

Report to the Regents on Research, Scholarship and Creative Activity

PRESENTED BY HOMER A. NEAL, VICE PRESIDENT FOR RESEARCH,
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The University of Michigan is one of the nation's premier universities for research, scholarship and creative activity. In this document, we seek to provide a brief overview of research and scholarship at Michigan, and to provide a context for answering some of the following questions: What is research and scholarship? Why do we do it? Who pays for it, why, and will they keep paying for it? What is the relation between research and instruction? What is it like to be a faculty researcher or scholar? How good are we at what we do? How will we be affected by changes at the national level? Although we will not answer all of these questions in detail, I hope that we will successfully set forth some of the parameters and highlights of our research enterprise.

Let us begin by looking at where we stand relative to some of our peer institutions. By at least one measure -- total research expenditures -- Michigan was the leading research university in the country in FY93 (the last year for which national data are available). Certainly we were first among public institutions; among all institutions, we ranked second only to Johns Hopkins University [we note that Johns Hopkins' total, however, includes the Applied Physics Laboratory, a laboratory funded separately by the Department of Defense].

Of course, sheer volume of research expenditures is not in itself a measure of excellence; it does, however, signify a remarkably diverse research effort -- and, inasmuch as the vast majority of these expenditures derive from peer-reviewed, federally sponsored programs, it is strong evidence of the excellence and competitiveness of our faculty.

We face several major challenges in our ongoing effort to sustain this broad research effort. Last year I noted that all research universities -- in fact, research institutions across the country -- had entered a period of uncertainty. The national environment for research and scholarship has been undergoing important shifts in recent years. The end of the cold war is forcing a rethinking of the nation's rationale for investment in science and engineering research. This, in turn, has led to a change in the missions and objectives of our national research laboratories, potentially bringing them into competition with universities as providers of service to industry. At the same time, the nation's economic growth has been constrained, limiting resources both in the private and public sectors [the effort to gain control of the federal deficit further crimps resources available to research]. And political pressures are being brought to bear on various specific areas of research, scholarship, and creative activity -- in some cases, such as the National Endowment for the Arts and the National Endowment for the Humanities, threatening the very existence of federal funding.

These changes are paralleled by two important developments in public opinion: the first is an increasing focus on near-term results, brought about in part by a relatively extended period of economic difficulty for many, and in part by other shifts within society; the second, and

perhaps more damaging development, is declining confidence in universities, in particular, and in the nation's research institutions, more generally.

We are, more and more, beginning to see the impact of these changes on the lives of our individual faculty. The federal funding agencies are undergoing significant retrenchment and refocusing, in line with greater accountability and the requirement that they devote a larger portion of their resources to research that is strategic in nature. During the past year, universities were, at several points in the federal budgeting cycle, threatened with the implementation of a "pause" in the reimbursement of indirect costs on federally sponsored projects. Although in the end this "pause" was not enacted, its being raised as an issue is clearly symptomatic of the new approach that is often being taken by the federal government to its relationship to research universities.

Fortunately for us all, the dialogue between researchers -- including research universities -- and the government took several important steps forward in the past year. In January 1994, Jim Duderstadt and I were privileged to be part of an important conference in Washington, D.C., a Forum on Science in the National Interest, called by the White House Office of Science and Technology Policy (OSTP), the National Academy of Sciences, the Association of American Universities, and other groups. This Forum brought together about 200 representatives from government agencies, from Congress, from universities, and from industry to discuss what needs to be done in order for the United States to meet the goal of world leadership in science, set forth by President Clinton.

The results of this conference were taken up by OSTP leading, eventually, to the creation of a new Administration statement on national science policy, which was issued by President Clinton and Vice President Gore on August 3 in the report *Science in the National Interest*. This policy promises investment in science as a national priority, targeting 3% of GDP for investment in R&D as an appropriate goal. "Science" in this context is broadly construed to cover basic, applied, and engineering research in the biological, biomedical, physical, industrial, mathematical, social, and behavioral sciences. The policy statement sets forth a general plan for a new era of science -- a plan in which the value of fundamental science is reaffirmed but is also resituated within a broader social environment [the report speaks of an "ecosystem" model for the pursuit of science]. The document proposes five broad goals:

1. Maintain leadership across frontiers of scientific knowledge;
2. Enhance connections between fundamental research and national goals;
3. Stimulate government, industry and academic partnerships that promote investment in fundamental science and engineering;
4. Produce the finest scientists and engineers of the twenty-first century;
5. Raise the scientific and technological literacy of all Americans.

