of Detroit. And you may recall a PBS series in the early 90's in which leading economists described the new economic order, lead not by the U.S. but by the Japanese. Things got so bad for us at one point, that something like the top ten largest banks in the world were all Japanese.

To add insult to our injury, the Japanese started buying up some of our most treasured symbols of power – major office complexes in New York like the AT&T headquarters and Rockefeller Center, and perhaps the cruelest blow of all…the Pebble Beach golf course. Talk about a challenge to our economic virility!

Our nation's reaction was no less dramatic than with Sputnik, only this time the response was lead by the private sector, not the government. Focus, accountability, relevance and the bottom line became the new national mantra. Companies like IBM, which had long heralded their corporate version of academic tenure, began massive layoffs. But fortunately, America retained the technological prowess and the entrepreneurial culture to recapture the dominant position in the world economy. We soon regained our leadership

position, in the process pioneering an information age economy that is likely to be dominant at least for the first few decades of the new century.

One corollary of our economic success is the new socio-economic culture that has infused the private sector and government at all levels. It's important that universities understand this new culture, for it is unlikely that any university can succeed unless it takes these new socio-economic dynamics into account.

I've taken the time to offer this little retrospective in order to emphasize two points. First, I think the larger social context within which we operate is fundamentally different than the one most of us grew up in . . . and that this context is not likely to change any time soon. Second, many faculty members do not seem to grasp this reality. In fact, I'm constantly amazed at how often my colleagues think that the changes universities are considering, and in some cases implementing, represent a sinister plot hatched by a devious coven of unenlightened presidents and provosts.

"If you would just tell the legislature how important what I'm doing is, they would get off our backs and give us more money," is the kind of refrain I hear often.

Indeed, the need for change within our universities is matched only by the resistance to change. I'm reminded of a bumper sticker I saw recently which said: "Change is good," it read. "You go first."

Now, I *don't* mean to imply that we in higher education are merely pawns of external forces we cannot influence. Clearly, we must actively and forcefully explain the importance of our fundamental mission to policy leaders and the general public. We must openly champion the value of a liberal as well as a professional education and the dangers inherent in under-funding the arts and humanities. We must be strong advocates for the essential role of basic research. And along with enlightened trustees and other friends, we can and should significantly influence the public policy decisions that impact our universities.

But we must also understand – and work within – the present socio-political context of the larger society because it, too, will greatly influence our success.

What are some of the implications of this new order for higher education? The *good* news is that the body politic sees much of what we do as vital to our nation's continued well being. Never in my lifetime have I witnessed such a pervasive focus on the quality of education at all levels. In particular, the light has dawned on the private sector, which now recognizes that their success, unlike that in earlier economic booms, depends upon our producing an abundance of well-educated graduates for the nation's workforce. There is even strong support for our research efforts, at least in areas where there is a connection to our economy.

The *bad* news? There is an aversion to any increase in taxes and to growth in government. This suggests that we can anticipate the following three trends in the coming years.

First, we will realize only modest increases in state funding, except in selected areas – primarily technology related – where there is a clear and obvious connection to economic growth. Targeted funding for programs that show promise of improving the quality of K-12 public education is likewise possible.

This means we will face continued financial austerity because, in the years ahead, it will be difficult to augment modest state increments with significantly increased student tuition. Many universities have already played the tuition card, and further significant

increases conflict with society's expectations for access to higher education and workforce development.

A second phenomenon that will affect our lives is a continuing demand for accountability. Now, I am a strong proponent of accountability and am working hard to increase accountability at Ohio State. But any good concept can be carried too far, or be misused, especially when it comes encumbered with time-consuming processes that rely on simplistic notions of performance. But however burdensome this trend may become, the push for ever greater accountability is probably an inevitable consequence of tight state budgets.

With increasing competition for a limited pool of resources, every allocation will receive heightened scrutiny. Governors and legislators will feel forced to document the impact of state expenditures. The push for faculty workload measures, monitoring of retention and graduation rates, measurement of time-to-degree, reporting of course availability, and calls for measuring the "value added" of a college degree will continue. And there's no place to turn for relief from these demands because the general public thinks they are reasonable things to measure.

