

**RIDING THE MOMENTUM OF  
RESEARCH:  
LEADERSHIP CHALLENGES IN PUBLIC  
RESEARCH UNIVERSITIES**

***Merrill Series on  
The Research Mission of Public Universities***

A compilation of papers originally presented  
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## INTRODUCTION

Mabel L. Rice  
The Fred and Virginia Merrill Distinguished Professor  
of Advanced Studies and  
Director, Merrill Advanced Studies Center  
University of Kansas

This year marked the eighth annual research policy retreat hosted by the Merrill Center in Valley Falls, Kansas. The 2004 topic was: *Riding the Momentum of Research: Leadership Challenges in Public Research Universities*. The research mission of public universities is a dynamic, ever-changing, and increasingly expensive enterprise. The momentum is driven by scientific initiatives that, by their very nature, are difficult to predict, can develop quickly, may persist for years or may have a short time of prominence, and require significant resources in the form of faculty expertise, funding, and physical space. The leadership of a comprehensive public university must accommodate the fluid nature of scientific initiatives to the world of long-term planning for the teaching and service missions of the universities. The policy retreat focused on how to meet the leadership challenges, by noting the ways that success has been achieved, and by considering ways to leverage the available resources across the universities in the region. The meeting ended with a call for evaluation of regional resources and the development of a Presidents' Plan for Faculty and Facility Coordination across universities. This regional initiative could significantly advance the funding potential for each research institution in the four-state partnership. The plan is being discussed as this publication goes to press

Twenty senior administrators and faculty attended from the four heartland states – Kansas, Missouri, Iowa and Nebraska. Mary Sue Coleman, our keynote speaker, talked about the University of Michigan's success in attracting major investments for research facilities. Three other chancellors attended and gave presentations: Robert Hemenway (University of Kansas), Harvey Perlman (University of Nebraska-Lincoln) and Jon Wefald (Kansas State University), as well as David Shulenburg (KU Provost and Executive Vice Chancellor – Lawrence), and Barbara Atkinson (incoming Executive Vice Chancellor – KU Medical Center). Keith Yehle, Legislative Director for Senator Pat Roberts, is also a regular attendee.

The 2004 topic built on discussions at the eight previous retreats in the Merrill series *The Research Mission of Public Universities*. Our benefactors, Virginia and Fred Merrill, to whom we are deeply appreciative, support these conferences. The inaugural event in 1997 focused on pressures that hinder the research mission of higher education. In 1998, we turned our attention to competing for new resources, and ways to enhance individual and collective

productivity. Michael Crow, our keynote speaker that year, encouraged us to identify niche areas for research focus, under the premise that it was most promising to do selective areas of investigation at the highest levels of excellence. In 1999, we examined in more depth cross-university alliances. Keynote speaker Luis Proenza encouraged participants to think in terms of “strategic intent” and he highlighted important precedents in university-industry cooperation as well as links between institutions. In 2000, we focused on making research a part of the public agenda. We heard from George Walker who encouraged us to meet the needs of our state citizens, business leaders and students who are quite able to “carry our water” and champion the cause of research as a valuable state resource. In 2001, Joan Lorden brought to the table her experience with the topic of evaluating research productivity. She provided a valuable overview of key elements to consider when selecting measures for evaluating performance, with a focus on the very important National Research Council (NRC) study from 1995. Our keynote speaker in 2002 was Martin Apple, President of the Council of Scientific Society Presidents. In light of 9/11, he proposed unique ways that universities can lend expertise on bioterrorism, while at the same time remaining faithful to the task of generating new knowledge that can lead to societal benefits such as better health and sustainable energy sources. In 2003, we focused on graduate education and invited two keynote speakers who provided views from the top leadership levels in the U.S. and Canada. Debra Stewart, President of the Council of Graduate Schools, spoke about challenges to graduate education in light of the push for curriculum reform, budget cuts, and new rules on immigration. Martha Crago, President of the Canadian Association of Graduate Studies, gave an update on initiatives in Canada, and offered her insights on how to build programs for the future during hard times, based on her experience as an administrator at McGill University. Both speakers addressed key issues about retention of students in the doctoral track, efficiency in time to degree, and making the rules of the game transparent.

As always, the pages of the Merrill white paper reveal many fascinating perspectives, and a frank examination of the complex issues faced by research administrators and scientists every day. It is with pleasure that I encourage you to read the papers from the 2004 Merrill policy retreat on *Riding the Momentum of Research: Leadership Challenges in Public Research Universities*.

## EXECUTIVE SUMMARY

### **KEYNOTE ADDRESS**

Mary Sue Coleman  
President, University of Michigan

- Institutions can make a difference in securing external funding for research. It is important to have appropriate support systems for the faculty. It is helpful for the grant administration office to provide guidance in preparing the proposals, building budgets, and meeting deadlines.
- Keeping track of trends in funding is critical. It is important to be aware of the priorities and initiatives of federal agencies and to look for opportunities. The more broadly involved your faculty are in professional activities, the better informed they will be about the large-scale picture.
- It is important to identify the best programs to target for growth and support within your institution. Tying the research and academic mission of the university to the economic climate of your state is also a good idea.
- The state of Michigan dedicated a significant portion of its tobacco company settlement to the Life Sciences Corridor, which involved making competitive awards in a state-wide initiative. The University of Michigan prioritized this initiative and established the Life Sciences Institute with a combination of a permanent endowment and seed funding from the University. In the last two years, the Life Sciences Corridor became the Technology TriCorridor and the state's commitment has shifted, but the core faculty at the University of Michigan are moving toward our goal of self-sustaining external funding.

### **UPDATE ON NATIONAL DEVELOPMENTS IN GRADUATE EDUCATION**

Robert Barnhill  
NSF/CGS Dean in Residence  
Past President and Senior Scholar, KU Center for Research

- The NSF, NIH and CGS sponsored a workshop in June 2004 on "Support of Graduate Students and Postdoctoral Researchers in the Sciences and Engineering: Impact of Related Policies and Practice." 100 graduate students, postdoctoral researchers, faculty, graduate deans, labor economists and federal agency representatives attended in Washington,

D.C. One of the purposes was to define the impact of financial support in encouraging U.S. citizens to enter the fields of science, technology, engineering and mathematics.

- Labor economists at the workshop observed that the U.S. depends on a cheap labor pool of graduate students and postdocs to accomplish its academic research. Graduate study and postdoctoral training account for about 10 years of a 40-year scientific career.

## **FIRST PANEL OF RESEARCHERS**

George Wilson, Distinguished Professor of Chemistry and Associate Vice  
Provost for Research, University of Kansas

Meredith Hay, Assistant to the Vice President for Academic Affairs, University of  
Missouri-system

Robert Brown, Director, Office of Biorenewables Programs, Iowa State  
University

- Research administrators should play a role in establishing the proper conditions for scientists, mathematicians, engineers and clinicians to interact. Information technology is an area where leadership from the top is important. Although faculty clearly provide the energy and creativity for collaborations, research administrators have responsibility for creating the “architecture” that facilitates this – by constructing research buildings to house people with potentially common interests and by continuing to enhance and create centers.
- Essential elements of successful collaboration are: strong and respected leadership; clear identification of mutual benefits; clear criteria for setting priorities; a process for assigning credit for accomplishments; and administrative support and reward to leadership.
- Without enabling technologies such as PCR and the automated DNA sequencer, the completion of the genome projects would never have been realized. Bioinformatics – the marriage of biology and computer sciences – is one of the most robust and fastest growing fields in science. Embracing interdisciplinary approaches has created unprecedented growth in life sciences research in academia by fostering invention and discovery.
- Can we engage in a non-zero-sum game? Is there a position of cooperation and interdisciplinary/intercampus partnerships that will achieve maximum gain for each team or institution? It will require a change in our university research culture.
- The Office of Biorenewables Programs manages the Bioeconomy Initiative that was launched at Iowa State University in 2002. The

Bioeconomy Initiative is inherently systems-oriented, requiring collaboration among teams of scientists and engineers from many disciplines. It spans the campus, with 35 affiliated faculty from 12 academic departments. The basis of the research is technology platforms – the convergence of enabling technologies into a highly integrated system for transforming a specific feedstock into desired products.

## **PANEL OF UNIVERSITY PRESIDENTS**

Jon Wefald, President, Kansas State University

Harvey Perlman, Chancellor, University of Nebraska – Lincoln

- All universities should focus on basic research. Kansas State University (K-State) is home to a major genome project – the sequencing of the genome of the red flour beetle. Land-grant institutions should also conduct research with a practical flavor where possible. K-State is the only university-based undergraduate education program in flour milling, feed milling and bakery science. 80% of the state's wheat harvest comes from K-State developed wheat varieties. To be useful, research findings have to leave the lab quickly and find their way into the economy as new products, processes, technologies and businesses.
- The Kansas State University Research Foundation is responsible for protecting the faculty's research through patents and copyrights. The University, City of Manhattan and State of Kansas through KTEC formed a partnership to develop the National Institute for Strategic Technology Acquisition and Commercialization which commercializes intellectual property at the university and also a large portfolio of donated patents.
- Research adds value to education. Students benefit from participating in a laboratory setting, and it clearly enhances their understanding of the basic discipline. Research also adds to the value of our states. K-State research adds about \$3 billion in economic development monies annually to the state of Kansas.
- Joe Collins' book *Good to Great* identifies three central themes for moving institutions from good to great: 1) Get the right people on the bus, then figure out where to drive it; 2) Develop a hedgehog concept – establishing your priorities at the intersection of three universes: the things that you can be the best in the world at, the things that you are deeply passionate about, and the things that drive your economic engine; 3) Be disciplined in confronting the brutal facts of your situation and sticking with your priorities. When applying these principles to administration of the University of Nebraska-Lincoln (UNL), the most difficult was to develop the hedgehog concept because a public university does not fully control its mission. We have come to define our concept as: being great in undergraduate education and research, which coincidentally responds to



the State's two primary needs – keeping young people in Nebraska and broadening the state's economy.

- One of the most difficult challenges is to remain disciplined and consistent with regard to priorities, and to think in the long-term. Priorities are a lot easier to follow when budgets are increasing. When Nebraska was faced with budget cuts, UNL protected its ability to make continuing investments in priorities by eliminating three peripheral academic programs after first reducing administrative functions. This resulted in termination of 23 tenured faculty who, all but one, took positions in other departments or took early retirement.

### **FIRST PANEL OF RESEARCH ADMINISTRATORS**

James Bloedel, Vice Provost for Research, Iowa State University

Ron Trewyn, Vice Provost for Research, Kansas State University

James Roberts, Vice Provost for Research, University of Kansas

- In the late 1990's many states began to view their universities as the primary driver of economic development efforts. Iowa hired Battelle to generate a roadmap about enhancing economic development based on areas of specialization and expertise within the universities. As a consequence, universities may be asked to reallocate funds from established programs in order to adopt initiatives targeted toward economic development. One benefit of committing to this area is that an institution can market itself as an entrepreneurial university, a niche that appeals to many students.
- Iowa State University (ISU) has developed a "System for Innovation." It includes an affiliated research park and an on-campus incubator system. ISU shares instrumentation facilities with companies in the research park and throughout the state. ISU provides technical support and advice to Iowa businesses through its business support centers. As a consequence, 57 new companies have started in Iowa based on technology developed at ISU. Recently, ISU was designated one of the top three U.S. universities in the development of patentable biotechnology. It is a new era for defining the role of the research university.
- Public universities must take control of their destiny if they are to continue to ride the momentum of research into the future. Keys to success include: creating dialog with institutional customers and stakeholders; institutionalizing opportunistic flexibility and fluidity; facilitating inter- and multidisciplinary research; leveraging areas of competitive advantage; partnering with "win-win" organizations and entities; addressing local, state, national and international needs; enhancing institutional economic development activity; developing

incentives to reward entrepreneurship; modernizing graduate education programs and options; implementing an information age outreach philosophy; marketing unique attributes and value-added outcomes; and identifying metrics to document returns on investment.

- Kansas State University (K-State) has established the National Agricultural Biosecurity Center to coordinate multidisciplinary activities focused on protecting America's agricultural infrastructure. This initiative began in 1999 when K-State created a Homeland Defense Food Safety, Security, and Emergency Preparedness Program – well in advance of the 9/11 terrorist attacks. In addition to USDA funding for the new Center, K-State has received funding for the Great Plains Diagnostic Network – a nine-state regional hub that provides county-by-county plant disease/pest surveillance and diagnostics. The NSF has also provided funding for veterinary telemedicine that includes livestock health sensors.
- KU is one of the fastest growing institutions in the country in terms of research volume. When we designate a research center on our campus, these are the attributes we consider: national or international prestige; it fits the special character of the campus; it is truly interdisciplinary; it provides administrative services to researchers; it is inclusive, not exclusive; it has a large volume of externally funded research, as measured by their discipline; it provides a significant return on investment; it is flexible. To be successful, a center must begin with a natural interest from the faculty. Top-down directed centers often do not work.
- KU uses a double-counting system for research dollars – credit and return of overhead money flow, first of all, back to the dean based on the faculty members' appointments, and the center gets a separate pot of money based on the grant itself, not on what the faculty do.
- We could create the situation where the graduate school really is the responsible authority for graduate degree programs that could either be located in academic units or in centers. A similar process could be used for giving credit for these degrees – we could double-count them. If a faculty member is a part of an interdisciplinary degree program in a center and has graduate students in the center, the home department could still get credit for that degree because of the faculty member's affiliation, and the research center could also count the degree. This creates more flexibility and enables the building of a degree program based on research strength.

## **SECOND PANEL OF RESEARCH ADMINISTRATORS**

Prem S. Paul, Vice Chancellor for Research, University of Nebraska - Lincoln  
Steven Warren, Director, Schiefelbusch Institute for Life Span Studies,  
University of Kansas

- Much of the increase in research funding at the University of Nebraska-Lincoln has occurred because of collaboration across departments, colleges, and institutions. In 2000, UNL had a handful of large multimillion dollar grants, but today it has numerous grants of this nature. One of the new grant-funded centers is the Nebraska Center for Virology. It involves faculty from the three major biomedical research institutions in Nebraska – the University of Nebraska-Lincoln, the University of Nebraska Medical Center and Creighton University.
- Faculty effort and institutional commitment are critical for obtaining grant funding of significance. In each instance of success at UNL, it is the faculty who conceived the innovative ideas and had the experience, desire and commitment to put together strong teams. At the institutional level, UNL provides support by awarding seed funding of research clusters and making strategic investments.
- KU's Life Span Institute has 12 programs with 87 principal investigators and has been in existence for four decades. The combined footprint of the Institute, together with shared programs at the Medical Center in Kansas City, represents approximately 36 million dollars in research, development, training, and clinical activity in a given year. The Institute leverages about 6 external dollars for every dollar received from the state of Kansas. NIH is the largest source of funding, but others include Health and Human Services, the Department of Education, the state of Kansas, and foundations.
- These are the characteristics of the Life Span Institute at KU: stable leadership and seasoned investigators, good state support, an evolving infrastructure, and administrative flexibility. The administration is essentially a federation of interests, not a top-down hierarchy. Program directors are active scientists, so they are impacted by the same things the PI's face.
- Tips for successful research centers: recruit, retain, mentor; evolve with the science; diversify the portfolio while enhancing its quality; build from your strengths and don't go into an area where you have no strength; measure and evaluate the effects of your policies and initiatives; reinforce innovation, creation and making a difference at all levels.

## **SECOND PANEL OF RESEARCHERS**

Lisa Freeman, Associate Professor of Pharmacology, College of Veterinary Medicine, and Director of Mentored Training, Kansas State University

Susan Sheridan, Distinguished Professor, Educational Psychology, University of Nebraska - Lincoln

- Of the 102 public institutions classified by the Carnegie Foundation for the Advancement of Teaching as Doctoral/Research Universities-Extensive, the top 50 have a significantly higher number of centers and institutes than their counterparts. Of 20 sampled among these universities, the mission statements of their centers revealed a strong orientation toward promoting multidisciplinary research, public-private partnerships, and economic development.
- There are unresolved and ambiguous issues related to university centers and institutes that pose significant challenges for trainees, faculty and administrators, namely, organizational structure, reporting requirements, educational mission, appointments, accountability, credit and incentives. It is important to collect data about the contributions of centers and to develop criteria for determining their value. It is also worthwhile to determine if there are effective means other than centers/institutes for encouraging multidisciplinary collaborations and translational research.
- The mission of the Nebraska Center for Research on Children, Youth, Families and Schools is to improve through cutting-edge interdisciplinary research, our understanding of optimal ways that parents, teachers and other service providers in family, school and community contexts can promote the intellectual, socio-emotional, physical and behavioral adjustment of children and youth. The long-term goal of the Nebraska Center is to become a nationally recognized center of excellence. Initial objectives are: 1) Conceptualize, generate, submit and secure competitive research grant projects; 2) Foster interdisciplinary research; 3) Provide opportunities for interaction with national researchers; 4) Increase the visibility of the Center and Center faculty affiliates.

## **CONFERENCE REACTION AND PLAN**

David Shulenburg, Provost and Executive Vice Chancellor, University of Kansas – Lawrence campus

- An important theme by Mary Sue Coleman is to encourage faculty initiative and provide institutional support.
- The states of Kansas, Nebraska, Iowa and Missouri should consider a formal collaboration for research dollars. At least three of the states are low population, and each of the universities represented at this

conference is moderate in scale. We could benefit from sharing resources and realizing economies of scale by working together.

- I propose that we hire a research team to do a SWOT analysis on the schools in our four states: identifying the major research opportunities that our resources don't now enable us to seize; identifying the existing faculty, facilities and expertise for addressing problems; identifying the facilities and faculty we don't have and need; and recommending where facilities and expertise would best be located among the universities in the region.

## KEYNOTE ADDRESS

### THE RESEARCH MISSION OF PUBLIC UNIVERSITIES

Mary Sue Coleman  
President  
University of Michigan

Thank you for inviting me to talk with you about issues related to our research mission. I have taught, conducted years of laboratory-based research, and been an administrator at four flagship research universities, so I have seen many ways that research programs can flourish as well as decline. I would like to start our discussion by presenting my own views on what all of us need to observe as we work toward advancing our universities by expanding our research programs and external funding. We all have opportunities that we can target for growth and encouragement. The world outside our universities looks to us for innovation. This is true at the regional, state, and national levels. In addition to being attuned to our own ambitions and possibilities, we always need to be aware of the expectations we face.