The University of Michigan has been very much engaged in the discussions concerning national science policy. I have already mentioned our participation in the conference last January. In March, we cooperated with the Gerald Ford Library on a visit to campus by Neal Lane, Director of the National Science Foundation. This past fall, as part of our newly established Distinguished Lecture Series on National Research Policy, we hosted two critical events devoted to further discussion of *Science in the National Interest*.

The first was the inaugural Distinguished Lecture, presented by Dr. Martha Krebs, Director of the Office of Energy Research in the Department of Energy. Dr. Krebs presented a lecture on September 13 titled "National Science and Technology Policy: Beyond Advocacy." She set forth an outline of the new science policy, and the associated structure of the new National Science and Technology Council (NSTC).

On October 3 and 4, we were pleased to host M.R.C. Greenwood, Associate Director for Science in the Office of Science and Technology Policy, for a symposium and series of meetings devoted to *Science in the National Interest*. This was the first symposium in the nation devoted to the new science policy statement, and it sparked much interesting discussion.

Of course, since then, the national political environment has undergone another significant change, as a result of the congressional elections. Even before the election, however, we had conceived of the need for a new approach to facilitating progress on a renewal of the university/government partnership that would be responsive to our nation's changing needs. We were keenly aware of the fact that *Science in the National Interest* represented only part of what would be required, and that what was still needed was a clear, simple, and explicitly shared understanding of what the university/government partnership ought to look like. In October 1994, I presented to the Committee on Institutional Cooperation (CIC) a proposal for a Summit devoted to renewing the partnership between the federal government and the universities. We envisioned this summit being built around a new Compact, defined by representatives of the universities, of Congress, of the Executive Branch, and of industry, and setting forth, at the level of general principles, on the one hand what the American people expect and require from their research universities, and on the other hand what the universities require from the federal government in order to meet these obligations.

Since this initial proposal, we have had discussions of the idea with M.R.C. Greenwood, with Congressman Vernon Ehlers of Grand Rapids, with Robert Teeter, a political consultant, with representatives of funding agencies, and with other knowledgeable individuals. The CIC presidents have unanimously endorsed proceeding with planning for this Summit, and we are moving forward. We will keep you apprised of further developments.

From this discussion of the macroscopic context of research, and our efforts to help shape that context, we turn to the other end of the scale -- to the particular researcher who makes the whole thing actually work. Too often we are in danger of taking for granted the people who bear the real burdens of research policy. I am speaking, most particularly, of the principal investigator (PI) -- a member of our faculty who has, as a result of the large-scale changes mentioned above, been forced to overcome an increasing number of difficulties in order to carry out sponsored research. The PI plays a rich role in the university: he or she is a generator of new knowledge; a provider of financial support to research scientists, postdoctoral fellows, graduate students and often undergraduate students; and a teacher, in the research setting, of postdoctoral, graduate, and undergraduate students. At the same time, he or she is a proposal-writer -- an increasingly time-consuming task -- and a grant administrator, required to conform to a vast array of regulations stemming from the sponsoring agencies as well as from the University. And, the PI does these things while maintaining the responsibilities of teaching and service that fall upon all of our faculty. Figure 1 captures these activities in a pictorial form. In addition, I refer you to our article in praise of the principal investigator in Issue No. 2 of the *OVPR Bulletin* (1994).