A third trend is an internal response to declining resources and increased demands for our services, namely the phenomenon of decentralized or responsibility-centered budgeting. While this phenomenon has existed within *private* universities for decades, if not since their inception, it is a much more recent phenomenon within *public* universities.

Simply put, it is a strategy to more tightly align a university's revenues with its expenses. Thus, research overhead and tuition generated by a college or department from its enrollments would be returned to the generating unit, minus some tax to pay for central services, such as the library, the registrar's office, etc. I started to say the president's office, but I'm not sure anyone would recognize that it provides a service.

Theoretically, such a system provides the incentive for departments to do things that are in demand and can generate new revenue. And while to a certain extent that does seem to occur, this system also has obvious downsides. For example, it creates a *dis*incentive for colleges to encourage their majors to take course in other colleges, since presumably this represents a lost revenue opportunity. But whatever the merits, universities across the country, including my own, are implementing these decentralized budgeting systems.

Given these three trends – limited budgets with funds targeted for perceived societal needs, increased accountability for the use of funds, and responsibility centered budgeting – let's consider how today's mathematics departments might fare. The answer is in the book, ***Towards Excellence,*** and the picture isn't pretty.

Even I was surprised at how bad the data are: From 1991 to 1997, there was a significant decline in overall enrollment and a near vanishing number of majors; a precipitous drop in graduate enrollment; and over sixty percent of course instruction at the first-year calculus or lower level. Yet, there was essentially no decline in the number of tenured faculty, and there was an actual rise in the number of non-tenured teaching faculty. In the environment I've described, it's impossible to imagine that these trends can continue much longer. Either enrollments will go up or faculty positions will go down.

But the situation isn't *all* bad. Mathematics has a number of impressive assets. Along with English, it is still seen as one of the two core disciplines upon which an educational foundation is built. As a result, Math is still a requirement at most colleges and universities. It always has had and undoubtedly always will have strong connections to

other disciplines, especially in the physical sciences and technology and increasingly in the biological and social sciences. These connections occur, of course, at both the educational and research levels. And mathematics is singled out with special importance in the move to improve the quality of K-12 education.

The question is how to draw upon these assets in addressing the liabilities we face. This is the question that the ***Towards Excellence*** book addresses so well, and the steps taken at the University of Michigan, Oklahoma State, the University of Texas and other universities provide excellent examples that others either have or should emulate.

In thinking about the issues you are facing, I tried to imagine myself as one of you, chair of a mathematics department. I asked myself, what would I do? How would I begin to address these problems?

Here's what I *think* I would do. First, I'd prepare for and then call a department-wide meeting. I'd circulate the ***Excellence*** book beforehand and invite the dean to give his or her perspectives on funding priorities. I'd share departmental enrollment and instructional load data and trends, much as the book does. In sum, I'd try to create a sense of urgency for change.

Hopefully, such a session would stimulate creation of a task force on the future of the department, a local version of the task force that produced this wonderful book. I'd also make certain the dean and the provost were informed and supportive of this effort.

I then asked myself, if I were the dean, provost or president, what would I like to see contained in the task force report?

First, as with ***Towards Excellence***, I'd like to see a commitment to the centrality of undergraduate education in the department's mission. I'd like to see a call for a reshaping and restructuring of the curriculum . . . with greater emphasis on active learning at all instructional levels, a call for departmental leadership in addressing the university's retention issues and diversity goals, a commitment to the development of joint majors and upper-level service courses in partnership with other departments, and the creation of a departmental tract to prepare K-12 teachers.

Next, I'd want to see a commitment from the department to assume leadership in the creation of a statewide consortium on K-12 issues. This consortium would include representatives from other mathematics departments in the state, high school math coordinators and teachers. It would address mathematics expectations of the universities' matriculates, discuss curriculum issues and develop mechanisms to provide feedback to local schools on their students' preparation and performance.

I'd also like to see a plan from the department on its future faculty recruitment strategies. The plan would indicate how positions would be reallocated to hire people in interdisciplinary fields such as the computational sciences, neural networks, and string theory, as well as experts in the teaching and learning of mathematics.