My remarks will focus on several critical themes:

- 1) Making sure that we have appropriate support systems for our aspirations;
- 2) Understanding the current funding environment and its vulnerabilities;
- 3) Identifying where we can advance our research mission in new ways;
- 4) Recognizing the complexity involved in ramping up the research component of a university, from staffing to infrastructure;
- 5) Communicating, internally and externally, the value we provide to our nation as it works to meet the challenges of remaining competitive and innovative in the global arena.

External funding for research has become a vital part of our success as prominent public universities, even allowing us to change the ways we teach undergraduates and involve them in research projects. This participation is also an important hallmark for our country – it led to our pre-eminence in science, technology, and innovation in the latter half of the twentieth century. At some institutions, such as the University of Michigan, external funding for our research activities far exceeds the appropriation we receive from the state. Access to these revenue streams has been very beneficial in terms of building the strength

and visibility of our academic departments, especially in medicine, life and physical sciences, and engineering. Of course, no research program just happens – virtually all prominent centers and departments develop their programs as the result of faculty initiative and institutional support.

I first want to underscore the need to make sure you have the support systems in place to allow research programs to flourish. As a former faculty researcher, I can assure you that individual faculty members sometimes find that the internal grant offices in a university impede, more than assist, in processing and administering external grants. Of course, all universities must be attuned to the importance of rigorous monitoring of external awards and the complex regulatory environment within which we need to function. But we need to make sure that our grant officers act more as facilitators than as gatekeepers.

Young faculty members need help in preparing competitive grant proposals and in understanding the mechanics of their initial grants, so that they will be successful in conducting their work and becoming competitive for the next grant. All faculty members, but especially new ones, need help in learning how to build and administer budgets. They need specific instructions regarding the regulatory environment, and they need clear advice about obtaining necessary approvals (such as testing on animals or human subjects) well in advance of their submission deadlines.

Institutions can make a distinct difference regarding the likelihood of success for a grant. Some universities conduct “boot camps” for new researchers. Others help create support groups to read and critique each others’ grants. We need to make sure grant offices are open late and grant officers are available at grant deadlines. Just providing a pick-up service for faculty at the last minute will be greatly appreciated by a nervous and tired professor – whether new or seasoned. Grant officers can be enormously helpful in putting together boiler-plate information for program projects and center grants. All grant offices should regularly conduct customer satisfaction surveys – just to see how they are doing.

Faculty also may need guidance in terms of reaching out to agencies; they need to be encouraged to contact staff at external funding organizations, and often need help in learning to do that effectively. The advance knowledge they acquire by discussing their ideas with a project officer can make the difference between a good but unfunded grant application and successful grant funding. In fact, some private organizations do require a pre-review stage, and applicants need to be advised of this as soon as possible by your grant officers. Faculty need to understand that they have a responsibility to inform themselves, but they also need to know that funding agencies wish to identify great ideas and people, too. This exchange of information can be productive.

Sometimes, faculty or units wish to compete for classified research projects. The world of classified research brings its own set of regulatory criteria and related issues at campuses where openness is highly valued. If your faculty members want to pursue this specialized area, you may wish to consider setting up a separate organization where the work will actually occur, so that your university has an arms-length relationship to the project and funding agency. Establishing such an entity may be complicated, and will require a significant amount of advice from your own experts in external research.

Your sponsored program administrative staff must be up to date and aware of the trends in funding and the logistics of funding agencies, so that they can smooth over the hurdles that new faculty members are sure to encounter – as well as the changes in funding systems that mid-career faculty members will discover in requesting renewed or new funding. As you look at the programs you might want to build through adding faculty members and staff, be sure you have appropriate administrative support. Even if you want to increase funding by encouraging current faculty members to become more active, you may need to add administrative staff in your grant and contract units to deal with the increase in workload. You do not want to have your faculty members stumble because of lack of institutional support.

Second, you should make sure, as an institution, that you understand where the opportunities and vulnerabilities exist in external funding agencies. Your grant and contract staff may be aware of trends, but you will also need to have academically-based administrators who are involved in that world to keep close watch on trends. Depending on priorities in federal-level budgeting, almost all agencies go through cycles of increased and decreased spending. These cycles are apparent to those who are close to the agencies and involved in their professional organizations – the more broadly involved your faculty are in a variety of professional activities, the better informed they will be regarding the large-scale picture. For example, NIH funding has grown dramatically over the past five years. Currently, it is in a steady-state mode that is creating a shock to the system. There are also opportunities that occur – such as the current emphasis on defense spending, which extends to research in bio-defense and anti-terrorism programs. Because this is a priority for our country right now, the funding opportunities have become more profuse – but, of course, that also means that the competition for that external funding has become much more vigorous.

Like federal agencies, private funding organizations also wax and wane in terms of their ability to provide funding, often depending on the value of their endowments, which can fluctuate. They frequently will establish priorities and initiatives about which we need to be aware. I am going to talk about one of our newer programs at the University of Michigan that has taken advantage of an opportunity offered by decisions of a private foundation. Again, the more



connected your staff and faculty have become professionally, the more aware they will be of the opportunities that present themselves.

All of us have faced budget constraints in the past few years. One area that is often cut is faculty travel to conferences. To our public audiences, travel may seem wasteful and cutting travel expenditures can make for good press coverage. But be careful, in making local budget decisions, that you are not making small savings that could have a larger adverse impact if your faculty becomes less engaged in the national academic community. It is critically important for your faculty members to be part of the scholarly networks of professional organizations, so that they are hearing about trends and opportunities in their field along with their colleagues from other institutions. When your faculty present talks at a conference, it is likely that someone in the audience may be part of a review process for that research. This is another important way for faculty to become known and to create a positive impression for their work.

Third, identify the areas where your institutions might promote research and external funding. As you consider this point, you will need to look at your own local politics as well as the broader national picture. It is not enough to tell a university faculty that research is a priority and that you, as administrators, are strongly encouraging your faculty members to explore new and expanded research portfolios by pursuing external funding more aggressively. You will need to provide institutional incentives as well, and you probably will need to target some areas for special treatment. Identifying the programs with the greatest opportunities and then making the case for promoting those units will be complicated. One of the examples I am going to discuss with you is the Life Sciences Institute at the University of Michigan, which is providing us with great visibility, but which also has generated a set of local issues on our campus.

Sometimes, the best opportunities may not lie in your most prominent departments – as I noted earlier, national trends in funding may dictate that a less prominent department could be positioned for a great leap forward. Only you and your campuses are in a position to judge what those might be. But as you know, it takes great finesse to present and explain the reasons for your priorities. No matter what you choose, there is a strong case to be made for increased prominence in one unit leading to higher visibility for the entire institution, and therefore to a greater ability to recruit faculty and attract funding to other areas of the university.

One of the associate deans at our Medical School, Ray Ruddon, formerly was an administrator at the University of Nebraska Medical Center (as Director of the Eppley Cancer Center), and he told me about the ways Nebraska had focused on research priorities in medicine. Nebraska established a National Cancer Institute-designated basic research center by focusing on pancreatic cancer and lymphoma, and increased the activity to a level that allowed the

center to become a clinical NCI-designated center. Kansas seems to be taking the same approach. Ray told me that the University of Kansas is also doing this with cancer research, to create a research base of a size that will move it toward consideration as an NCI-designated research center. But as you know, if you have been working in this area, your research base does need to increase to a significant size to receive that initial designation.

Another opportunity for identification of programs is the agenda of your own state. Tying your research and broader academic mission to the economic climate of the state is a critical piece of local politics – and I know that most or all of you have been making that case to your legislatures. Many states are looking to the biotechnology industry to revitalize their economies, and are setting up funding that ranges from a few million dollars to hundreds of millions of dollars to jump-start enterprises in biotechnology. The competition for faculty in these fields has become fierce as a result, and you likely will need to provide significant institutional support as well if you want to take advantage of the new priorities of your states.

I mentioned that you will need to provide some institutional incentives to help faculty members increase their success in obtaining external funding. Let me address some of these incentives within the context of hiring new faculty members. The incentives I am highlighting do not pertain only to new faculty; you may want to explore these ideas as you seek to retain current faculty and to stimulate new research activity. I know you will have more ideas as well, which we can delve into during the discussion period.

When I was running a research program, I especially appreciated the flexibility I was sometimes provided when I won external awards that paid part of my salary. As an incentive, the University of Kentucky permitted me to use the released salary funds in a way that best suited my research projects. This is the sort of accommodation that a university can provide, which makes professional life more agreeable, without any additional cost to the university.

Some of you have established very successful programs in other areas. For example, I know that Kansas State University has made a priority of the nomination and preparation of undergraduates for Rhodes, Marshall, Truman, and Goldwater Scholar programs. Your focus on these programs and on your students' success has had tremendous results. This is a great testament to the value of a focused effort. In seeking to generate greater success in research funding, I wonder if all of us might do more in preparing our faculty members for the application process and competition of external funding agencies. If we brought the techniques of Kansas State University to this arena, we would certainly have faculty better prepared to face the process, and likely would have better success rates as a result.

Fourth, consider the large-scale infrastructure of ongoing costs involved in building major research programs. Increased faculty activity will lead to new needs in staffing, in student support, and in physical space. I want to provide you with two examples of newer programs at the University of Michigan that have been planned and built with a significant component of external funding.

You may have heard of our Life Sciences Institute (LSI). It has become a centerpiece of our campus, and is having a profound impact on not only our research programs, but also our instructional programs. The Life Sciences Institute was conceived at a time when the state had committed \$1 billion over twenty years to the Life Sciences Corridor, in 1999. Michigan had decided to position itself as a leader in the life sciences, and created this funding by dedicating a significant portion of its tobacco company settlement to the Life Sciences Corridor. The state planned to provide competitive awards to universities and industry, and the University of Michigan began to position itself to attract funding from this state-wide initiative.

Seeing the broader scientific interest in building the field of the life sciences, the University decided to create the Life Sciences Institute with a combination of permanent endowment and seed funding from the University. We also committed to a considerable infrastructure program, and have opened the first two buildings dedicated to the Life Sciences Institute – a research building and a commons that contains extensive meeting and office space. Our third building, which will complete this complex, will be devoted to undergraduate teaching in the sciences. We designed the laboratory space to enhance the interdisciplinary activity the Institute is intended to foster; the laboratories do not have walls, so that there is a natural interaction among the scientists. We have appointed a number of faculty members to the Institute – some were already prominent scientists on our faculty, and others have been hired specifically to be part of this Institute. All are hired into academic departments, but have an appointment to the LSI. Because a large portion of the initial funding was one-time seed money, we have an expectation that the LSI will largely be funded through external research grants and private donations once it is fully staffed.

As you are well aware, hiring in the life sciences has become very competitive, because so many states have seen that biotechnology is a field that will be burgeoning over the next few decades. This competitive atmosphere has made hiring the best scientists very challenging, even with all the resources we can provide.

We have also had to deal with a disturbing shift in the state commitment over the past two years – the \$50 million per year has been scaled back to \$25 million per year, and the former Life Science Corridor has become the “Technology Tri-Corridor,” now including automotive technology as well as technology related to homeland security. There has been substantial resistance from the academic and industrial scientific community about this reduced funding

and trifurcation of focus, and there is hope that the life sciences will re-emerge as a state funding priority. I have pointed out that employment in the life sciences has seen substantial growth, with 33,000 new jobs in this field in Michigan since 1998.

LSI was created and sustained because of institutional prioritization and support, taking advantage of a state and national trend to support the life sciences. Even though the state priority has become less promising, we have maintained our own commitment to the life sciences, and our core faculty is moving toward our goal of self-sustaining external funding.

Another example of external funding and a new research program is our Department of Biomedical Engineering (BME), located in the College of Engineering. It was founded by faculty members Matthew O'Donnell (who is currently chair), John Faulkner, Steve Goldstein, and Charles Kane. BME is an example of a program that was established by the confluence of three essential factors: the critical need for coordination between the fields of engineering and medicine; the relentless persistence of several faculty members with vision and initiative; and the serendipity of a unique funding opportunity.

The defined field of biomedical engineering is fairly recent, and many programs, like our own, started in other departments. Some bioengineering centers started and continue to reside in medical schools, while others, like Michigan's, were founded and still reside in colleges of engineering. Our unit in bioengineering started as a Ph.D. program, comprised of faculty members from both the College of Engineering and the Medical School, but with no faculty members who were appointed in biomedical engineering. There was a need for this program because the medical faculty wanted to work with students who had expertise in engineering – and the engineering faculty wanted its students to have more exposure to the health sciences.

There were few actual departments of bioengineering even fifteen years ago. Most scientists and engineers in this field were in small research programs. Much of the research pertained to tissues and organs – developing technology for kidney devices, etc. The field began to change dramatically when medical science began to explore structures at the cell and molecular levels. Then the engineers began to develop protocols from the perspective of their own field: to make models in order to predict behavior, and to design tools to facilitate this research. At this point, in the early 1990's, students who worked on these projects needed substantial background in both engineering and life science. And at this moment, a funding organization – the Whitaker Foundation – increased its funding of bioengineering, particularly in the establishment of departments.

In 1996, the Whitaker Foundation decided to expend all of its capital in the next ten years, ending in 2006, with the bulk of its funds being devoted to the

creation of departments in bioengineering. The University of Michigan was one of the recipients of a large grant, which allowed it to establish a Department of Bioengineering, increase the faculty size to 12 core faculty, from two, and to create an undergraduate program in bioengineering, which has just graduated its first class of exceptional students in 2004. The new faculty members have brought extensive research funding to the University. The senior faculty have targeted pre-tenure faculty who have already won their first grants, thereby promising a high success rate of external funding. By placing such an emphasis on funded research, the department has increased its external research expenditures by over 100% in two years' time.

This story is different from the LSI creation because it developed as a result of faculty initiative. The faculty members involved would be the first to say that they had to swim upstream to create this department. There is a moral to this particular story – that we need to learn to recognize not only when our faculty members have the zeal to make a project succeed, but also when they or we, as administrators, can target the external resources that will make their vision a reality, leading to even greater prominence for their College and University. And finally, as I stated at the outset, we also need to be attentive to larger challenges, such as global issues where we can make significant contributions, and for which targeted funding is often available.

We have a value to offer our states and our nation, and we need to remember to make that case to our external audiences as well as to our own campus constituencies. I am currently working with the National Innovation Initiative, which is part of the national Council on Competitiveness, an organization that encourages leaders of universities and business to develop ideas for economic prosperity. Our nation is facing a challenge about how best to position itself for prosperity in this century. We need to remain a global leader for innovation, providing a competitive advantage for creation of jobs, products, and new industries. This Initiative is tackling the question of the changing nature of innovation, which has itself been transformed because of geographical, economic, and workforce pressures. We need not only to increase our research activity, but to create new types of leaders, new ways of thinking, and new capacity to deliver ideas and products.

Our universities are competing against each other for funding – in a healthy way – and as a nation, we are competing to maintain and intensify our position as a leader in producing ideas and products. This is a challenge our universities are ideally equipped to tackle – we have brilliant minds across many disciplines, and we have scientists, engineers, and social scientists who can help translate our ideals and theories into pragmatic outcomes.

In summary, my own suggestions for enhancing research and external funding focus on the practical components necessary for research to flourish: having appropriate support systems for our faculty members; understanding the

positive and negative nature of the funding environment; identifying the best programs to target for growth and support; and taking into account the complexity of staffing, funding, and infrastructure involved in the world of funded research. At the same time, we need to recognize that we represent more than research programs – we have a wonderful opportunity to convey our values broadly through our research and the solutions we can offer the world.

# UPDATE ON NATIONAL DEVELOPMENTS IN GRADUATE EDUCATION

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Last summer's Merrill Center research policy conference was entitled, "Recruiting and Training Future Scientists: How Policy Shapes the Mission of Graduate Education." I wrote an article, "Is Academic Research Sustainable?" for the proceedings of that meeting and described some national and local trends in university research.

During the past year I have been the National Science Foundation/Council of Graduate Schools Dean in Residence in the Division of Graduate Education at the NSF, an appointment that was initiated by discussions with CGS President Debra Stewart at last summer's Merrill Center policy meeting. This brief note is devoted to national issues in graduate education.

During the past year I co-organized and co-chaired a workshop on "Support of Graduate Students and Postdoctoral Researchers in the Sciences and Engineering: Impact of Related Policies and Practice," with Dan Stanzione, AAAS Fellow at the NSF Division of Graduate Education. The NSF, NIH and CGS sponsored the Support Workshop. Approximately 100 graduate students, postdoctoral researchers, faculty, graduate deans, labor economists and federal agency representatives attended the 1 ½ day workshop on June 17-18, 2004 in the AAAS Building in Washington, D.C.

Here I briefly recount the findings of that workshop. I also connect events from that workshop with presentations made at last summer's Merrill Center meeting.

At the summer 2003 Merrill Center policy meeting, CGS President Debra Stewart enumerated the following four major challenges in graduate education: curriculum reform, Ph.D. quality assessment, funding policy and post-9/11 policy. The Support Workshop touched on the first three of these challenges, with its principal emphasis being the third challenge – funding policy. Debra Stewart mentioned challenges in the funding of graduate students stemming from stipends that were too low as well as concerns caused by the recent doubling of NSF stipends in a small set of fellowship/training programs. (There are 5000 students in these particular NSF programs – about 20% of the graduate students supported by the NSF and about 2% of the national

population of science and engineering graduate students.) The Council of Graduate Schools annually asks Graduate Deans for their top three concerns. Until the last couple of years, the number one concern was graduate student support. (Recently that topic has fallen to number two as the considerable decline in state support of universities has threatened the whole state university enterprise.) Several additional themes from the 2003 Merrill policy meeting were also featured in the Support Workshop, including diversity as mentioned by Suzanne Ortega and me, an NSF GK-12 project (one of the programs favored by the increased stipends) by Diandra Leslie-Pelecky, and several of the summarizing statements by Martha Crago.

Several members of the five Midwestern four-corners universities represented at the Merrill policy meetings — the University of Kansas, Kansas State University, the University of Nebraska, the University of Missouri and Iowa State University — had members at the 2003 Merrill conference, the 2004 Merrill conference and the Support Workshop. These included: Ron Trewyn from Kansas State University, Prem Paul from the University of Nebraska, Suzanne Ortega from the University of Missouri-Columbia, Jim Bloedel from Iowa State University, and I represented the University of Kansas. Thus our four-corner universities were well represented in this national discussion.