THE IMPORTANCE OF THE PRINCIPAL INVESTIGATOR

We have many reasons to be proud of our faculty's accomplishments. Although we cannot even begin in this context to account for all of their achievements in research, scholarship and creative activity, we can point to some of the more salient examples of recognition. During this past year, we saw three of our faculty -- professors Akil, Watson, and Yamada -- elected to the National Institute of Medicine. One -- professor Wright -- was elected to the National Academy of Sciences. Three faculty members were elected to the National Academy of Engineering. Two of our newer faculty received very prestigious awards: professor Wooley of mathematics, a Packard Foundation Fellowship; and professor Ni of mechanical engineering, a Presidential Faculty Fellowship. We recognized several faculty with prestigious internal awards. The list could go on for some time; and we have here touched only the tip of the iceberg.

In addition, I would like to draw your attention to another fact about research here at Michigan that was only recently brought to my attention and that I found fascinating. As you know, the University has long held a premier position in social science research, and particularly in longitudinal studies. The breadth and scope of these studies is remarkable: they cover a wide range of issues, and together include an astounding 126,000 subjects (individuals or couples or families) from throughout the world.

Keeping in mind, then, that it is our faculty that makes our research engine run, we turn now to a brief profile of that engine. We note the following salient points:

- total research expenditures increased by 3.3% in FY94, to \$386M.
- within this total, federal research expenditures increased 5.4% -- an indication that we remain competitive with our peers.
- moreover, prospects for the future look bright: proposals to federal agencies exceeded \$1 billion, for the first time in the University's history (a 23.9% increase).
- proposals to the U.S. Department of Health and Human Services (HHS), which had declined slightly in dollar value in FY92 and FY93, increased 26.4%.
- the dollar value of research awards in FY94 increased 12.6%.

Figure 2 shows the trend of our total research expenditures over the past ten years.

TREND OF RESEARCH EXPENDITURES, FY85-94

We note, then, that we are continuing on an upward slope in terms of federally sponsored research expenditures (which accounted for 69.2% of our total expenditures in FY94). At the same time, however, our non-federal expenditures, and particularly our internal, institutional expenditures, have remained more or less flat for several years (Figure 3). We will be giving this matter attention in the months ahead.

RESEARCH EXPENDITURES BY FEDERAL & NON-FEDERAL SOURCES, FY85-94

As Figure 4 shows, federal expenditures are the largest element in our research spending profile.

RESEARCH EXPENDITURES BY SPONSOR GROUP, FY94

HHS continues to account for the lion's share of federal research on this campus (58.0%), followed by the National Science Foundation (16.9%). A full third of expenditures can be assigned to the Medical School; Engineering accounts for 21%; the Institute for Social Research (ISR) for 10.1% and LS&A for 9.6% (See Figures 5 and 6).

UM RESEARCH EXPENDITURES BY AGENCY, FY94

RESEARCH EXPENDITURES BY ADMINISTERING UNIT, FY94

We note that in any of these assignments there could be a great deal of crossover among units: research projects that involve faculty from several units typically process their expenditures through only one unit; faculty who have joint appointments also tend to route all of their grants through only one of their units [this might be particularly true in the case of ISR which, we note, includes a large number of faculty from LS&A].

We might wonder how well we are prepared to handle the shifts in the national environment. Fortunately, one of the benefits of a diverse and accomplished faculty is that they are, as a group, able to pursue research at the cutting edge -- and this, in turn, places them in a competitive advantage vis à vis national sources of funding. Federal agencies are shifting their priorities, but our faculty are already deeply engaged in many of the areas of research that the agencies are now coming to emphasize.

I will note that one of our special interests in the Office of Research (OVPR) is interdisciplinary research. In this regard, our campus is, indeed, thriving. Last winter we surveyed our deans, and asked them to tell us with which other units their faculty have significant research interactions. The answers reveal that our colleges are, indeed, bound together by many vital connections.

Last year I outlined a number of areas where I intended to focus our energies. I have already commented on several of them, such as our involvement in national science policy through the initiation of our Distinguished Lecture Series, as well as our active participation in settings where we might influence national science policy. The following is a brief summary of our accomplishments relative to the goals I presented at last year's Regents meeting.