I'd want the plan to address the graduate curriculum as well, how the department intends to change the curriculum to reflect the changing employment circumstances and the needs of the discipline. I'd want to see a plan that described a graduate program that provided non-academic career opportunities *and* prepared future faculty to be good stewards of an undergraduate program as well as able researchers.

Finally, I'd include a commitment to implement what I think is the most important single strategy in ***Towards Excellence***…individualized faculty workloads. I think there is no area where universities' actions are more subject to valid criticism than the way we

utilize our human resources. I'm certain the situation has improved somewhat from when I was a chair . . . but surely not enough. In my day, we had a uniform teaching load regardless of whether faculty were actually engaged in research. Indeed, we perpetuated a myth that *everyone* was involved in research. God help the person who tried to take on some special assignment involving undergraduates. Rumors would start to buzz in the hall. What's wrong with old Joe? His career must surely be on the skids. Such attitudes were never justified, but with the issues facing our departments and universities, they can no longer be tolerated.

We *do* need a new reward structure, one more in tune with current reality, and presidents, provosts and deans alike need to lead and ease the way for their creation. Mathematics departments are wonderfully suited to help support this effort. The demands on the department are perhaps more varied than any other department in the university and, given the data in the book, it's impossible not to conclude that personnel in most departments are under utilized. I'm confident that a department coming forth with a creative strategy in this area would gain enormous favor with the administration. Certainly, they would with me.

In advocating individualized workloads, I want to make one point very clear. As research universities, we have every reason to expect that candidates for tenure will demonstrate a research mastery of his or her field. In mathematics, this would almost certainly mean research published in major peer-reviewed journals. But, as Ernie Boyer pointed out in his brilliant essay, ***Scholarship Reconsidered***, careers in academia are long, and few sustain an uninterrupted, 40-plus-year career of important research activity. As we all know, this is especially true in mathematics. Let's accept and take advantage of this fact. Let's make it not only possible but admirable for people to contribute to the department's many responsibilities. Let's make it possible for individuals to gain promotion to full professor if they excel in scholarship related to the learning of mathematics or in outreach to the K-12 sector.

Enough of my preaching on this topic. As you can probably sense, it is one on which I have strong views.

In any event, once a plan is developed, I'd invite the dean, provost and president in to hear a presentation on it and seek their support for its implementation. I can't speak for any other president but I can tell you such a plan would get my attention and support. I'd want to use it as a model for other departments. And I would certainly want to insure that any department willing to commit to such a plan had the resources to do so.

In conclusion, I offer one final word of perspective. When we talk about change of the magnitude under discussion at this conference, one can be left with the impression that everything being done today is bad. It is true that our rhetoric does tend to get away from us, so let me state for the record that I don't feel that way. Many good and valuable things are under way. We don't need to change everything.

Certainly, as chairs of departments at research universities, you have an important responsibility to sustain the high level of research that has produced remarkable advances in our discipline. The identification and nurture of bright young talent, the support of established, productive researchers is a vitally important responsibility of a department chair. Any implication that this is not the case is, in my view, terribly misguided and is most definitely *not* what I'm suggesting.

What is needed so desperately at this time is what is described so well in the book…balance. We need balance in the department's mission, reflecting the multiple responsibilities we have. We need balance in the allocation of resources to meet these multiple demands. And most of all, we need balance in the allocation of people's time and responsibilities so that departments can meet – and meet well – the obligations of there total missions.

This leads to my final thought about the book. It so wonderfully describes the single most important ingredient for building a successful department…the leadership of the chair. This is not an easy time to be a department chair, especially chair of a mathematics department. But, I'm confident that if you can help effect the kind of changes in your departments that are called for in ***Towards Excellence,*** it will be one of the most rewarding experiences of your lives and among the greatest contributions of your careers.

The strategies set forth in ***Towards Excellence*** are the right ones for your departments, and not because they *may* lead to more resources, although I hope they do. They are the right strategies because they represent the most appropriate and effective ways we as mathematicians can use our talents to serve society's needs and the common good. And that, after all, is what we who chose careers as researchers and educators are supposed to be all about.

Thank you again for letting me participate in this impressive meeting.