The Support Workshop was designed to address various aspects of financial support for U.S. citizens, science and engineering graduate students and postdoctoral researchers. Of the many stakeholders in American science and engineering, we focused on universities and federal agencies, although foundations and industry also had some representation in the workshop. Labor economist Richard Freeman was engaged to complement NSF statistical reports on science, technology, engineering and mathematics (STEM) workforce issues. Prior to the workshop, we held focus group sessions with the following sets of people: graduate deans, the National Postdoctoral Association, graduate students, the Council of Scientific Society Presidents (Marty Apple, who spoke at the 2002 Merrill Center policy meeting, is President of the CSSP), and AAAS Fellows.

The specific goal of the workshop was to consider the role and impact that financial support plays in encouraging U.S. citizens to enter STEM fields.

Let me cite a few of the particularly interesting findings from the 1-½ days of discussions:

- Alan Leshner, Executive Director of the AAAS, observed that nowadays graduate study and postdoctoral training account for about 10 years of a 40-year scientific career, that is, one fourth of the whole career, which has a definite effect on lifetime research accomplishments. Because it is the first quarter of a career, and graduate students and postdocs are poorly paid, this long period has career-long financial implications, as well.



- Labor economists at the workshop observed that the quality of graduate students declines as the number of awards available to them increases. Harvard economist Richard Freeman emphasized that the U.S. currently depends upon a “cheap” labor pool of graduate students and postdocs to accomplish much of its academic research. He and others suggested the idea, for graduate study, of a 5-year end-to-end support agreement with students. This could have several different components, mirroring the current situation in which students average 2.5 different types of support (research assistantships, teaching assistantships, fellowships, traineeships, self-funding).
- The focus groups including the graduate students, postdocs, and AAAS Fellows agreed that the most important uncertainty for them was the length of time to, and uncertainty of obtaining, their first professional position. Money along the way is important, in that too little drives prospective STEM students out of the field. There are also probably differential effects of money for encouraging or discouraging minorities and females to enter STEM fields. Lack of health care can also drive graduate students and postdocs out of the profession.

The co-chairs, Dan Stanzione and I, concluded that the single most important message from the workshop was that the attractiveness of early professional careers in STEM must be systemically addressed. *We believe there is a national disconnect between the desire to benefit from a cheap, young labor force for research (graduate students and postdocs) and the imperative to make STEM careers attractive to young people.*

Finally, there is a continuing national debate on the question: Are there too many or too few STEM graduates? The answer is yes to both possibilities. There are too many graduates narrowly trained for academic activities and/or in areas that are already overflowing with students; there are too few graduates if we consider the broader national and societal problems that must be addressed.

Considerable additional information, including the agenda, list of participants, copies of all presentations and handouts, and a bibliography is available at: [http://www.ehr.nsf.gov/dge/support\\_workshop/index.html](http://www.ehr.nsf.gov/dge/support_workshop/index.html). See the Merrill Center website for its research policy publications: [www.merrill.ku.edu](http://www.merrill.ku.edu)

### *Conclusions*

National policy on important topics can be affected by small groups of people (cf. the concept of a “tipping point”). Thus, in this example, last summer’s Merrill Center meeting about graduate education has led directly to an influence on the national conversation about the role and importance of financial support for graduate students and postdoctoral researchers in STEM fields.

It is in the national interest to produce high quality research in science and engineering. Economists tell us that an inexpensive labor force of graduate students and postdocs makes achieving this goal easier; however, the lack of a defined time to a good first professional position deflects many U.S. students from these careers. These opposing forces must be understood, and then better managed, for a sustainable, robust American future in science and engineering.

## TWO PERSPECTIVES ON COLLABORATION: RESEARCHER AND ADMINISTRATOR

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In 1999 I participated in the Merrill Conference “Building Cross-University Alliances that Enhance Research.” For the 1999 white paper, I wrote of my personal experience in collaborative research that involved a twenty-year collaboration with French scientists along with other collaborations that have provided long-term NIH support. Having recently assumed an administrative position in the Office of the Vice Provost for Research, I’d like to focus on the application of my previous experience to the present theme – How can a research administration support and encourage collaboration through the development of faculty leadership in research?

Teich and Gramp<sup>1</sup> have described the mission of faculty as being composed of three elements: Research – generating knowledge; Teaching – disseminating knowledge to the future work force; and Service – disseminating knowledge to the community at large. When I was an Assistant Professor I received each year from the administration of the university a form to report the percent time devoted to these three areas. I was only able to fill out the form to my satisfaction by normalizing effort to a 40-hour week in which case the total was more like 150% instead of 100%. This is, in my view, an important point because potential candidates for leadership roles are already heavily committed to their own work, and this will have to be taken into account. Investigators are experiencing even more demands on their time, especially administrative.

The turn of the millennium has seen a significant increase in the scope of collaborative activity. The National Institutes of Health has called for a reexamination of the way research is organized and the National Science Foundation also has numerous programs designed to enhance collaboration. Second, it is expected that, as scientists, we will be more diligent about imparting knowledge to the K-12 education arena, and involving minorities and minority institutions for the purpose of generating interest and commitment in science. Third, it is increasingly understood that research results should be placed virtually immediately in the public domain and, aside from the intellectual property issues, this requires informatics capability for ready public access while maintaining the requisite security. Finally, the university is being increasingly perceived as an engine for economic development and this requires the transfer of technology to the public sector. There are more imperatives now, and collaboration is more complex. For the purposes of this discussion we will define interdisciplinary interactions as low-dimensional, for example, involving the interaction of a chemist

and a biochemist. While the chemist and biochemist are nominally in different disciplines, they share much common knowledge. Multidisciplinary interactions, on the other hand, would not only involve multidimensional interactions, but these interactions would require the development of a common language for communication because the multiplicity of approaches would have to be coordinated. These varied interactions might also involve multi-institutional projects, industrial partnerships and collaborations with government laboratories.

Last spring the Kansas Legislature passed the Kansas Economic Growth Act (KEGA). Its purpose is to provide resources for investment in bioscience, broadly defined. As part of a planning process, we decided to solicit proposals from the faculty. It was made clear that activity supported by this mechanism should eventually lead to technology transfer and economic development. We received a whole range of responses to the initiative. Faculty who have already had experience in moving discoveries in the laboratory to the public domain viewed this initiative as an excellent opportunity for research and development. A perhaps equally small group rebelled against the entire notion, stating clearly that they were perfectly happy interacting with colleagues in their own department. They did not wish to spend time in meetings that would prove to be a distraction to getting their own research done. It is, of course, not reasonable to expect faculty, who came to the university with the mission defined above, to now assume responsibility for the technology transfer process. If this part of the university mission is to be a success, we will have to find ways to help them, and, in the process to engage more faculty.

The KEGA discussion also coincided with the unrolling of the NIH Roadmap. Although the data are strictly anecdotal, a number of young investigators expressed concern that the focus on centers and broad initiatives would result in a deterioration of R01 (individual investigator initiated) grants as support for these other programs increased. In FY2002 NIH awarded 43,500 research grants, of which 63 percent were for R01 funding.<sup>2</sup> The R01 grants accounted for 53.4% of total funding (\$16.8 billion). NIH Director Elias A. Zerhouni, M.D. recently paid a visit to the Lawrence campus and met with young faculty. He assured them that the percent of R01 grants was holding steady, there was no intent to reduce their number, and indeed that the average number of grants held by individual investigators was approaching 1.5. He pointed out that the purpose of centers is to link the R01 activities into a broader network with the necessary infrastructure to rapidly create and consolidate new knowledge and translate it into tangible benefits for people.

In order to develop an institutional response to aiding in the creation of multidisciplinary collaborations, it is perhaps important to define the process. Traditional problem solving, as depicted in Figure 1, might involve three persons/groups (A,B,C) with slightly different perspectives. They would look at the problem and pick out those parts that they knew how to solve, a perfectly logical and appropriate approach. The solution, however, would not encompass the entire

problem but only parts A, B and C. There are clearly many problems for which this would be sufficient, but there would be, as a consequence, a delay in resolving the entire problem. Figure 2 shows a more broad-based approach that might, in the Roadmap context, involve scientists, mathematicians, engineers and clinicians. Creating the proper conditions for these interactions is clearly a challenge and one in which research administration should play a role.

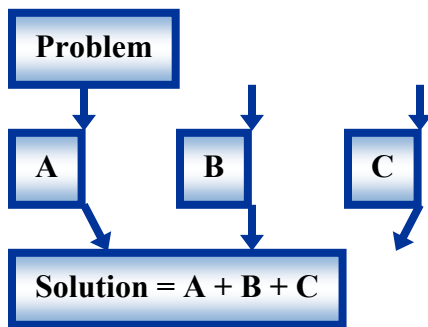


Figure 1 - Traditional Problem Solving

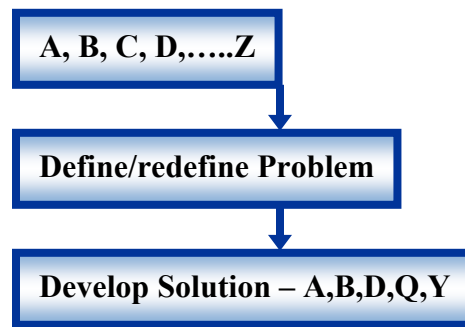


Figure 2 – Broad-based Problem Solving

As Kansas has EPSCoR status with NIH, we are eligible for several programs designed to build infrastructure. One such program is the Centers for Biomedical Research Excellence (COBRE). There are presently four such centers in Kansas: one at KU Medical Center, one at Kansas State and two administered at KU-Lawrence. Although administered at the units indicated, there are participants from the other institutions in the various projects. I would like to comment on one of these with which I have the greatest familiarity, a COBRE project led by Robert Hanzlik on Protein Structure and Function. The mission of the COBRE program is to “expand and develop biomedical research capability through support of a multidisciplinary center.” Initially there were three Assistant Professors in Chemistry, Medicinal Chemistry and Pharmacology and Toxicology and two Associate Professors in Microbiology and Microbiology/Genetics. Each was assigned mentors and provided with a reasonable level of grant support. Regular symposia were held and outside speakers were brought in to participate. Most interesting were the Associate Professors who have been able to incorporate into their research programs concepts in structural biology that have enabled them to think about their research in very different ways and employ new methodologies. For the Assistant Professors the focus has been on helping them write competitive R01 proposals. Some of the original participants have graduated and have been replaced with new additions. The awarding of this COBRE grant coincided with a decision to construct a Structural Biology Center, containing an 800 MHz nmr, protein crystallization and x-ray crystallography laboratories, and state of the art mass spectrometry for proteomics. The COBRE centers are expected to eventually acquire a life of their own to be supported through

expanded research activity. There is a high probability that they will succeed because they have excellent leadership and significant levels of funding.

What are the essential elements of successful collaboration?

- Strong and respected leadership
- Clear identification of mutual benefits
- Clear criteria for setting priorities
- Process for assigning credit for accomplishments
- Administrative support and reward to leadership

It is clear that the source of energy and creativity for collaborations must come from the faculty, and in this sense “bottom up” evolution is essential. The Office of the Vice Provost for Research has been proactive in identifying potential team builders, and we have been assisted by some of the present team builders who also understand what skills are needed. For some years we have had in place the Research Development Fund (RDF) that provided up to several hundred thousand dollars to initiate new programs. We can certainly point to some successes, but, in general, this type of support did not lead to grant proposals designed to enhance infrastructure and promote multidisciplinary interactions. Accordingly, this program has been restructured as a fund for a Major Project Planning Grant (MPPG). A major project might be a center proposal or program project grant to NIH, a Science and Technology Center to NSF, or a major initiative to the National Endowment for the Humanities. The product of the grant is a proposal, and the MPPG will support release time from teaching, administrative support, development of grant materials, travel to visit potential collaborators, and external review or a “mock” site visit. We hope that this will enlarge the pool of individuals with the skills and incentive to assume the leadership roles necessary to make major initiatives a success.

There are other activities that probably need to be managed from the “top down,” but with plenty of faculty consultation. Information technology is one of these areas, particularly as it relates to high performance computing and to handling of very large amounts of data. The issue of wide dissemination of information has already been noted. Finally it is the responsibility of research administration to facilitate collaboration by creating alternative “university architecture.” As it is highly unlikely that departments are going to disappear, it is then necessary to devise alternative mechanisms for facilitating interactions among faculty from diverse disciplines. We are doing this in two ways: 1) Constructing research buildings that will house people with potentially common interests (for example, bioinformaticians from math, biology, pharmacy and engineering) and 2) Continuing to enhance and create centers. This approach has attracted critical masses of highly motivated researchers who, in turn, create additional resources for KU. The Institute of Medicine of the National Academies has recently reviewed, on behalf of NIH, the extramural centers programs, which constitute 9% of total NIH funding, and have come to the following conclusion:

...the recent changes in the nature of biomedical research, which involve opportunities to understand complex biological systems through collaborations among multiple investigators in different fields and different institutions and by assembling large-scale research infrastructures and databases, will probably result in the expanded use of centers and other mechanisms that support collaborative research by interdisciplinary teams.

While my report has focused heavily on NIH, there are clearly other modes of funding from numerous other sources. It is extremely important to remember that collaborative research is not for everyone and there are many different styles of research and scholarly activity that must be supported and encouraged if we are to claim to be a university.

### *End Notes*

<sup>1</sup>Teich, A.H. and Gramp, K.M. in “Competitiveness in Academic Research”, Teich, A.H., ed., American Association for the Advancement of Science, 1996.

<sup>2</sup>Manning, F.J., McGeary, M., Estabrook, R., eds., “NIH Extramural Center Programs: Criteria for Initiation and Evaluation” , National Academies Press, 2002.



# NON-ZERO-SUM GAME RESEARCH STRATEGIES IN TIMES OF FLAT FEDERAL RESEARCH BUDGETS

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Sustaining momentum in any endeavor requires clear understanding of how we arrived where we are and the ingredients necessary to propel us to our goal. To sustain the rate and rise of the academic research enterprise we must know the key elements in our growth and how these elements are likely to change in the future. What I would like to do is take a brief look back over the last decade of academic research in the United States, with particular focus on the growth of the life sciences. Then I will try to answer three questions:

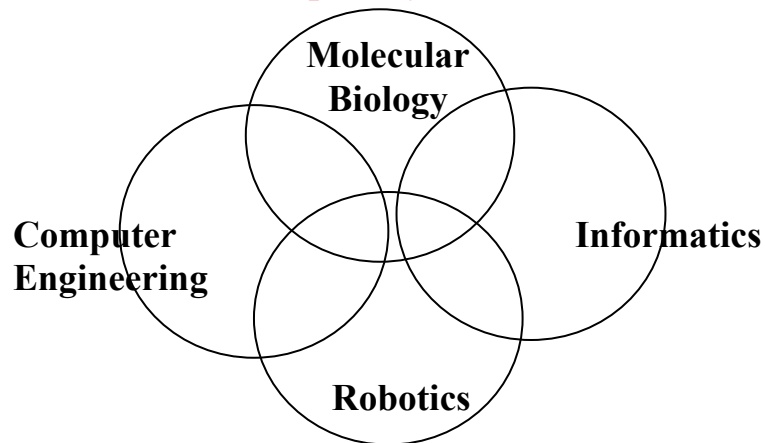
1. Over the past decade, what have been the drivers for funding academic research?
2. What will be major drivers for the direction of federal research funding in the future?
3. What strategies must we employ to remain competitive?

There is no question that the dawn of the Human Genome Project in 1990 has been one of the most important investments by the federal government in life sciences. Efforts coordinated between the National Institutes of Health and the Department of Energy resulted in the completion and publication of the human genome in 2003. In addition to the human genome, mapping the genome of other species and phyla such as the mouse, rat, maize and soy (and other genome projects) resulted in an overall investment of nearly \$2.7 billion in contracts and grants related to mapping these genomes. The genome project was the catalyst for our nation's and the world's current multi-billion dollar biotechnology industry. It is the basis for many of the regional "life sciences" initiatives across the country. Those universities positioned to contribute to the genome project were awarded substantial contracts from the Department of Energy (DOE), the National Institutes of Health (NIH) and the National Science Foundation (NSF).

Fundamentally, the advances in university research programs due to the genome project are founded in not only the fields of molecular biology and chemistry, but also other fields such as computer engineering and robotics. Without the underlying enabling technologies such as the invention of PCR and the automated DNA sequencer, the completion of the genome projects would have never been realized. Further, the emergence of bioinformatics, resulting

from the marriage of biology and computer sciences, is one of the most robust and fastest growing fields in science. Thus, one of the principal drivers for the unprecedented growth of life sciences research in academia has been the embracing of interdisciplinary approaches needed for invention and discovery. Universities that were positioned to build teams of biologists, engineers and computer scientists, and engage in non-zero-sum game strategies to achieve maximum gain for each team member, were the ones who benefited the most from the federal investments in the genome project.

### **Genome Project: An Ideal Model for Multidisciplinary Teamwork**



A second major driver in the past decade for the growth in academic biomedical research has been the congressional goal of doubling the NIH budget. Since 1999, the five-year increase in NIH spending resulted in a \$27.2 billion budget in 2003, surpassed in recent years only by spending on homeland security. Importantly, over half of the total budget at NIH has gone to academia resulting in NIH being the largest single source of funds for academic research. Many universities benefited from this doubling. And, while “the rich did get richer,” there were many smaller universities that appreciated large increases in national rankings and percent increases in NIH funding from 1998-2003. Universities that benefited from these unprecedented federal investments in life sciences and engineering positioned themselves early on to set their sails appropriately and make significant advancements in their research expenditures.

*Over the past decade, what have been the drivers for funding academic research?*

- Many if not the majority of these landmark events in science were a direct consequence of interdisciplinary teamwork.
- Non-zero-sum game strategies were employed.

- We must acknowledge that revolutionary advancements in science and medicine and, by default, breakthrough advances in individual research programs require working together, both across campus and across institutions.

*What will be major drivers for the direction of federal research funding in the future?*

Unfortunately, for the near future, federal research funding budgets are expected to be flat for FY05 and probably FY06. And since most of academic extramural research funding is generated from federal grants and contracts, it is realistic to expect the rate of growth to be less during this time of flat budgets. But given that dose of reality, we all still want to achieve the maximum growth possible for each of our universities and, in a zero-sum game environment, there will be winners and there will be losers.

Or can we engage in a non-zero-sum game? Is there a position of cooperation and true interdisciplinary/intercampus partnerships that will achieve maximum gain for each team or institution?

We do have some hints, at least from the NIH, about how this agency is planning on investing extramural funding for the future. As stated in the NIH Roadmap, the research teams of the future will require cooperation and collaboration across disparate disciplines: "The scale and complexity of today's biomedical research problems increasingly demands that scientists move beyond the confines of their own discipline and explore new organizational models for team science."