RESEARCH INTEGRITY

Last year I discussed the need for universities to strive to regain the public confidence lost in recent years, and pledged to take steps to insure that we have in place appropriate institutional policies to govern our actions. I am pleased to report that we have issued a new integrity in scholarship policy after consultation with the faculty and deans. This *Policy Statement of the Integrity of Scholarship and Procedures for Investigating Allegations of Misconduct in the Pursuit of Scholarship and Research*, provides clear guidelines supporting high standards of academic integrity, as well as laying out the steps our community will take in policing itself to maintain these standards. [The policy statement appears in *OVPR Bulletin*, 1995, Number 3.]

In addition, we developed a framework of policies and procedures to review faculty members' financial conflicts of interest in sponsored projects and technology transfer arrangements. This policy will become operational in the coming year.

Promotion of university discussion on research integrity issues is also a part of our agenda. Last year we hosted a lecture by Professor David Smith, Director of the Poynter Center for the Study of Ethics and American Institutions, on the subject of how to teach research ethics. Subsequently, OVPR, with the cooperation of the Rackham School of Graduate Studies and the Provost's Office, sponsored the attendance of four university faculty members at a week-long Poynter Center Workshop on teaching research ethics. We will be sponsoring a second set of UM faculty delegates to the second of three annual workshops to be held this coming May.

Last year we initiated a project with Rackham that we are calling *Rights and Responsibilities of Graduate Students on Organized Research Projects*. The objective is to provide institutional guidance to faculty members and graduate students on the sometimes contentious issues that arise when graduate students participate in sponsored research projects. [There is also discussion of this issue in *OVPR Bulletin*, 1995, Number 3.]

RESOURCES AND THE PROMOTION OF NEW RESEARCH

Last year I discussed the context for research support internal to the University, pointing to the importance of maintaining our research infrastructure as well as the need for "seed funds" to promote new areas of research. In addition to the Presidential Initiatives Fund, I announced the creation of a Strategic Research Initiatives fund to ensure that faculty initiatives in areas deemed crucial will have a source of internal, initial funding. The direction of such funding would be, in part, guided by a planning process, undertaken in collaboration with the Provost, which asked the deans to describe their research goals for the foreseeable future.

I am pleased that we have been able to make some progress in this area, seeding several new interdisciplinary programs which emerged as high priority needs among the deans and serve to support some of our most promising faculty. Initiatives which are underway include:

- Culture and Cognition Program
- Program for the Study of Complex Systems
- Collaboratory for Research on Electronic Work
- Program in Cognitive Science and Cognitive Neuroscience

- Biomolecular Recognition Program
- Global Change Program

In addition, we have continued our traditional programs of funding promising faculty research projects as well as contributing to the development of key elements of our research infrastructure, most notably by providing equipment that cannot be secured from sponsors, yet is critical to the evolution of new research.

ARTS/HUMANITIES INITIATIVE

Last year I noted that we needed to see what more OVPR could do to help support the arts and humanities on campus. I am pleased to report that we have made tremendous progress on this front in the past year. In conjunction with the schools and colleges of LS&A, Architecture and Urban Planning, Art, and Music, we have established two new awards: the Michigan Humanities Award, for tenured faculty in the former two units, and the Michigan Arts Award, for tenured faculty in the latter two units. [Recipients of the Awards will be released from teaching for one term during the 1995-96 academic year; the Office of Research and the faculty member's school or college will provide funds to the home department to hire a replacement instructor.] In addition, we have worked with the University Library to bring one of the nation's foremost experts in computing in the humanities back to campus; we expect humanities computing to be a significant area of technological development over the next few years, and we are positioning the University to assume a leadership role.

PRESIDENTIAL INITIATIVES FUND COMPETITION

Last year I announced that President Duderstadt had committed to undertaking another Presidential Initiatives Fund (PIF) competition as part of a comprehensive effort to support new areas of research and training. OVPR provided assistance in conducting this competition and in making recommendations to the President.