Areas in which NIH plans on investing in the future include:

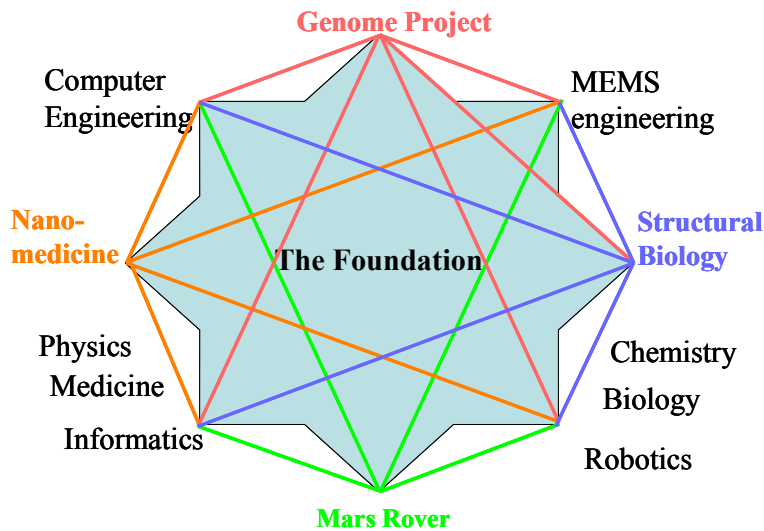
- High-Risk Research
- Interdisciplinary Research
- Public-Private Partnerships
- Building Blocks, Biological Pathways, and Networks
- Molecular Libraries & Molecular Imaging
- Structural Biology
- Bioinformatics and Computational Biology
- Nanomedicine

Another area of future federal investment will be in the National Nanotechnology Initiative to be supported by NSF, DOE and NIH. The FY 2005 request in nanoscience by NSF is about \$305 million, a \$56 million increase over the FY 2004 request. The DOE FY 2005 request in nanotechnology is \$211 million, an increase of \$8 million over FY 2004. Finally, the NIH FY 2005 request in nanomedicine is \$89 million, \$9 million over the FY 2004 appropriation.

*What strategies must we employ to remain competitive?*

Sustaining the momentum and gains achieved over the last 15 years will require a change in our university research culture. The classic university “stove-piped” approach to scientific discovery and advancement of new knowledge is no longer adequate to meet the rapidly evolving world needs in science, engineering and medicine. Federal agencies funding basic and applied research are looking at interdisciplinary teams to develop new fields of investigation such as Systems Biology, Nanomedicine and Bioinformatics. These teams will also need to work closely with their social science colleagues as we look to apply these new technologies within a complex and diverse society. Thus, we must find new ways to encourage, reward and institutionalize interdisciplinary and intercampus research collaborations.

The diagram below illustrates four examples of research and engineering that will continue to lead the evolution and revolution of scientific discovery for humankind in this century: the Genome Project, Structural Biology, the Mars Rover Project and Nanomedicine. Each of these areas is grounded in interdisciplinary, non-zero-sum game collaborations between areas of research such as computer engineering, MEMS, physics, medicine, chemistry, biology, robotics and informatics.



Our future success as academic research institutions will boil down to a willingness to accept and embrace change and must be entered into with strong leadership and leaders. Will there be barriers to the successful implementation of a non-zero-sum game strategy? Absolutely. It is imperative that we overcome these barriers and work creatively to foster change.

# THE BIOECONOMY: BUILDING A CAMPUS-WIDE INITIATIVE FROM A NATIONAL PRIORITY

Robert C. Brown  
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Iowa State University

I am a participant in a campus-wide initiative at Iowa State University (ISU) called the Bioeconomy. Our Vice-Provost of Research, Dr. James Bloedel, invited me to attend this year's Merrill conference and talk to you about this initiative, which has just wrapped up its second year of activities. I have brought with me some copies of our second annual report, if you would like an in-depth look at our organization. The report can also be downloaded from our website<sup>1</sup> – just Google “biorenewables” and hit “I’m feeling lucky.”

Well, we are feeling extremely lucky at the Office of Biorenewables Programs, which manages the Bioeconomy Initiative. President Geoffrey has supported the initiative with new faculty lines. Dr. Bloedel is providing generous operating budgets. We have caught the attention of federal agencies. Even the state has taken notice, or at least opened its eyes.<sup>2</sup>

I say lucky, because we, the affiliated faculty of the initiative, are not prepared for the task at hand. None of us were trained to organize as complex an initiative as this one has proven. As academic researchers we think team work is great as long as we are left to ourselves. We know that a system prospective will help our students land jobs in industry, but we have them focus on our own specialties.

And so I say we were lucky because the Bioeconomy Initiative is inherently systems-oriented, requiring teams of scientists and engineers from many disciplines working together. I cannot offer any sure-fire formulas for assuring success, but I can describe how we muddled through and point out some of the pitfalls that are common in such endeavors.

We define the Bioeconomy as: “An economy in which the energy and raw materials for society are derived from plant-based materials.” From these plant-based materials are derived a variety of “biobased products”: transportation fuels, commodity chemicals, natural fibers, and electric power. Some people mistakenly assume that biotechnology is the only basis for these transformations. In fact, a variety of thermal, mechanical, chemical, and biological processes are employed to convert plant-based materials into products. For example, biodiesel, one of the early success stories of the emerging Bioeconomy does not involve any biotechnology in its production.

A wide variety of crops and plants, collectively referred to as biorenewable resources, have potential as feedstocks in the production of biobased products. These include, not surprisingly, corn and soybeans as well as crop residues and crops dedicated to the production of biobased products, such as switchgrass and hybrid poplar.

The Bioeconomy offers several advantages over the current petroleum economy. The substitution of indigenous agricultural and forestry resources for imported petroleum will improve environmental quality by reducing pollutant emissions associated with fossil fuels. In the United States, the Bioeconomy has the prospect for making productive use of excessive agriculture lands and improving national security by reducing our nation's dependence on resources from politically unstable regions of the world. Finally, biobased products will transform rural development in many parts of the world by introducing new crops and new markets to the agricultural economy.

The Bioeconomy is a national priority. As far back as 1992, federal legislation targeted research in biobased products. A significant milestone was achieved in 1999 with the release of a national vision and roadmap in biobased products. Recent legislation promoting this vision and roadmap includes the Biomass R&D Act of 2000, the Securing America's Energy Future Act of 2001, the Farm Bill of 2002, which includes an historic Energy Title, and the Farm Security and Rural Investment Act of 2002. The federal government has formed a permanent council on biorenewable resources, consisting of the Secretaries of Agriculture and Energy, the Environmental Protection Agency Administrator, the Director of the National Science Foundation and other agency heads, to coordinate national planning for research in biobased products.

The biobased products industry is built upon four major thrust areas: plant science, production, processing, and utilization. Traditionally, academic researchers would approach a problem from the perspective of only one of these thrust areas. However, meeting ambitious national goals of providing at least 25% of organic carbon-based industrial chemicals and 10% of liquid fuels from biobased products by 2020<sup>3</sup> demands concerted and integrated effort in all four-thrust areas.

The Bioeconomy Initiative at Iowa State University was launched in 2002 as one of President Geoffrey's six campus-wide academic initiatives. ISU administration recognized that the Bioeconomy Initiative faced a particularly daunting challenge in getting organized. Most of the other initiatives were "fresh starts" on campus and involved faculty with common visions. The Bioeconomy Initiative, on the other hand, would require collaboration among several centers and programs on campus that already were working on various aspects of biobased products. Each had an inflated view of its own importance in the field of biorenewables and none were eager to make concessions relative to

leadership and direction of the initiative. In short, we were told, the proposed initiative lacked “cohesion.” Nevertheless, it is hard to imagine an initiative with more potential for impacting an agricultural state like Iowa, and we were given a chance to rectify this shortcoming.

Our first step was to establish an administrative structure that we hoped would provide cohesion among the various interested parties on campus. Starting another center on campus, as was done by the other academic initiatives, was clearly not a viable approach since it threatened to usurp the biobased programs of existing units on campus. Instead, we created an Office of Biorenewables Programs (OBP) at ISU, which is intended to orchestrate rather than dictate activities in biorenewable resources. The OBP has direct ties to the several units on campus with compelling interests in biorenewables, including the Ames Lab, the Institute for Physical Research and Technology, the Plant Science Institute, the Iowa Agriculture and Home Economics Experiment Station, ISU Extension, and the Iowa Energy Center.

The staff of the OBP is small and service-oriented. As director, my primary duty is to serve as the chair of the Science and Engineering Committee (SEC), which manages the Bioeconomy Initiative. In this I am assisted by Tonia McCarley, a full-time P&S staff person who is responsible for day-to-day operations of the OBP. Jill Euken, an extension field specialist, provides critically important engagement with industry and agricultural producers.

The Science and Engineering Committee (SEC), consisting of faculty members representing diverse academic disciplines, works collectively to realize the goals of the Bioeconomy Initiative. The committee meets as frequently as once a week to make decisions important to sustained momentum of the several activities of the Office of Biorenewables Programs.

The SEC reports to the Executive Council, consisting of Deans and other high-level university administrators, who set strategic direction of the initiative. The Council meets monthly to advise the Science and Engineering Committee.

The Bioeconomy Initiative spans the ISU campus. We have 35 affiliated faculty from twelve academic departments ranging from agronomy to mechanical engineering. The OBP works closely with eight research units on campus. Our external partners include the industrial development association, BOWA, and the state-funded Iowa Energy Center.

The OBP has several responsibilities. Of course, it is charged with bringing cohesion to ISU’s diverse efforts in biorenewables. It serves as the “front door” for external inquiries about biorenewables so that potential clients and partners are assured “one-stop shopping.” The OBP administers a newly instituted Biorenewable Resources and Technology graduate program, which I will subsequently describe in more detail. The OBP assists affiliated academic

departments and research units in preparing multi-disciplinary grant applications related to biorenewable resources. It serves as liaison between ISU and biobased industries. And the OBP has been responsible for coordinating the search for new faculty in the field of biorenewables.

Some of the things we don't do are also important. We don't administer contracts and grants, which means we don't take credit for them, either. We don't control infrastructure. We don't have a budget to teach classes. We don't hire or fire faculty. Indeed, we have very little in the way of clout usually associated with academic departments or research centers, but these concessions were important to bringing together the various campus interests in biorenewables.

So how do we get things done? Our early efforts have focused on activities that are mutually beneficial, such as building a graduate training program and developing contacts with biobased industries. However, our successes have reinforced the value of "hanging together" and our attitudes are maybe less parochial than they once were.

The mission of the Bioeconomy Initiative includes research, education, and outreach, which is in alignment with the overall mission of the university. I want to highlight a few activities in each of these three areas.

The basis of our research is technology platforms. A platform is defined as the convergence of enabling technologies into a highly integrated system for transforming a specific feedstock into desired products. The platform teams parallel the way industry conducts research and product development. Platform teams organize faculty and students for cross-disciplinary, systems-oriented research and collaborative learning. To date, seven platforms have been developed: biobased products from vegetable lipids; biosystems analysis and assessment; expression and purification of recombinant proteins; lignocellulosic feedstock development; metabolic engineering of new fermentation products; natural fiber utilization; and syngas fermentation.

By way of illustration, I will describe the syngas fermentation platform, with which I am very familiar. The overall objective of this research is to develop value-added products from distillers' dried grains (DDG), a byproduct of ethanol fermentation via the dry grain milling process. The corn dry milling industry is rapidly expanding in the United States for the production of fuel ethanol. Although this is a promising development for production of biobased transportation fuels, markets for DDG may become saturated as a result. Development of value-added products from DDG will be critical to the future profitability of the corn ethanol industry.

We propose to thermally gasify this high fiber by-product to produce syngas, a mixture of carbon monoxide (CO) and hydrogen (H<sub>2</sub>), which then



serves as feedstock in an anaerobic fermentation. Although a variety of fermentation products can be produced from syngas, this study employs the bacteria *Rhodospirillum rubrum* to produce polyhydroxyalkonates (PHA), polyesters with potential applications in the manufacture of biobased plastics, fibers, and films.

Although our preliminary assessment suggests that this technology is economically attractive, it faces several challenges. We have recruited faculty with an unusual combination of interests to tackle these problems. I am responsible for evaluating gasification and gas clean-up technologies. Professor Heindel, a mechanical engineer, is investigating the rate at which syngas can be dissolved into the fermentation broth. Professor Dispirito, a microbiologist, is cultivating *R. rubrum* for maximum yields of PHA. Professor Nikolau, a biochemist, is investigating the metabolic pathways from carbon monoxide to PHA. Michael Duffy, a business specialist at ISU, is investigating market issues related to use of these biopolymers in consumer products. We recently obtained \$1 million dollars from the U.S. Department of Energy to investigate this platform.

In support of our teaching and learning mission, the OBP has established the first-in-the-nation graduate program in Biorenewable Resources and Technology, which was approved by our Board of Regents in 2003. In response to concerns that this new major may produce graduates faster than the emerging biobased industries can hire them, we offer the degree as a co-major with more traditional disciplines. Seventeen students enrolled in the first year.

The core of the new curriculum is a course on the fundamentals of biorenewable resources, several laboratory modules, and a seminar course conducted every semester. I have written a textbook, published last year, to support the fundamentals course. We have also offered this course through distance education and we are exploring a web-based curriculum to be shared among several schools offering courses in biobased products.

We consider our outreach activities an essential part of our mission. Without engaging agricultural producers and industry, the Bioeconomy would always remain an academic initiative. Accordingly, we worked with stakeholders in our state to develop an Iowa Vision & Roadmap for a Bioeconomy. We assisted industry in developing a biobased products development association, aptly named "BIOWA." We provide regular updates to producers and industry through an annual industrial outlook conference. Iowa State has also been a major player in the Federal Biobased Products Preferred Procurement Program, which is developing standards and testing methods to assure that biobased products are manufactured from "renewable carbon" instead of "fossil carbon."

Although we don't measure success in something as pedestrian as extramural funding, we don't mind bragging about the dollars our faculty are

bringing into the university for biorenewables, which amounted to \$12 million in FY 2004. This included three awards to ISU from a joint DOE/USDA Biomass solicitation that only made 19 awards in a field of 400 proposals.

I will close by summarizing what I consider to be challenges common to any interdisciplinary research initiative at a university. First, the initiative must receive adequate institutional resources to make a start. Second, a management structure must be adopted that brings cohesiveness among diverse disciplines (I think that this usually requires the administrative unit be located outside academic departments or colleges). Third, the university must be generous in assigning credit for successes; otherwise faculty will return to their academic homes. Fourth, initiatives will require considerable help from university administration in securing cost-share for major grant applications. Finally, if the initiatives include interdisciplinary academic programs, they will need resources for teaching courses and developing curricula.

Our Bioeconomy Initiative has made good progress in meeting these challenges. Much of this can be credited to the confidence that faculty have that their efforts will be recognized and appreciated by the university.

#### *End Notes*

1. Office of Biorenewables Programs web site: [www.biorenew.iastate.edu](http://www.biorenew.iastate.edu)
2. National Research Council, "Biobased Industrial Products," National Academy Press, Washington, D.C., 2000.
3. Battelle Memorial Institute, "The State of Iowa Biosciences Path for Development: Economic and Core Competency Analyses," March 2004.

# LEADERSHIP CHALLENGES FOR PUBLIC RESEARCH UNIVERSITIES: THE PERSPECTIVE OF ONE LAND-GRANT INSTITUTION

Jon Wefald  
President  
Kansas State University

All Universities are in competition – we all know it and we can state it up-front. We compete for the brightest and the best faculty members. We compete for the sharpest and the most insightful students – the ones who can challenge the faculty members to think in new and unique ways. And we compete for the resources that keep the financial blood flowing in our research and educational programs. Just as “location, location, location” is the business mantra, “Grants, Gifts, and Tuition” is the chant of the research university president.

Dr. Freeman in her talk gave us a faculty perspective on this issue. She emphasized the increasing role that Centers and Institutes are playing in campus research life. Centers and Institutes are not only changing some of the ways that we conduct and administer our research, but they also are helping us in our quest to be successful in a competitive marketplace. By creating these centers, we are building teams of faculty members – collaborations that help us attract and keep our best faculty. We want the team to be strong – so strong that the brightest young faculty are attracted and want to join. We want the team to be so strong, that should a faculty member decide to leave, they would be leaving an essential part of them. In short, they would be leaving their best, creative ideas back in Manhattan.

Teams are tools for recruiting and retaining the best faculty members, and they are also tools for recruiting the sharpest and most insightful students, as the opportunities for student involvement within the teams grow. We want the teams to be strong, so strong that they attract the attention of the funding agencies. And, in terms of the quest for dollars to support the University infrastructure, these funding agencies are finding Center-based programs an important research funding vehicle. For example, our Konza Prairie Biological Station’s Long-Term Ecological Research Program through the National Science Foundation (NSF) is probably one of the oldest such entities on our campus – with continuous and substantial funding since the early 1980’s. The Centers of Biomedical Research Excellence (COBRE) awards funded by the National Institutes of Health (NIH) are probably the newest examples and these awards to Kansas State University (K-State), the University of Kansas (KU), and the University of Kansas Medical Center (KUMC) facilitate important inter-institutional collaboration and help build teams that transcend the borders of any single campus.

Land-grant research universities have valuable strengths: because they are the historical national centers of research on life sciences that relate to plants and animals and the environment, the land-grants have been recruited for important new roles in national security. We have been tapped to help protect the nation's food supply from bioterrorism threats, and the land-grant universities have responded with amazing speed and focus.

The Land Grant Mission of K-State implies a depth and diversity in the types of research that we have, with mandated emphasis on science, life sciences, mathematics and engineering. That focus continues to prepare land-grant graduates for a host of career path options. Why is basic research so important for our academic enterprises?

First, all universities should focus on basic research, whether it is in molecular biology, material surface chemistry, or particle physics. Today, for example, K-State is the home to a major genome project – the sequencing of the genome of the red flour beetle. This little critter is an important research tool in comparative development and evolutionary genetics, with a practical side as well. It is a major pest of stored grain, and studying this organism within the genome project – the most basic of basic research – falls well within our agricultural mission.

The K-State Department of Physics is home to the Macdonald Laboratory, funded by the Department of Energy, for the study of the basic structure of atoms/matter and the lab is ranked as a national-class program. Again, as an example of the growing trend for different universities to form teams of researchers, I also understand that K-State physicists are forming a partnership with their KU colleagues to make a run at having the planned \$50 million Cosmic Ray Observatory be built in western Kansas.

Second, our mandate as a land-grant institution implies that research should have a practical flavor where possible. What we mean by this is simple: our research should have value to the people of the state. For example, we have an international reputation in our Department of Grain Science and Industry. K-State is the only university-based undergraduate education program in flour milling, feed milling, and bakery science. In these industries, we have an unparalleled reputation with food preparation professionals from all over the world who attend advanced training workshops in Manhattan.

Similarly, wheat genetics – and our national Wheat Genetics Research Center – extends a basic genetic approach to studying the most important food crop in Kansas – and possibly in the world for that matter, as wheat is beginning to edge out rice as the most important source of the world's calories. Led by our fourth-ranked Department of Plant Pathology, our genetic approaches have improved yield by increasing wheat plant resistance to insect, bacterial, fungal, and viral damage. The development of new wheat varieties is always a team

effort at Kansas State University. It involves at the very least agronomists, plant pathologists, entomologists, and cereal chemists. Wheat varieties – like Jagger and 2137 – have been developed at Kansas State University in the past several years to excel in the growing conditions of Kansas and much of Oklahoma and Texas. Kansas is the No. 1 producer of wheat in America and you should know that 80% of our state's wheat comes from wheat varieties developed at K-State. The President of the Kansas Senate, Dave Kerr, has publicly and recently lauded K-State wheat varieties like Jagger because his wheat fields have produced higher yields with Jagger and 2137 wheat varieties. Dr. Bikram Gill, a world-class wheat scientist, states that K-State's Jagger wheat is not only the No. 1 winter wheat variety in Kansas, but is also grown in the neighboring states of Nebraska and South Dakota to the north and Oklahoma and Texas to the south and many countries in the world, including Turkey, Russia, Eastern Europe, many of the former Southern Soviet Republics, and Latin America.

Third, to be truly useful, research findings have to leave the laboratory quickly and find their way into the economy of Kansas as new products, processes, technologies, and businesses. Our Kansas State University Research Foundation, which holds the intellectual property for the University, was chartered in the early 1940's. This group is responsible for protecting our faculty members' research through patents and copyrights, and works for licenses through the National Institute for Strategic Technology Acquisition and Commercialization. The University, the City of Manhattan, and the State of Kansas through its state entity called KTEC formed a partnership to develop NISTAC, which commercializes not only University Intellectual Property (IP), but also a large portfolio of donated patents as well.

Let me give you several examples of our recent success. The Research Foundation holds several patents from applied research performed by the Grain Science and Industry group. One of those patents, developed by Dr. Paul Seib of the Department of Grain Science and Industry, described a way to treat plant-based starch such that it is not digested by the enzyme amylase – that makes it unavailable to the human body when ingested. Three years ago, the Research Foundation could not even find a licensee for that interesting patent. Then, along came the Atkins Diet, and, now, the Kansas-based company that currently has the license cannot keep up with demand for the low-carb wheat and potato starches for use in food products. We recently honored Dr. Paul Seib for his achievements at an awards banquet in Manhattan.

Another example of an outstanding commercialization success involves chemistry on the nano-scale – that is at the billionth level. Nanoparticles of metal oxides are so small that they do not behave like they do in bulk chemicals. They have the extraordinary characteristic of being able to absorb toxic chemicals and nasty biologicals (such as Anthrax spores and viruses) and detoxify them. After the chemical reaction, the chemicals are benign and the biological organisms are dead.

The nanoparticles have great potential to neutralize and clean up chemical spills. In an extremely short time, the commercial entity, Nanoscale Materials Incorporated, was established as a start-up company in Manhattan, Kansas. Nanoscale, Inc., now has several products in the marketplace – including a FAST-ACT product that is currently being developed at the Aberdeen Proving Ground Fire Department. K-State will be represented at the Olympics in a few weeks, as FAST-ACT will be also deployed in Athens for the 2004 Olympic Games. Through the efforts of our Research Foundation and NISTAC, this intellectual property was patented and brought to market through a series of developmental steps in a business incubator, small stock offerings, and as an anchor member of our new Research Park. The FAST-ACT Nanoscale products are being sold nationally to a multitude of first responders from coast to coast. This is a remarkable example of how research universities can impact regional economies.

This is a great example of focused human curiosity. We call it basic research that proceeded from question to question to question until the scientist involved knew something that humans had not known before.

The K-State chemist by the name of Professor Ken Klabunde discovered essentially a new state of matter. The extremely small particles are incredibly reactive. The early experiments revealed they detoxify many harmful chemicals. Subsequent work revealed a wide-open range of useful possibilities. His insights lead from laboratory work to a general realization that commercial products might be based on these findings. Uses continue to emerge for these potent, detoxifying products that do no harm to the environment.

Still another example of our on-going research came with a donated technology. K-State received a gift of patents and process technology from Procter & Gamble for a drink that mixes milk and fruit juices and fortifies it with calcium and Vitamin C. Through the efforts of our K-State food scientists in the College of Human Ecology and the Mid-America Commercialization Corporation in Manhattan, a company called NutriJoy was established to develop and market this product. So far, the product is being very successfully marketed on the West Coast and the Midwest. Wal-mart stores and their Sam's Club groceries, for example, are now carrying the delicious Peach Mango Cal-C drink. What we are trying to do here is to develop a seamless method of moving intellectual property, whether developed at the University, donated by corporations, or licensed from others, through the developmental stages into viable commercial products.

Finally, another good example of our success with both basic and applied research comes readily to mind with our new Food Safety and Security program at K-State. In the fall of 1999, long before September 11, 2001, a group of K-State scientists and I testified before Senator Pat Roberts' U.S. Senate

Emerging Threats Subcommittee on the threat from terrorists and rogue nations for America's food supply. We pointed out in October of 1999 the monumental threats that were facing America's entire food system. America has the greatest agri-business and food system in the world and it provides the safest and lowest-cost food of any country on the face of the Earth. The American people spend about 9-cents out of every dollar for food. This is what gives the American people the highest standard of living of any nation in the world. If agro-terrorists were successful, for example, in introducing Anthrax to several of our feedlots in southwestern Kansas, this could have enormous and negative repercussions not only for the economy of Kansas, but for the economy of America. Just imagine if, in a short period of time, the American people had to spend 25-cents out of every dollar for food rather than 9-cents and I think you can get the idea of what consequences that would have on our economy.

K-State now has over 100 research scientists in a number of Colleges and Departments working on food safety and security. We have built a national reputation in the field of protecting America's food supply. For example, the National Plant Diagnostic Network at K-State is a key part of our Homeland Security effort to protect agriculture and our Department of Plant Pathology is the regional leader of the Great Plains Region for 9 states. The region's farmers grow 95% of the nation's sunflowers, 84% of the sorghum, 73% of the wheat, 42% of the cotton, and 35% of the sugar beets.

Moreover, through the joint efforts of our College of Veterinary Medicine, our Department of Animal Sciences and Industry, our Division of Biology, and our Food Sciences Program, and many other departments, we are combining the scientific expertise that we have at Kansas State University to focus on both intentional and unintentional threats to the nation's food supply. Again, with over 100 research scientists at K-State forming a huge team of researchers on food safety and security, we are in an especially strong position since human health as well as our food supply are threatened by transgenic organisms, such as Anthrax, West Nile Virus, Asian Bird Flu, Ebola, BSE – or Mad Cow Disease – and other threats which begin as animal diseases and can also affect humans. Thanks to the foresight of the Kansas Legislature, we are preparing to build a \$52 million BL3 (Biological Security Level 3) research facility bonded by the State of Kansas. This is the kind of multidisciplinary program that we believe will be very successful in competing for large federal grants and will position Kansas State University as the No. 1 leading land-grant university in food safety and security. We have already been very successful in receiving federal grants, both for the research programs and for the building, and we believe that these successes will continue and increase. A Georgia expert on biosecurity buildings around the world, who is helping to design our new food safety and security building, maintains that this new building will be the most state-of-the-art food safety building in the world and the only food safety building – federal, state, or private – in the world to take in both plants and animals with a food processing floor in the same building.

I want to switch gears a bit and talk about the leadership challenge from a public education perspective. More and more, state government views its financial commitment to us as only including the classrooms. Legislators seem to view research almost as a kind of hobby, something that faculty members do just to amuse themselves. In their view, our faculty could more efficiently handle larger teaching loads given the increases in tuition that we have all suffered (or had to impose) on our campuses. Even giving them the indicators of the economic impact of research is often not enough to sway the argument.

I believe just the opposite, that research is all about the future; and I trust that, for each of you, the hairs on the back of your neck stand up a bit when this topic is raised. Gary Burtless and Roger Noll, writing in the 1998 book *Challenges to Research Universities*, underscore a point that we see over and over again. Research adds value to education. And it adds value to our respective states. At K-State, with a relatively modest amount of State funding, our research efforts add about \$3 billion in economic development monies annually to the state of Kansas – which puts K-State up with our state’s largest corporations in terms of its impact on the state.

For graduate-level research, the point should be obvious. Despite the fact that many in our legislatures really do not understand any need for education beyond the bachelor’s degree except for a degree in law or the MBA. Research and graduate education are sides of the same coin, and I will not belabor this contention any further.

The research university adds value to an undergraduate degree, and that is a point we need to constantly underscore. As Burtless and Noll phrase it, “the key issue in evaluating educational aspects of research universities is whether education and research are complementary.” Of course, they are that and more. Successful researchers obtain grants and publish peer-reviewed books and articles, and, in doing so, they work at the frontier of knowledge. The best education we can offer a student is to steep them in current knowledge, the “what’s happening now” in any field – knowledge not limited to a textbook.

Students benefit when they can learn by participating in a laboratory setting and it clearly enhances their understanding of the basic discipline. When this happens, we have doubled the use of our resources – we have made the research infrastructure also the educational infrastructure. Our students have the opportunity to work with new technologies that cannot even be on the radar screens of students at institutions without a research mission. In fact, many of our top undergraduate students mention their hands-on research as the most exciting part of their educational experience at K-State – in addition to the financial support they receive.



Dr. Coleman's colleague at the University of Michigan, Provost Paul Courant, offers a crystal clear rationale for the imperative to prepare students to have diverse problem-solving skills: "**Because we don't know what the next problem is going to be.** One of Michigan's biology faculty recently suggested that that is the argument for basic research. It's the best one-line explanation for both basic research and liberal education that I have ever heard." To Provost Courant's thinking, I would add that it is an outstanding rationale for fusing undergraduate education with scholarship in all disciplines – not just "big science."

K-State, being a student-centered research university, has shown real academic success in demonstrating how students, who have become research and laboratory assistants in their freshmen and sophomore years in departments like biology, chemistry, physics, and many other departments, have a definite edge in applying for the nation's most prestigious academic scholarships. For at least the last 15 years or more at K-State, we have tried to get as many of our best and brightest students into various research projects as soon as the first semester of their freshman year. Many of those students have gone on to win a very high number of Rhodes, Marshall, Truman, Goldwater, and Udall Scholarships during the years that I have been President at Kansas State starting in 1986 until the present.

For example, the Goldwater Scholarship is awarded to promising students in the sciences and math. K-State students have won 49 Goldwater Scholarships since that program started – more than any public university in America. K-State students have won 27 Truman Scholarships since that program started – more than any other public university in America. From 1986 to the present, K-State has had 97 students win the Rhodes, Marshall, Truman, Goldwater, and Udall Scholarships and that is 23 more than any other of the 500 public universities in the nation. Penn State students have won 74 of these five academic scholarships. We actually won more of these five prestigious scholarships than MIT or the University of Chicago. Much of our success is due to the fact that we not only get students involved in various research efforts as undergraduates, but also, they receive very good advising.

I want to close with an anecdote that demonstrates the importance of student involvement in the world of research. This example involves a young woman from a small town in Kansas. She recently graduated from K-State and is currently in law school, studying intellectual property law. While on her passage through K-State, she was awarded one of the Goldwater Scholarships that I just mentioned.

Her first visit to K-State was during the summer before her freshman year, when she came to campus to learn about the K-State bachelors in biology. She and her father sat across the desk from the biology advisor, and she pointedly

admitted that her visit was only as a courtesy to her dad – she had been accepted into Cal Tech, and that is where she wanted to go. Period. The end.

As part of the visit, the biology advisor took her on a tour and showed her a research laboratory. She sat down, and the professor showed her how to work the fairly expensive microscope. On its stage, she was looking at those red flour beetles that I told you about earlier as one of the few genome projects in the state. In that microscope, she was comparing the appearance of normal beetles with others that were developmental mutants.

She looked up skeptically, and asked, “How long would I have to wait before I could have a project like this in here?” The answer from the professor: “Could you start next week?” And, five minutes later, that future Cal Tech student switched to K-State because Cal Tech does not let freshmen do work in laboratories. No exceptions.

One other example of note is an undergraduate student by the name of Rachel Eddy from Western Kansas, who is a National Merit Scholar and true freshman. She is right now conducting cutting-edge research in Wheat Genetics in Professor Bikram Gill’s lab under a Howard Hughes Fellowship. She is able to interact with a steady stream of international geneticists who visit the KSU Wheat Genetics Research Center during the year.

K-State’s mantra to undergraduates is “opportunity, opportunity, opportunity.” If the students want to get their hands and minds wrapped around a research puzzle, we give them every chance to join research teams right away.

Burtless and Noll summarized very well what research universities like K-State offer each and every student: “The key point is that attending a research university is privately worthwhile if it provides a good return on the student's investment.”

Clearly, a central leadership challenge for public research universities is how we creatively move our research enterprises to new levels, while enhancing the learning environment for students. Through my comments today, I hope that I have given you some examples of how we are trying to meet this challenge at Kansas State University.

## “GOOD TO GREAT” IN PUBLIC RESEARCH UNIVERSITIES

Harvey S. Perlman  
Chancellor, University of Nebraska-Lincoln  
and  
Harvey and Susan Perlman Alumni Professor of Law

In April of 2001 I participated in what was, for me, a most unexpected and unnerving event – my installation as Chancellor of the University of Nebraska-Lincoln. Eighteen years as a law professor and 15 years as dean of a law school hardly prepared me to lead an institution for which graduate education, federally funded research, and technology transfer were the drivers of institutional reputation and success. In search for direction in how to manage an institution as complex and reportedly unmanageable as a research university, I stumbled upon Joe Collins’ book “Good to Great.”<sup>1</sup> If religious persons return to the Bible when their faith is challenged, then this book has become the bible of my administrative team. The book is a study of why some companies remained good while others became great. Because it is the study of management of private sector companies, one must regard it as a metaphor rather than a set of instructions, but for good or ill we have tried to follow its teachings. The precipitous decline in state revenues and resulting budget cuts during the 2001-2004 period that would ultimately deprive us of 12 ½ % of our state budget gave us an early opportunity to test its principles.

A brief comment about the University of Nebraska-Lincoln (UNL). It is both the comprehensive research and land-grant institution for the State of Nebraska. It is a member of the Association of American Universities, and the flagship campus of the University of Nebraska system. While it has an illustrious history, in recent years it has consistently underperformed relative to the quality of its faculty. The barriers to innovation and collaboration seemed high and there was too often a fear or resentment toward the celebration of excellence and achievement. Institutional ambitions were modest and such markers as federal competitive grants reflected that modesty. These were not my conclusions; they were the conclusions of a task force consisting of faculty, administrators, and community members who issued a report in 2000.<sup>2</sup> Notwithstanding these critiques, we were, in fact, a “good” institution.

In a nutshell, Collins’ research identifies three central themes for moving institutions from good to great: The first is getting the right people on the bus,

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<sup>1</sup> Jim Collins, *Good To Great: Why Some Companies Make the Leap . . . and Others Don't* (Harper Business, 2001).

<sup>2</sup> 2020 Vision: The Future of Research and Graduate Education at UNL (2000).

then figure out where to drive it.<sup>3</sup> The second is developing what Collins calls a “hedgehog concept” – that is, establish your priorities at the intersection of three universes: the things that you can be the best in the world at, the things that you are deeply passionate about, and the things that drive your economic engine. The third is to be disciplined in confronting the brutal facts of your situation and in sticking with your priorities. My remarks describe how we have tried to follow this advice in moving our university forward.

### *Getting the Right People on the Bus*

I had an early opportunity to recast the campus administration. When I took office, I faced three vice-chancellor vacancies and 5 vacant deanships. Either through good fortune or hard work, we were able to attract very talented people, who have worked well as a team. In the recruitment process we followed Collins’ advice. We did not measure candidates against our own vision of the future (given my background I hardly had a formulated vision for a research university), but rather listened carefully to the vision that our candidates brought to the table. We have also been less than patient with long-time administrators who had no vision other than retention of the status quo.

Of course, it is far easier to change the composition of an administration than it is to change the composition of a faculty. We had, in my judgment, a remarkably good faculty, but the culture in many departments held down their ambitions and their achievements. As Collins confirms, changing the culture of an institution cannot be dictated from above. Cultural change at the local level occurs from within – a theme that I will revisit – either by the introduction of new blood or by one unit witnessing success in other units.

Shortly before I became Chancellor, the University received an unexpected and largely unrestricted bequest of \$128 million dollars. My predecessor allocated a significant part of that endowment as matching funds to encourage other donors to fund professorships and chairs. Wisely, he required that the recipient of such chairs could only be faculty recruited from other universities. We now have approximately 24 such endowed professorships which have allowed us to recruit some very gifted senior faculty from other universities. In almost every instance, they have not only brought their prestige to our University, but have also directly upgraded the ambition and the culture of their home departments.

Simultaneously, Prem Paul, as our new Vice Chancellor for Research, was able to stimulate a few selected faculty members toward more collaborative and more ambitious grant requests and had early successes with three, multimillion dollar proposals for federal centers of excellence. Thus, we were fortunate to have provided examples of success, either by hiring successful

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<sup>3</sup> Collins, at 41 et. seq.

senior faculty, or demonstrating what resident faculty were capable of accomplishing. Moreover, we have now established a tradition of celebrating these achievements with major news conferences and public receptions for faculty who have significant success.

It is more difficult to change personnel within a public university than the private sector so we decided some effort had to be directed toward improving the engagement of our existing faculty and staff. Again, we borrowed from the private sector. The Gallup organization has its headquarters in Nebraska and its long-time Chairman, the late Don Clifton, was a former UNL faculty member. The University had previously partnered with Gallup on a number of academic initiatives and we again sought their help. In addition to the well-known Gallup poll, the company's core business includes consulting with business management on a wide variety of management issues. Clifton is known as the parent of positive psychology, a theory that suggests that, in working with people, one should focus on maximizing their strengths rather than attempting to address their weaknesses.