The goal of the Presidential Initiatives Fund is the enhancement of intellectual leadership. Investments for the following purposes serve that overarching goal:

1. To encourage research in new, less established areas of scholarship and creative activities, especially in emergent areas where there may be high risk but potential for high gain.
2. To promote scholarship and creative activities through new modes of inquiry in various styles of interaction and collaboration and through new alliances.
3. To integrate graduate and undergraduate research training in interdisciplinary and innovative research.

Our effort was directed at helping the President identify a few projects which could not happen without this special support and would have no other likely source of funding. Even though only a handful of projects are funded, the encouragement of faculty creativity inherent in this

process has widespread benefit. While some proposals may not receive PIF funding, they often find other sources of support, whether from other UM sources or from sponsors.

Seventy-nine proposals were received, involving over one hundred faculty. These represented a broad array of disciplines and innovative approaches to enhancing the scholarly life of the University, and it is difficult to make choices from among this display of faculty talent.

RESEARCH SCIENTISTS

When I last reported to you, I had just begun a review of the nature of our commitments to this group of faculty who are focused on the conduct of research and have traditionally raised their salaries from sponsored projects. Over the past year we have made great strides, working with the schools and colleges, the Research Scientist community, and the Faculty Senate (through our Research Policies Committee) to clarify and strengthen the definition of this group. As a result we have created a new category, Research Scientist II, which will allow units to identify their most distinguished Research Scientists and give them greater security by providing access to internal funding as their own research programs ebb and flow. In addition, all Research Scientists will benefit by a strengthening of promotion criteria and support for career development.

MICHIGAN MANDATE: DIVERSITY AND GENDER

OVPR has traditionally supported research undertakings that focus on diversity issues and support non-traditional approaches to the study of race, gender, and ethnic conflict. Over the past year we were particularly pleased to share in the initiation or support of many new projects, including:

- International Working Group on Racism: Research on Inter-ethnic Cooperation and Conflict
- Women of Color in the Academy
- Michigan Women's Health Initiative
- Feminist Practice Project
- Colored Museum Project

In addition, we are collaborating with Rackham to produce a videotape entitled, "Diversity and the Academic Disciplines: Do Race and Gender Really Matter?" We have brought together some of our most distinguished faculty and graduate students from across the disciplines for a discussion that confronts the changes in our core academic pursuits brought about by the growth in participation by women and people of color in the academy.

The edited version of this penetrating discussion will be used to stimulate discourse on this topic in many settings, on our campus and elsewhere, in an effort to deepen our collective understanding and appreciation of the impact of race and gender on the conduct and content of our intellectual and academic lives.

HISTORY OF SCIENCE

Over the past year, we have been privileged to acquire oversight of the historic Detroit Observatory. Constructed in 1854, it is the second oldest building on campus, and the oldest unaltered observatory in the United States with its original instruments still intact and operational. With the assistance of an advisory committee, we are working on the restoration of the facility with plans to transform it into a museum as well as a unique location for meetings and events. Hopefully, in the not too distant future when we have completed the basic repairs, we will invite the Regents to meet there, and provide a glimpse of the heavens through the historic 12.5-inch Fitz refracting telescope.

TECHNOLOGY TRANSFER AND ECONOMIC DEVELOPMENT

As we made evident in our presentation to the Regents in October, we have continued to make strides in this arena. The formation of an Economic Development Council, the increased focus on new business development, and support for strategic alliances all point to a more proactive and successful presence by the University in the economic life of our city, state, and nation, and, increasingly, our global community.

Our licensing of UM technology continues to be a strength, and several of our licenses, particularly in the medical arena, will bridge the gap between laboratory research and the public welfare. Noteworthy, also, is the strength of our software licensing program. As many of you know, Ann Arbor is one of the "hottest" centers for software development in the nation. Finally, we are pursuing an increasing number of inventions -- a sign that disclosures from UM faculty continue to be of high intellectual quality, as well as meriting the commercial protection achieved by a patent.

U-M LEVERAGING RESOURCES: SOURCES

The leveraging of resources is critical to the health and success of our scholarly program. The University provides these funds to support or seed research, hopefully securing additional resources as a result. The UM contribution to research, as we understand its fiscal dimension, is in a steady state. Nonetheless, the judicious use of these internal funds becomes an important element in crafting programs of research that become self-supporting and contribute to the overall intellectual life of our academic community.