After considerable empirical research, the Gallup organization has devised a climate survey called the Q12 which consists of 12 questions, the only 12 questions that were shown empirically to have a direct correlation to worker productivity and morale. More significantly, Gallup has developed a process for an organization to undertake to improve its Q12 scores, a process premised on the idea that work climate is created within work groups and that only work groups – here read academic departments – can change the organization-wide working environment.

We have just completed the conduct of the survey for the second time. The introduction of the Q12 to a university setting generated a predictable response. While staff members seemed to respond positively to the survey, faculty began arguing with the structure and nature of the questions and the reliability of the data. (It was fascinating for me to see our faculty attack a survey instrument that had been empirically tested in over 10,000 replications and argue instead for survey questions they had quickly scribbled on napkins.) Nonetheless we have had response rates close to 80%. For me, the survey was not as important as the subsequent process, designed to force departments to meet and develop “impact plans” to improve the engagement of their members. The Q12 survey questions seemed to be intuitively logical and indeed addressed many of the concerns I had received, over time, from the faculty.

For example, the first three questions ask whether as an employee I know what is expected of me at work, whether I have the materials and equipment necessary to do my work right, and whether I have the opportunity to do what I do best every day. With increasing expectations on faculty in multi-mission institutions, one senses faculty frustration with these growing demands as well as the traditional untenured faculty member's complaint about not knowing what

they need to do to get tenure. These questions address these concerns directly and are the most susceptible, in my opinion, to responsive measures.

The next three questions ask whether I have received recognition or praise for doing good work in the last seven days, whether someone at work cares about me as a person, and whether there is someone at work who encourages my development. Here again, these echo the complaints I frequently hear about the need for faculty mentoring and administrative support. And notwithstanding the academic traditions of independence and self-sufficiency, I believe faculty appreciate and deserve recognition for their successes.

The next four questions relate to whether a faculty member feels a sense of belonging to the department or the institution: my opinions seem to count; the mission of the institution makes me feel my job is important; my associates do quality work; and I have a best friend at work. We have had a lot of highly creative caustic remarks about the “best friend” question, but Gallup tells us the question relates to whether there is someone the person can trust in the workplace. Apparently the question generates considerable resistance in private sector companies as well. As individualistic and self-reliant as faculty purport to be, most of them want to be engaged with their department and institution, although few will readily admit it. And it seems intuitively correct – as well as being empirically verified – that their level of engagement affects their performance. On the whole high achieving faculty tend to be good campus citizens.

The last two questions ask whether someone at work has talked to me about my progress and whether I have had opportunities within the last year to learn and grow. These again reflect concerns I hear about the quality of annual evaluations and the challenge of finding ways to utilize the evolving talents and interests of faculty over the course of their careers.

Whether or not any of this is empirically sound, I can tell you that the overall Q12 scores of individual departments bear a remarkable correlation to my intuitive impressions about the quality of those departments and their willingness and ability to achieve excellence. It is an open question whether I can encourage some of the low scoring departments to actually engage the process of trying to improve their scores, since in departments where faculty are not engaged with each other, these conversations are hard to begin. But the survey results have provoked some very good conversations and actions among some departments and we intend to continue the administration of the survey. We hope to do some activities at the campus and dean level to provide by way of example some efforts to address the survey results.

## *Conceptualizing a Hedgehog*

Collins describes “hedgehogs” as “dowdy creatures that know ‘one big thing’ and stick to it.”<sup>4</sup> Trying to develop a “hedgehog concept” for the University presented the most difficult translation from private sector to a public university. The concept requires that you develop priorities that can satisfy three separate criteria: a program at which you can be the best in the world, a program about which you are passionate, and a program that responds to the single greatest impact on your economic success. A private sector company can shed any activity that fails to meet these requirements and can focus on the “one big thing.” A public university does not fully control its mission. Private sector companies are measured on the basis of one factor: profit. Public universities are measured on multiple, conflicting, and often contentious factors.

At the University of Nebraska-Lincoln (UNL), I continue to believe the single most important factor driving our economic engine is public support. Notwithstanding the decline in tax support, the people of Nebraska continue to provide approximately one-third of our budget, and those dollars are currently essential to our survival. Thus any hedgehog priority must be such as to merit public support. The narrower and more focused we become, the more narrow our public support. Similarly, while we can think about “one big thing,” the very nature of a university is dependent on multiple disciplines, some inevitably stronger or weaker than the others. We could not, for example, decide to do only physics or only English, even though if we focused our resources on either, we would be well on our way of being “best”. And, we could not declare our hedgehog to be research alone, since most of the public continues to believe we are a teaching institution, as indeed we are. Moreover, UNL is the state land-grant university with both an obligation and an expectation for outreach and engagement.

The other hedgehog characteristics are also difficult to apply to a research university at the institutional level. The passion of our faculty for any program has a direct correlation to how directly involved they are in the program. And being the “best in the world” requires one to define the “world.” For the institution at large we chose to define it as a set of aspirational and yet realistic comparative institutions.<sup>5</sup>

Thus for the institution, our hedgehog concept has become a combination of undergraduate education and research which coincidentally responds to the State’s two primary needs: keeping young people in Nebraska and broadening the state’s economy. We believe we have a fair shot at being great at

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<sup>4</sup>Collins, at 119.

<sup>5</sup>2020 Vision Report, *supra*, at 53, Exhibit 2.

undergraduate education, and certainly we have areas in research where we might claim to be the best or awfully close. We have also set in motion a prioritization process that will allow each department or cluster of faculty to define their own “hedgehog” – a more fruitful level for a true focus to occur. As a land-grant institution, we have, of course, not ignored our outreach efforts, but we believe that outreach is an extension of teaching and research, not a separate unrelated mission.

In tying undergraduate education and research together, we have acknowledged the historical tension between commitments to teaching and to research. I know it is customary to say there is no conflict between teaching and research and, in theory that is true. On the ground it’s quite another matter. I am convinced that a public university must emphasize both, not only to preserve its public support, but also to retain the loyalty and engagement of those faculty whose primary contributions will be on the teaching side of the institution. At least for me, one of the real challenges of managing a research institution is to assure that the voice of teaching is heard over the roar that can be created by highly visible technical innovations and multimillion dollar grant awards. A similar challenge is to find ways to celebrate the research accomplishments of those in the arts and humanities, whose major grants seldom rise above the low six figures. But all of these challenges relate to achieving our “hedgehog” concept.

### *Discipline in the Face of Brutal Facts*

The most difficult challenge that universities like ours currently face is the effort to remain disciplined and consistent with regard to priorities, and to think in the long-term. Presidents and Chancellors tend to come and go in relatively short order and, as they do, ideas about priorities and hedgehogs tend to change. The result, of course, is few ideas are fully achieved unless one can embed them so deeply into the culture of the institution that no transitory leader would dare depart from them. That would be some trick in a university setting. But we consciously think about ways to do so.

In the relative short-term, our sense of priorities was tested, when, like most public institutions, we faced significant budget reductions during the last two years. Priorities are a lot easier to follow when budgets are increasing. However, we were able during the last two years not only to stick to our priorities but to advance them.

When the prospect of budget cuts became a reality, we decided, after much debate and consideration, that we would respond with vertical reductions, designed to protect our ability to make continuing investments in our priorities. For two rounds we were able to reduce administrative functions, consolidate some outreach efforts, and eliminate some functions that did not involve faculty. However, by the third round, we found it necessary to eliminate three peripheral



academic programs resulting in the termination of 23 tenured faculty. While all but one of these faculty members were either offered tenured positions by other departments or took early retirement, the outrage by some of the unaffected faculty was intense.

The decision to breach tenure was a very difficult decision and was the product of intense discussion among my senior staff and vice-chancellors. I personally had nothing to lose since my only future ambition is to return to the law school and continue teaching. But others in my administration have much of their careers ahead of them and, being a part of the administration that terminated tenured faculty, seemed unlikely to be career enhancing. In returning to Collins book for reinforcement, we discovered this quote:

Everyone would like to be the best, but most organizations lack the discipline to figure out with egoless clarity what they can be the best at and the will to do whatever it takes to turn that potential into reality.<sup>6</sup>

I am pleased, and a bit surprised, to report that as the smoke has cleared, a vast majority of faculty appear to have supported our decisions. In fact, this decision turned out to be much less contentious around the state than our recent firing of a football coach.

During this same period the Board of Regents set aside approximately \$5 million dollars of continuing funds to be invested in priority programs. The Board stuck to its decision even though the university was cutting budgets elsewhere. We had earlier engaged a process that asked Deans to surface their own priorities and we now invited each of these programs to submit proposals for these funds. Each proposal required a request for funds, a description of how they would be used, a description of how the proposers would reallocate resources within their own departments to accomplish the priority (after all, if it's a priority when you are asking for new funds, it should be a priority in spending existing resources), the outcome to be expected, and the metrics for measuring success. We currently have 20 priority programs that have received this funding as well as private funding allocated for this purpose. These are local hedgehogs at the departmental or multi-departmental level – the most appropriate place for hedgehogs to inhabit in a university. And we are beginning to see evidence that these programs are elevating their achievements and their aspirations.

### *Conclusion*

Certainly, UNL as a public research university faces all of the challenges and issues of other research institutions. We are concerned about the reduction in state funding. We are concerned with the international situation that is

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<sup>6</sup> Collins, at 128

restraining university research and student recruitment. We are working hard to have the research infrastructure keep up with our research success. We are struggling to figure out how to manage technology transfer in a realistic way. But most importantly we are trying to embed into the culture of our university a focused, rigorous, uncompromising commitment to excellence.

And even through one of the most difficult financial periods in the University's history we have seen competitive grants increase dramatically, we are enrolling an increasing percentage of the "best and the brightest" of graduating Nebraska high school students, we are increasing our non-resident and minority students, and we are recruiting faculty from prestigious universities to join our efforts. We have many more things that need to be accomplished in order for us to claim that we are "great". But, I think, we no longer doubt that we will get there.

# ECONOMIC DEVELOPMENT AS A UNIVERSITY MISSION

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Since their inception, land grant and many other public universities have had a long-standing commitment to engaging and serving citizens of their state and to developing programs consistent with this priority. In fact, many such universities, including Iowa State University, have incorporated “engagement” as one of the key elements in their strategic plan during the last decade. The enactment of the Bayh-Dole Act in 1980 offered universities a new opportunity for engagement: the opportunity to contribute to economic development in their state and region. As a consequence of this legislation, universities were able to develop and own intellectual property derived from the discoveries in their laboratories for more than two decades. The objective of this legislation was to move the scientific achievements of the university into the public domain. As a result, many new businesses were established based on university technology, and many others grew substantially. This process had a remarkable impact on economic development. However, this process was an indirect one: the universities passed the responsibilities related to economic development onto the private sector through the licensing of technologies. Furthermore, in general there were no incentives for the universities to be involved in programs related to community entrepreneurship.

In many states there was a significant change in the expected role of universities in economic development during the late 1990's. Many states began to view their universities not only as a generator of intellectual property on which to build businesses but also as a primary driver of the states' economic development efforts. In my view, this tendency was stimulated considerably as a consequence of the recession that followed the travesty of September 11, 2001. This new framework has resulted in many legislators and many governors advocating new programs and incentives to promote the role of state-supported universities in economic development. As a consequence, several states, including Iowa, are undertaking specific programs in which universities are key components to their overall economic development strategy. Some states have taken this a step further. In order to develop a comprehensive plan for incorporating the universities into the state's economic development program, they have hired Battelle to generate a roadmap. These roadmaps contain a plan for enhancing economic development based specifically on areas (referred to as platforms) of specialization and expertise within the universities.

This intense interest in the universities as drivers of economic development has resulted in defining this area as a new mission for several institutions. I contend that this extends well beyond previous expectations

regarding the universities' contribution to the economy of their state. This trend offers new challenges to university administrations. First, they must retain control of defining their own objectives and missions while responding to the directives of the states' legislative leadership regarding economic development. Second, institutions must firmly maintain funding priorities for their mainstream programs.

Two very significant funding problems can develop as a consequence of this new priority. Universities may be asked to reallocate funds from established university programs in order to adopt initiatives targeted toward economic development. In addition, there may be pressure to accept unfunded mandates. In this era of tight budgets and small staffs in many administrative offices, accepting such a mandate can be very demoralizing, since the lack of funding virtually ensures that the desired objectives cannot be met. Universities must develop strategies for meeting these challenges.

Once these strategies are established, the focus on economic development offers some new opportunities for public institutions, especially land grant institutions. For example, the economic development mission can be promoted as a new basis for establishing the university's relevance among many stakeholders, including legislators. This mission also provides an excellent context in which to "sell" and illustrate the importance of the educational and research programs of the universities. Furthermore, economic development is an excellent framework for productive interactions between the university, the community and state. Finally, a commitment to this area enables the institution to market itself as an entrepreneurial university, a niche that is considered very important and appealing to many students interested in ensuring that their college education will enhance their success in the job market after finishing their degree. Iowa State University has developed two programs with this focus. A formal minor in entrepreneurship was recently instituted and has become very popular with undergraduate students. In addition, a learning community focused on entrepreneurship has been established. This provides approximately 35 students with the opportunity not only to live together with students having similar professional goals but also to access programs and tutorials developed specifically for this learning environment.

In general this new focus on economic development has been easily adopted into the priority system at Iowa State University. ISU has always had a very strong commitment to outreach as well as applied research, consistent with its motto "Science with Practice." In brief, Iowa State has developed a "System for Innovation." In addition to having the traditional components of sponsored research and tech transfer offices, the university has an affiliated research park as well as an on-campus incubator system. In addition, it has developed shared instrumentation facilities available not only to faculty but to companies in the research park and throughout the state. To facilitate research in the pre-commercial phase, pilot (scale-up) facilities also have been developed. Finally,

Iowa State has developed a very strong system of entrepreneurial centers. These include centers which provide advice to new and existing companies regarding business management practices. Iowa State University also has developed several business support centers that are responsible for providing technical support and advice to Iowa businesses.

As a consequence of this program, there have been 57 new companies started in Iowa based on technology developed at Iowa State University. In addition, the university has received many accolades for its technology transfer activities. Most notably, Iowa State is first among all universities in the number of licenses and options executed per year on its intellectual property. Furthermore, its faculty have received a total of 27 R&D 100 Awards, second among all U.S. universities. Most recently, ISU was designated one of the top three U.S. universities in the development of patentable biotechnology.

With this system in place, Iowa State University has become progressively more and more involved in the economic development activities sponsored by the State of Iowa. In fact, the Regents' university system as a whole has made a new commitment to this area. A subcommittee of the Board was established recently to coordinate activities across the three Regents' universities and to provide a mechanism for coordinating interactions with the legislators and Governor in this area.

The recent Battelle study, performed at the request of the Governor of Iowa, established a plan by which the state, industry, and the Regents' universities could partner in generating a significant growth in economic activity in the state. The final report outlined six platforms based on the expertise of the Regents' institutions. If this plan is implemented, Iowa State could experience a very exciting period of growth in the areas to be emphasized in this program.

The growth of activity in areas related to economic development poses new challenges to the traditional practices in the university environment. If faculty contributions in applied research are going to be supported and encouraged, approaches must be developed for the inclusion of IP development among the factors addressed in the promotion and tenure proceedings. In addition, entrepreneurial activity among faculty can lead to significant conflict of interest problems both for the individual as well as for the institution. Universities must generate the administrative infrastructure required to address these challenges proactively.

A successful university program focused in economic development also must address challenges related to interactions with business and industry. Because of the expectations and requirements of the Bayh-Dole Act and the extrapolation of the regulations associated with the Act to research funded by non-federal sources, the issue of IP ownership often becomes contentious in discussions with industry. These problems can be compounded by the

complexities related to the participation of certain foreign nationals and publication restrictions that often enter discussions in some research contracts. Furthermore, the use of space for industry-sponsored programs in buildings funded through tax exempt bonds can also pose a problem. For example, the restrictions related to research in buildings funded in this manner can impact the possibility of assessing company products if in fact it can be argued that the research is not being performed in the public interest. In addition, laws related to unrelated business income tax can relate to fees accepted for the use of instrumentation facilities or for the evaluation of specific products manufactured by industry partners.

Very interestingly, the university's participation in economic development also has resulted in new parameters for measuring the university's performance. Who would have anticipated 20 years ago that a Board of Regents would be interested in performance indicators such as jobs created in the research park, number of new start-ups per year, number of invention disclosures and patents per year, and the number of licenses and options executed?

Evolving a win-win situation for the university through its activities in economic development requires adherence to some important guidelines. First of all, it is very important to educate the state legislators with regard to the university's role in economic development activities, including issues related to setting objectives and establishing funding priorities. It is only through this process that the university can ensure that its own needs and requirements will prevail! Recruiting the State Department of Economic Development as a partner in the economic development activities of the university is also very important. This practice will ensure that the activities of the university are pursued consistent with the overall economic goals and objectives of the state. The failure to engage this agency in this process may result in the establishment of expectations that the university cannot meet. Finally, as emphasized above, public universities need to be very cautious about the impact of state economic development initiatives on the funding of university programs. The economic development initiatives of the university must be funded from new money; they cannot be derived from funds reallocated from core university programs. For a university to thrive, it must maintain its excellence in academic programs and facilities. This can only occur if the university programs and faculty salaries are funded adequately. Without an excellent faculty and excellent academic programs, the development of sophisticated technology required for the development of the state's economy will be curtailed significantly. In addition, universities must adamantly reject any unfunded mandates!

In summary, the area of economic development can be viewed as a new era in defining the relevance of a university to its region and state. Depending upon the degree of entrepreneurial culture on the university campus, the participation in this area can result in an enhanced relationship with the state government and state agencies as well as a level of economic growth that can

more effectively support the university system. The engagement of industry is key to this process and ensures that the university will have knowledgeable and effective partners both with regard to the execution of programs as well as in the generation of highly credible advocacy at the state legislature. Through these effective partnerships, the involvement in economic development activities, rather than serving as a challenge to the university's priorities, can become an integral part of its primary mission.

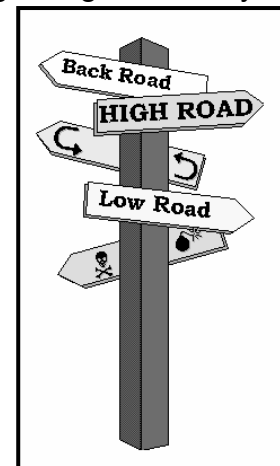
## RESEARCH CHALLENGES IN CHANGING TIMES:

### LEAD, FOLLOW, OR GET OUT OF THE WAY

R. W. Trewyn

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Doctoral research universities have been riding the momentum of research for many years, but maintaining that momentum will be problematic in today's fluid environment. The crossroads at which universities find themselves is not new – they've been there awhile. But the challenges regarding which way to go are continuing to grow. And given their choice, most universities would opt to stay where they are, maintaining the status quo. However, doing nothing during times of significant change is not a viable option. Institutions not moving forward strategically – changing with the times – will soon be left behind, becoming ever less relevant and underutilized.



There are many roads to choose from, but each university must identify the best one for its institution – its high road – if research momentum is to be sustained and perhaps even enhanced. To be done effectively, universities should seek advice and counsel from their institutional customers and stakeholders. Today these include: students and trainees (undergraduate and graduate students, as well as postdoctoral researchers); the employers of their students and postdoctorals; sponsors of institutional research and scholarly activity; citizens/taxpayers of the state; governing board officials; and state legislators. Most universities do not solicit strategic planning input from these customers and stakeholders, but their various perspectives would be invaluable in identifying the best road to follow. Internal self-assessments alone won't get the job done. Real-world considerations are essential.

In looking to the future, research universities must decide whether they will lead, follow, or just get out of the way; the latter relegating them to the *Status Quo U* ranking where they'll atrophy and allow other entrepreneurial institutions to gain preeminence in their state or region. Perhaps a few elite research universities will be able to sustain their momentum without instituting substantive changes, but they're likely to be the exception.

*The Academy in Flux at the End of the Twentieth Century*

**Educational Providers.** There has been a major proliferation of educational providers in recent years, and there's little doubt that the



unresponsiveness of existing providers contributed to this propagation. Various for-profit institutions have entered the market (some quite successfully), which signifies there was a need and there's money in it. Also, a number of Fortune 500 companies have created substantial education and training programs, something they probably wouldn't have done if their needs were being met. While that might be perceived as strictly a teaching issue, research is a required component for training the science and technology workforce required in the new millennium.

**Disciplinary Silos.** The disciplinary silos within universities produced constraints that became increasingly problematic in the 1990's. Research in the sciences isn't practiced on a disciplinary basis anymore – at least, not often. Most of the truly illuminating questions and answers are now at the boundaries between disciplines and across various disciplines. In fact, Alan Leshner, chief executive officer of the American Association for the Advancement of Science (AAAS), noted during a 2004 presentation in Washington: “There is no longer such a thing as disciplinary science.”<sup>(1)</sup> Interdisciplinary and multi-disciplinary science is where the action is these days. However, conducting such research can present difficulties for university faculty who reside in discipline-based departments.

Participating in interdisciplinary research can be especially problematic for young faculty who must be promoted and tenured within their academic unit. Allowing them to have research appointments in multidisciplinary centers offers one means for addressing this dilemma, but it's an open question whether such centers provide sufficient fluidity in these changing times. Many university research centers become just another vertical silo restricting horizontal interactions and external teaming opportunities. Building horizontal flexibility, or bridges, in the vertical world of universities is an ongoing challenge.<sup>(2)</sup>

**Technology Innovation.** As also stated by Dr. Leshner, AAAS: “Technology is now driving science. It used to be the other way around.”<sup>(1)</sup> That has created unique and unexpected problems for research universities as well as the sponsors of research. Funding agencies can't be approached for the acquisition of high-tech instrumentation if the technology is ahead of the science; data required to justify the purchase are lacking. Leshner offers the early days of microarray technology as an example. Few public universities have the flexible resources to invest significant internal dollars into unproven tools, and in cases such as microarrays, scientific advances are slowed as a result.

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<sup>(1)</sup> Leshner, Alan. “National Perspectives on Traineeships and Support.” *Support of Graduate Students and Postdoctoral Researchers in the Sciences and Engineering: Impact of Related Policies and Practices*, Council of Graduate Schools, NSF, and NIH sponsored meeting, Washington, DC, June 17-18, 2004.

<sup>(2)</sup> Trewyn, R.W. “Graduate Education and Research in the Year 2000: Fashioning Horizontal Flexibility in a Vertical World.” *Building Cross-University Alliances that Enhance Research*, Merrill Advanced Studies Center, University of Kansas, MASC Report No. 103, pp. 59-68, July 1999.

Information technology may be the most demanding illustration. Keeping up with the nearly exponential growth in this field is basically impossible. Universities could spend every flexible dollar every day on the information technology infrastructure and still not be leading edge. Strategic investment is required, but what's strategic – and for whom?

**Graduate Education.** The graduate education enterprise in America has been the standard of excellence worldwide for decades, and graduate programs have contributed a major human resource component – a sizeable pool of graduate assistants – that has underpinned university research. Unfortunately, the number of domestic students in the sciences and engineering has been inadequate for years. These graduate programs have become increasingly reliant on international students, a potential problem that became substantial ON September 11, 2001. In addition, the quality of graduate education in other countries has improved in recent years, so U.S. programs are now less attractive to foreign students. The diminution of that talent pool does not bode well for the future.

Furthermore, that's not the only problem. For well over a decade, fewer than half the graduates of doctoral programs in the sciences and engineering have been hired into U.S. research university faculty positions. Yet, graduate programs across the country continue to train doctoral students for jobs in the academy. That's not very insightful. Graduates should be provided with the skills needed for the positions they'll obtain, and there should be enough flexibility in their programs to allow for appropriate courses and training.

**Economic Development.** Commercialization of intellectual property (IP) has become an increasingly important activity of public research universities in the past two decades — beginning with the passage of the Bayh-Dole Act in 1980. Wherever technology-based economic development has had a significant impact in the country, one or more research universities played a crucial role (e.g., Research Triangle Park, Silicon Valley, San Diego, Pittsburgh). Noting these successes, additional universities have opted to get involved, while state legislators, governing officials, and related institutional stakeholders have pressured others into expanding the commercialization of IP emanating from their research. Licensing revenue and job creation are mighty incentives, but only a few universities have been highly successful in this realm. Most are lucky to recover the out-of-pocket and other costs associated with patenting inventions and otherwise protecting university IP. When staking out a position in the global economy, the IP costs can be substantial, the rewards hypothetical – and hypothetical doesn't pay the bills.

**Comprehensiveness.** In the 1970's and 1980's, being a comprehensive research university was a primary goal for many institutions. Big-time universities had to be all things to all people. Fortunately for university

stakeholders, those times are a thing of the past – at least, for the most part. It's just too expensive; few public institutions can afford it.

Although it was by no means universal, many public universities were beginning to figure out by the 1990's that they would have to focus on their core research and academic strengths in order to prosper. Even during those economic boom years, state funding for higher education was not keeping pace in many states (Kansas, for example), so it became increasingly difficult to stay competitive in the full spectrum of disciplines, sub-disciplines, specialties, and sub-specialties. In states with multiple public universities, program duplication was tough to defend in the statehouse. And while it was largely negative factors that drove institutions to focus on their core competencies, when they did so, many realized real benefits in teaming with other public and private entities in research. In optimal circumstances, synergistic outcomes were achieved.

**Return on Investment.** University faculty members tend to dislike having their students referred to as “customers” or “clients,” since it draws parallels to marketing and sales in the profit-driven private sector. The thought of documenting return on investment (ROI) for higher education is probably not appreciated either. Nonetheless, there is increasing pressure on universities to develop appropriate metrics to quantify various outcomes of the educational enterprise. And why shouldn't prospective students have an indication of the ROI they might expect?

In fact, there have been increasing expectations among outside interest groups (including, but not limited to, the institution's customers and stakeholders) that outcome measures should be provided for all the institutional missions — teaching, research, and service. Of these, teaching is probably the easiest to quantify (the U.S. Census Bureau publishes data for mean annual earnings by level of education); the value-added by research is the most difficult.<sup>(3)</sup> Campuses are attempting to judge the latter nonetheless.<sup>(3,4)</sup> And while the time spent by faculty, staff, and students on public service activities should be relatively easy to quantify, few universities track these activities. That's changing though, due to the ever-increasing scrutiny from both outside and inside the institution.

**State Budgets.** As already mentioned, state financial support for higher education has been declining nationally for years. Seldom has it kept pace with annual increases in either inflation or state revenue. During most of the 1990's, state revenues in Kansas were substantially higher than inflation; however, the

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<sup>(3)</sup> Trewyn, R.W. “Evaluating University Research Productivity: What's the ROI ... and Who Cares?” *Evaluating Research Productivity*, Merrill Advanced Studies Center, University of Kansas, MASC Report No. 105, pp. 71-75, June 2001.

<sup>(4)</sup> Bloedel, James. “Judging Research Productivity on an Entrepreneurial Campus.” *Evaluating Research Productivity*, Merrill Advanced Studies Center, University of Kansas, MASC Report No. 105, pp. 81-84, June 2001.

annual state budgets for higher education were not. As a result, the state proportion of the budget at K-State and other Kansas public institutions continued to drop, a trend consistent with the majority of public universities in America. Out of necessity, tuition and other resources have been used to cover shortfalls.

### September 11<sup>th</sup>

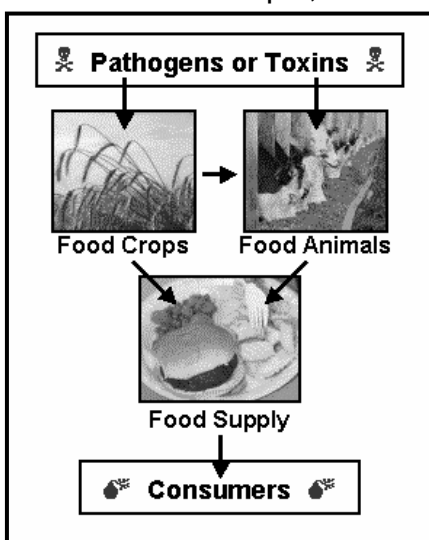
September 11<sup>th</sup>, 2001 “will live in infamy,” just like December 7<sup>th</sup>, 1943. There’s no question that 9/11 changed America in momentous ways, and public research universities were not immune to the consequences. In fact, they have been impacted significantly.

Clearly, the national research agenda has changed post-9/11. Even if the new Department of Homeland Security were to provide little support for research at universities, the agencies that traditionally fund such projects have modified their focus areas in response to new threats and America’s vulnerabilities. However, research universities are adapting.

Another highly significant effect has been on the international graduate student population that supports much of the university research enterprise. The new screening systems now in place have created major impediments. Substantive fees have been added in 2004, and it’s unclear how big that negative impact will be. In addition, the improvement of the international educational competition will decrease the availability of scientific talent even further. With too few students, research momentum will be difficult to maintain.

### K-State Initiatives

**Research.** Because of the changing academic landscape, K-State launched new research-related initiatives to become better positioned for the future. For example, the National Agricultural Biosecurity Center (NABC) was

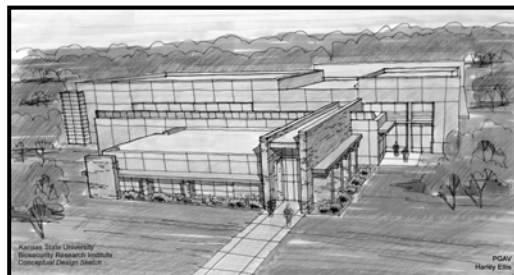


established to coordinate multidisciplinary activities focused on protecting America’s agricultural infrastructure. Having recognized the vulnerability of American agricultural to terrorist attacks, K-State crafted a broad *Homeland Defense Food Safety, Security, and Emergency Preparedness Program* in early 1999. It’s referred to most often as the food safety and security (FS<sup>2</sup>) program. The FS<sup>2</sup> mission is to protect the agricultural economy (food crops and food animals), the domestic food supply, and the American public from endemic and emerging biological threats. In October 1999, K-State President Jon Wefald

presented testimony to the U.S. Senate's Emerging Threats Subcommittee on the asymmetry of the agricultural biological weapons threat. K-State's efforts have continued unabated since that time, but the relevance and importance of the FS<sup>2</sup> program were not widely recognized nationally until after 9/11 and the ensuing bioterrorist assault with anthrax in the U.S. mail.

The NABC has received significant funding from the USDA to: (1) evaluate the means, hazards, and obstacles involved in disposing of large numbers of contaminated animal carcasses, (2) assess agroterrorism exercises and their outcomes, and (3) analyze pathways by which foreign plant and animal diseases might enter the country. The NABC has also been funded by: (1) the Department of Defense (DoD) to conduct agroterrorism exercises involving National Guard and NORTHCOM military assets, (2) the General Services Administration (GSA) to develop select agent monographs, and (3) the Department of Justice (DoJ) to conduct law enforcement agrosecurity assessments. In addition, K-State has funding from the USDA to manage the Great Plains Diagnostic Network – a nine-state regional hub (one of five) – that provides county-by-county plant disease/pest surveillance and diagnostics, and from the National Science Foundation (NSF) to perfect a veterinary telemedicine system with livestock health sensors and wireless data storage capacity.

**Infrastructure.** A foundational component called for in the 1999 FS<sup>2</sup> program was a fully integrated (food crop, food animal, food safety) biocontainment [BL-3 (Ag)] facility on the K-State campus. That proposition is to become a reality in 2006. Construction has begun on a \$50 million Biosecurity Research Institute (BRI) that will include: livestock infectious disease research space (holding up to 32 800-pound animals); a slaughter floor and processing capabilities; plant pathogen/pest, insect vector, molecular biology, and diagnostic laboratories; and research support space. The BRI should help sustain, as well as generate, research momentum. The NABC will oversee the diverse BRI research programs, linking them to other campus efforts.



**Graduate Education.** Modernizing graduate education has been another focus at K-State. The Graduate Council eliminated a number of old policy impediments (e.g., antiquated restrictions on transfer credits) and developed modern-day policies (e.g., authorizing concurrent degree programs). To address professional development needs and enhance course flexibility for students, graduate certificate programs are proliferating; more than 20 are now being offered and many more are under development.

K-State led the development of the first real-time Internet-II (I-2) course in the country. It is an advanced graduate course in plant pathology created in

partnership with the University of Nebraska and Oregon State, first offered in 1999. Three of the world's experts in molecular plant-microbe interactions (one on each campus) team-teach the material to students on all three campuses. Remarkably, the same sort of dynamic interchange between students and instructors that one expects in the classroom for an advanced graduate course occurs between all three distant locations. The I-2 class is so successful, it has been taught multiple times with varying partners; Oklahoma State has also been part of the mix. The only problem is that the course has become too popular.

K-State has also focused substantial resources on developing mediated instructional materials for on-campus courses and adapting these for use in distance education. Complete master's degree programs are now offered remotely, and many more are being developed. The food science, safety, and security (FS<sup>3</sup>) distance education program is one effort that's expanding rapidly, an outgrowth of the FS<sup>2</sup> initiative in 1999. K-State has also received pilot funding from the Ford Foundation via the Council of Graduate Schools to establish two multidisciplinary graduate programs, in Security Studies and Community Development – the latter a collaborative effort involving multiple universities.

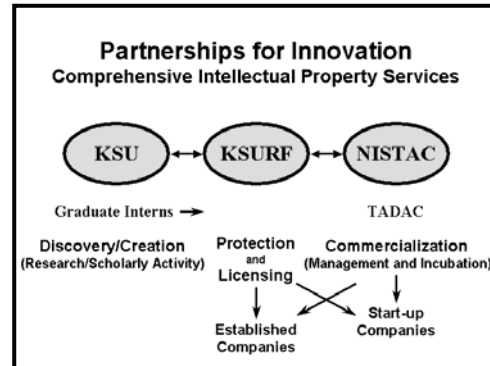
***Economic Development.*** K-State has a long history in technology transfer, given that the KSU Research Foundation (KSURF) responsible for such activities was formed in 1942. KSURF is a not-for-profit corporation involved in protecting and licensing university IP. Traditional licensing transactions with major corporations have been the mainstay over the years, but company start-up ventures are becoming a substantially bigger focus.



The first enterprise of this type (launched in 1995) created *NanoScale Materials, Inc.*, a company that now has its corporate offices and laboratories in the K-State Research Park. Products currently on the market include *Fast-Act*<sup>™</sup>, a “chemical hazard containment and neutralization system” that almost instantaneously destroys hazardous chemicals including chemical warfare agents such as Sarin nerve gas. With the homeland security concerns post-9/11, *NanoScale* should be well positioned in the market place.

It is anticipated that equity positions in technology-based start-up companies will provide greater returns than traditional licensing, but that remains to be determined. Obviously, it's not without risk, since many such ventures fail each year.

K-State’s approach to commercialization of university and non-university IP was described at last year’s Merrill Conference.<sup>(5)</sup> It’s a partnership effort involving multiple entities. One of the crucial team members was the Mid-America Commercialization Corporation (MACC), a regional innovation center in the Kansas Technology Enterprise Corporation (KTEC) network. MACC has recently evolved into the National Institute for Strategic Technology Acquisition and Commercialization (NISTAC). While MACC focused on local and regional economic development, NISTAC will be doing that plus partnering with non-profit entities in other parts of the country to promote technology-based economic development nationally.



MACC established the Technology Acquisition, Development, and Commercialization (TADAC) program in 1998, which was designed to acquire dormant corporate technologies that offer significant commercial potential. It’s not uncommon for companies to abandon a technology they’ve invested in heavily and brought close to market – e.g., when corporate strategic priorities change or market projections fail to meet company thresholds. A \$100-million annual market may not be big enough for some Fortune 500 companies, but in Manhattan, Kansas, that wouldn’t be bad. Last year, the TADAC portfolio contained about 600 patents that had a combined independent valuation at the time of donation of almost \$400 million.<sup>(5)</sup> There are now over 800 patents in the portfolio.

The fact that most acquired corporate technologies are much closer to market than is typical of university technologies makes them highly attractive for start-up ventures. The *Cal-C*<sup>®</sup> “smoothies” sold by the Manhattan start-up *NutriJoy* were based on a *Procter & Gamble* donation,<sup>(5)</sup> and they entered the market in less than 2 years from the time MACC acquired the patents. *Cal-C*<sup>®</sup> is being sold in Kansas, Arizona, the Pacific Northwest, and various other places in the West. It will be distributed widely in the Midwest soon.