The UM funds used to support research come from a variety of sources, some administered by the schools and colleges and others from various central sources, such as Strategic Research Initiatives in OVPR or the Presidential Initiatives Fund which were mentioned earlier. Another important source of leverage is in the form of cost sharing -- funds the University expends on a sponsored project, usually for equipment, faculty time, or graduate student support. Taken together, all of these leveraging funds contribute to our ability to secure grants and remain competitive in a wide range of scholarly pursuits.

U-M LEVERAGING RESOURCES: USES

UM funds are often most valuable when they stimulate the development of a new or emerging field of scholarship. In these instances, achieving a critical mass of academic resources can make the difference between a research project that is short lived and one which blossoms into a major source of knowledge and training. For some emerging areas of research, traditional funding sources are not equipped to provide adequate review, or are tied to conventional programs of research. The intensive nourishment the UM provides with its own funds can enable a project to reach a level of achievement that external sponsors may more easily recognize and support.

For some ongoing areas of research, the UM contribution sends a clear signal that we value this kind of research, and see it firmly connected to our own commitments. In addition, while not attracting new funds, some UM funds support areas of scholarship and creativity which would otherwise not be represented in our community, thereby limiting the opportunities for faculty creativity and educational opportunities for both graduate and undergraduate students. This is particularly true in the arts and humanities where external funding is scarce.

U-M LEVERAGING RESOURCES: EXAMPLES

In the next section of my report, research highlights for FY94 are summarized. The section provides a great many examples of research programs and activities that are leveraged with UM resources. For instance, the Culture and Cognition, Global Change, and Cognitive Science and Cognitive Neuroscience programs were leveraged with UM resources.

Programs which now have strong external sponsors but which benefited in their early stages from UM leveraging include the Center for Ultrafast Optical Science and much of the UM research in Human Genetics. The UM can point to many, many examples of successful use of UM resources to attract sponsor funds.

OVPR has produced a videotape that provides further evidence of the rich scholarly environment created by the partnership between UM and external sponsor funds.

LOOKING AHEAD

While 1994 was an exciting and productive year, we are already well into meeting the demands of 1995 and beyond! We will continue many of our current initiatives into the future.

I conclude with a brief outline of some of my major objectives for the coming year. These are best formulated as a series of themes which define the future of the University of Michigan, and, in some respects, all major research universities that hope to thrive in today's dynamic environment.

As I have already outlined, I see the work we are doing on *The National Agenda: A New Compact for Universities and America* as critical to the long-term health of the research university, and Michigan is in the forefront of this movement.

Increased focus on the Integration of Research and Education is essential to the health of our enterprise and the establishment of the New Research University -- one which operationalizes the idea that every learner is discovering knowledge and every scholar is a perpetual student. As an example, we have undertaken discussions with the National Science Foundation about how we might initiate a comprehensive, systemic examination of science education at a research university in the first two years of college; these discussions have been conducted under the rubric of "Science Education in the New University." This "New University" will involve important shifts in educational paradigms, toward an emphasis on multiple modes of learning, and an increased usage of active, hands-on, group-learning methods.

We must also continue to face the challenges posed by the interrelatedness of the University and the economy. Technology Transfer, in its continuing evolution, must fashion new paradigms for university/industry relations. We must find approaches that preserve the core academic values which we cherish and still provide a bridge between the critical technologies that are invented in the university laboratory and studio and the industrial partners that can bring these technologies to the public. We need to evaluate alternative models and policies in the year ahead to determine those best suited to this complex task.

Last, and never least, we must persevere in our effort to support the highest standards in Ethics of Scholarship, and take seriously our role in Engendering Values in the Next Generation of scholars. I have already mentioned our initiation of a project focused on the rights and responsibilities of graduate students, and that is the first component of this broader effort. If American universities are to retain their role as defenders of the right to pursue truth, wherever it leads, then universities must also accept the challenge of instilling and maintaining the highest standards of academic integrity in the university community.