In addition to facilitating local start-ups like *NanoScale* and *NutriJoy*, NISTAC is working with economic development entities in other parts of the country to match regional needs with TADAC-held technologies. The NISTAC leadership team has concluded that the standard economic development model in use nationally is dysfunctional at best. The “rob thy neighbor” approach to job creation has been utilized for decades, with communities and regional alliances

<sup>(5)</sup> Trewyn, R.W. “Recruiting and Training Future Scientists: Converting Intellectual Capital into Intellectual Property.” *Recruiting and Training Future Scientists: How Policy Shapes the Mission of Graduate Education*, Merrill Advanced Studies Center, University of Kansas, MASC Report No. 107, pp. 51-58, June 2003.

investing heavily to steal companies from other locales. NISTAC contends that the billions of dollars invested in these activities may have had a net negative impact on the national economy. As a result, NISTAC is attempting a new approach – delivering dormant corporate technologies to areas in need. Discussions are ongoing with multiple distressed urban areas for that purpose.

However, reversing the decline of rural economies will be more difficult. Rural America comprises 80% of the landmass, but only 20% of the population.<sup>(6)</sup> And, unfortunately, the dawn-to-dusk work ethic cultivated in rural settings seldom equates to sweat equity – just lots of sweat, with little or no equity. Novel strategies are needed to stimulate rural economic competitiveness, because only 6-7% of new innovation is occurring in non-urban areas.<sup>(7)</sup>

### *Riding the Momentum of Research in the 21<sup>st</sup> Century*

Public universities must take control of their destiny – they must lead – if they are to continue to ride the momentum of research into the future. They must evolve with the times or resign themselves to sliding backwards, eventually being by-passed for some entrepreneurial *New Millennium U* that is positioned to seize emerging opportunities.

Many of the keys for universities to continue riding the momentum of research listed in Table 1 are interdependent or overlapping with one another. And, clearly, not all of the issues would have to be addressed. Nevertheless, these are some areas where public research universities could take the lead if they so choose. Every one of them is important in this era of rapid change.

Kansas State is working on all these topics with varying degrees of effort (from moderate to major), and the intent is to assume a leadership role in some. Others may be areas where K-State will eventually follow, but there is no thought of K-State getting out of the way of any. All are vital to the land-grant mission. Time will tell how successful K-State's "lead or follow, but never get out of the way" stance will be.

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<sup>(6)</sup> Porter, Michael, Ketels, Christian H.M., Miller, Kaia, and Bryden, Richard T. "Competitiveness in Rural U.S. Regions." Report from a project at Harvard University supported by the *Economic Development Administration, U.S. Department of Commerce*, pp. 3, 2004.

<sup>(7)</sup> Reamer, Andrew, Icerman, Larry, and Youtie, Jan. "Technology Transfer and Commercialization: Their Role in Economic Development." Report from award #99-06-07435 to the Georgia Institute of Technology from the *Economic Development Administration, U.S. Department of Commerce*, pp. 59, 2003.



**Table 1.**

<b>New Millennium Keys to Research Momentum</b>
<p><i>Dialog with Institutional Customers and Stakeholders:</i></p> <ul style="list-style-type: none"><li>➤ Institutionalize Opportunistic Flexibility and Fluidity</li><li>➤ Facilitate Inter- and Multidisciplinary Research</li><li>➤ Leverage Areas of Competitive Advantage</li><li>➤ Partner with “Win-Win” Organizations and Entities</li><li>➤ Address Local, State, National, and International Needs</li><li>➤ Enhance Institutional Economic Development Activity</li><li>➤ Develop Incentives to Reward Entrepreneurship</li><li>➤ Modernize Graduate Education Programs and Options</li><li>➤ Implement an Information Age Outreach Philosophy</li><li>➤ Market Unique Attributes and Value-Added Outcomes</li><li>➤ Identify Metrics to Document Returns on Investment</li></ul>

## RIDING THE MOMENTUM: INTERDISCIPLINARY RESEARCH CENTERS TO INTERDISCIPLINARY GRADUATE PROGRAMS

James A. Roberts  
Vice Provost for Research  
University of Kansas

A natural, positive outcome in this age of interdisciplinary research is the emergence of interdisciplinary research centers. At the University of Kansas, we have a long history of interdisciplinary research centers dating back to the 1920's. We have capitalized on this strength to achieve an unprecedented growth in research over the last several years. In the fall of 2003, in a conversation with our chancellor Robert Hemenway and me, Elias Zerhouni, the director of the National Institutes of Health, stated in so many words that universities should not be adding money to academic units. Instead, Zerhouni said, they should be investing in interdisciplinary research centers. This relates to Steve Warren's comments regarding the NIH's view of the success of centers.<sup>1</sup>

At KU, our major centers report to the Office of the Vice Provost for Research. The range of subject matter for these centers includes such diverse themes as drug discovery and delivery, energy, information technology, the humanities, education, environmental science and engineering, bioinformatics, and life sciences. In our established structure, funding for these centers flows through the Vice Provost's office budget, and an Associate Vice Provost for Research oversees the administration.

For a center to be strong, it must have certain characteristics. In fact, we use specific attributes to measure the qualifications for a center to become known as a designated center, one of the major centers on our campus.<sup>2</sup> These attributes include:

1. having national or international prestige
2. fitting the special character of the campus
3. being truly interdisciplinary
4. providing administrative services to researchers
5. being inclusive, not exclusive (A good example of this is the Life Span Institute, which has 12 major centers, including the Merrill Advanced Studies Center.)
6. having a large volume of externally funded research, as measured by their discipline (We are careful to not put the same funding expectation on a center that is doing major NIH work in drug discovery and drug delivery that we put on a center for the humanities, for example.)

7. providing a significant return on investment (At KU, we do in fact measure return on investment by our centers – gauged in terms of dollars and other metrics – and we have closed centers because of low returns.)
8. being flexible (In fact, most centers are going to have a natural progression if they are done right: they are born, they thrive, and they die. Sometimes academic units seem to have eternal life. Centers can get there as well if we are not careful.)

The creation of a research center really has to begin with a natural interest from the faculty. It has to be bottom-up to be successful. Top-down directed centers often do not work. Faculty-inspired centers come about by thinking big: they are often event-driven. They can develop from state programs, new funding sources that are set up, major grants, or winning a program project. Oftentimes, a “hero factor” is there, where a single individual is responsible for the development of the center. Centers should embody leadership in the sense of how they help the faculty.

At their best, research centers provide crucial support for interdisciplinary teams. They have facilities, administrative support, and seed funding opportunities. They are nimble and flexible. Another important function that happens in strong centers is the mentoring of junior faculty.

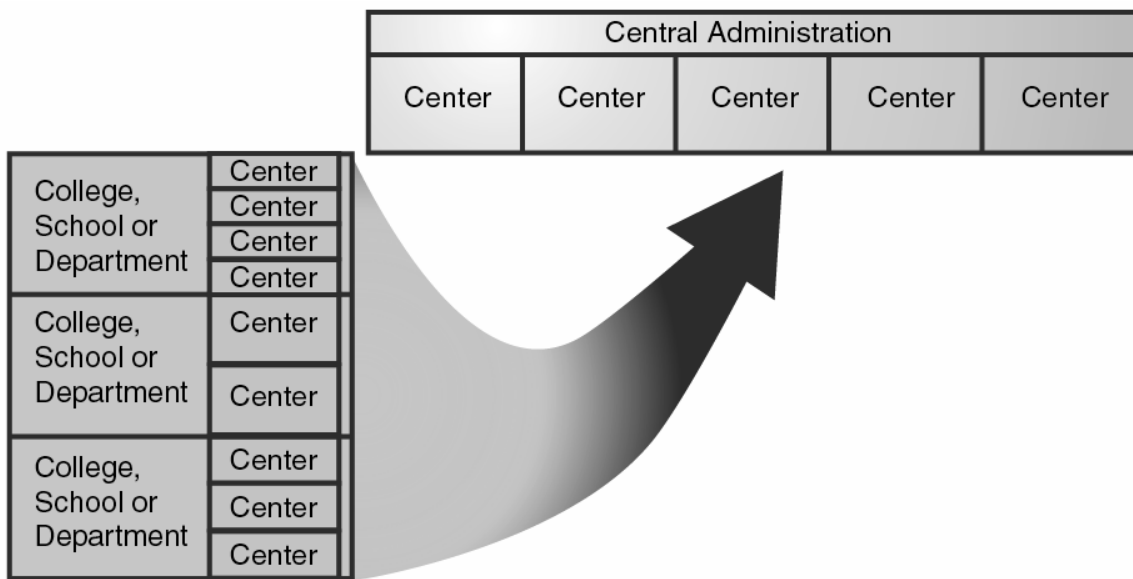


Figure 1. Organizing Successful Research Centers

At KU, we believe it is important that the interdisciplinary centers not report to colleges or departments, but rather to central administration. We have to bridge the college/departmental boundaries. Right now, that is done through the Office of the Vice Provost for Research. This creates in effect a matrix with the centers running along one axis and the colleges and departments running

along the other. This is shown in Figure 1. The faculty members appear as elements on the matrix. Faculty are, of course, members of their own department, but they can also be members of a center. They may or may not be paid by that center. They can have a split appointment or they can be a member of a center strictly as a volunteer. Successful situations in both instances have occurred at KU.

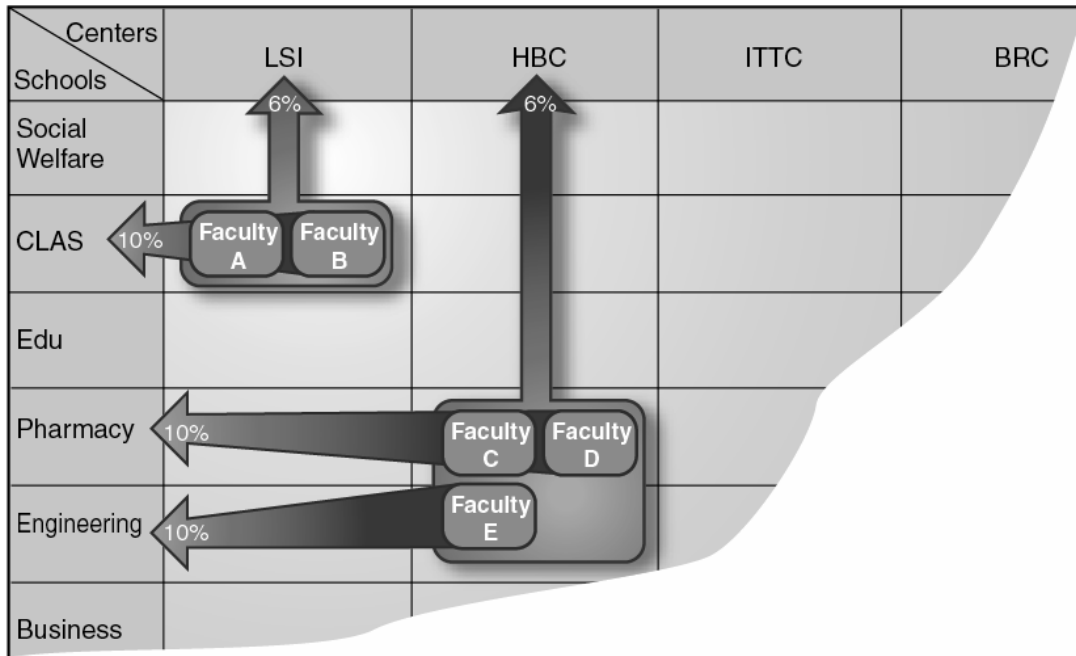


Figure 2. Distribution of Credit and Return-of-Overhead to Academic and Research Units<sup>3</sup>

When the old departmental model is “pulled apart” to create the matrix, as shown in Figure 1, credit and money problems arise. What we have done at KU about competition for money or credit in centers is to initiate a double-counting system. It is actually a triple-counting system to be precise. Credit and return of overhead money flows, first of all, back to the dean based on the faculty members’ appointments. Although there is a default algorithm for assigning the credit, the investigators decide how the distribution will be handled. It has to total 100%, no more. Consider the example shown in Figure 2. Here is a grant that is shared by three faculty members, two in the School of Pharmacy, and another in the School of Engineering. The grant is being administered by and through the Higuchi Biosciences Center (one of our research centers). The credit for the grant flows back to the School of Pharmacy and the School of Engineering in proportion to the expenditures on the grant. Those deans receive 10% of the overhead generated on the grant based on the expenditures. Meanwhile, the Higuchi Biosciences Center gets a separate pot of money, 6% in this case, based on the grant itself, not on what the faculty do, but the grant. The point here is, first of all, that these two pots of money are non-competitive – the deans cannot get part of the 6%; the centers cannot get part of the 10%.

One exception, however, occurs if the center happens to be paying part of the salary of the faculty members. If this is the case, the center gets that share. So the 10% share really flows to whoever is paying the salary of the researchers.

When we keep track of expenditures, we also triple-count in the sense that we can add all of this up by academic unit or we can count by faculty member. Either adds up to a total for the university. We can also compute totals by research center; that is, we add up all the grants and allocate them to the research centers. We have a separate list that adds up to the same total for the research centers. The School of Pharmacy is able to say “this is how much research we did,” based on what their faculty do, regardless of where they do it. And a research center can say “this is how much research our center is doing,” based on the grants that go through that center. An “other” category covers non-center research or non-faculty research. This is shown in Figure 3.

University of Kansas Sponsored Project Activity by Academic Unit: FY 2003							
	AWARDS		EXPENDITURES				
	No. (1)	TOTAL	No. (1)	Federal Science & Engineering Research	Direct	Facilities & Administrative	TOTAL
ALLIED HEALTH	19	2,218,755	34	892,073	1,533,807	268,104	1,801,911
ARCHITECTURE AND URBAN DESIGN	3	28,262	4	4,683	20,582	6,482	27,064
BUSINESS	8	901,642	10	152,683	538,252	58,333	596,585
LIBERAL ARTS AND SCIENCES	271	38,925,380	573	26,219,753	29,034,001	6,682,720	35,716,721
Administration	0	0	4	0	82,219	0	82,219
NSF EPSCoR	0	0	23	159,970	482,416	20,931	503,347
Humanities	26	649,113	26	12,145	1,843,369	126,083	1,981,597
African & African American Studies	1	1,115,613	68				
<b>TOTAL (3)</b>	<b>1,274</b>	<b>178,269,222</b>	<b>2,282</b>	<b>90,875,892</b>	<b>136,594,122</b>	<b>28,021,013</b>	<b>\$164,615,135</b>

University of Kansas Research Sponsored Project Activity by Research Unit: FY 2003							
	AWARDS		EXPENDITURES				
	No. (1)	TOTAL	No. (1)	Federal Science & Engineering Research	Direct	Facilities & Administrative	TOTAL
LAWRENCE CAMPUS DESIGNATED CTRS.	286	52,005,920	436	27,295,750	38,040,812	7,495,491	45,536,303
Biodiversity Research Center	12	4,096,361	30	2,632,782	2,036,544	645,039	2,681,583
Center for Research on Learning	25	6,281,813	45	1,279,024	5,402,378	632,035	6,034,413
Higuchi Biosciences Center	110	13,190,085	117	9,272,366	8,945,343	2,357,205	11,302,548
Information & Telecomm. Technology Ctr.	26	5,913,261	76	4,191,357	4,592,392	1,073,026	5,665,418
Hall Center for the Humanities	19	1,729,102	27	36,298	1,989,295	135,572	2,124,867
Grant Development Office	10	440,288	18	36,298	424,126	24,290	448,416
African Studies Resource Center	1	221,925	1	0	206,527	16,522	223,049
Center for East Asian Studies	2	202,833	2	0	257,022	12,906	269,928
Ctr. for Russian & East European Studies	1	251,000	2	0	504,999	18,996	523,995
Center of Latin American Studies	744	88,764,599	1,321	0	506,621	68,633	775,254
<b>TOTAL (3)</b>	<b>1,274</b>	<b>178,269,222</b>	<b>2,282</b>	<b>90,875,892</b>	<b>136,594,122</b>	<b>28,021,013</b>	<b>\$164,615,135</b>

Figure 3. Academic Unit and Research Center Allocations<sup>4</sup>

This system has worked quite well for us. Sometimes difficulties occur when deans and center directors make special deals on the side. We in the research office try to not get involved in the special deals, although sometimes they are hard to avoid. Frankly, if everybody were to stick to the basic model, there would be very few disagreements.

This then is the center structure that we have developed at KU. It has worked very well for us; we have been among the fastest growing institutions in the country in terms of research volume. Irwin Feller singled out KU in a talk he gave at the AAAS conference earlier this year in Seattle.<sup>5</sup> Feller studied interdisciplinary research at universities and concluded that there were five universities in the country that “get it” when it comes to doing interdisciplinary research. They are the University of California at Santa Barbara, UCLA, MIT, and then two universities represented at the Merrill conference – KU is one of them; Michigan, the other.

Next we consider how graduate education relates to research centers. We know that in the traditional administrative model, there is a one-on-one relationship between departments and degrees (Figure 4). And in fact we saw this in spades at KU. At the School of Engineering a few years ago, we were attempting to merge the Department of Mechanical Engineering and the Department of Aerospace Engineering, but only administratively. This action was not going to have any impact at all on the degrees offered. But some alumni fought this because they could not get it out of their heads that there was not the usual one-to-one relationship between department and degrees. They saw a degree program disappearing. There have been, of course, a lot of administrative mergers. Today there is certainly a model for developing interdisciplinary degrees where multiple disciplines come together, form an alliance, and organize the degree program. An example is the biomedical engineering degree that was discussed earlier.<sup>6</sup>

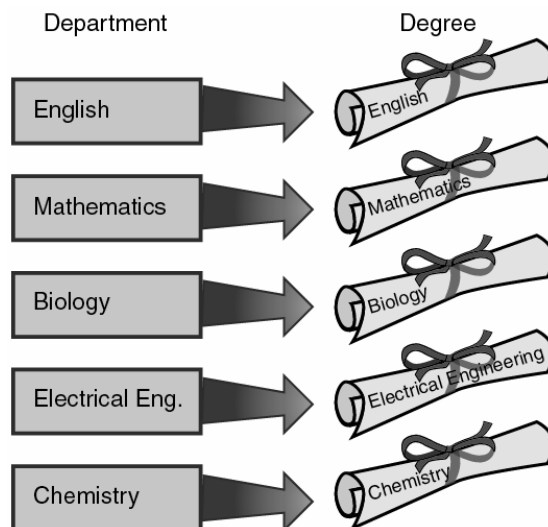


Figure 4. Traditional Administrative Model

There is an interesting case study we might consider. I was department chair for Electrical and Computer Engineering at the time computer science merged into engineering. If one looks at the historical development of computer science at KU, it came from an interdisciplinary group, an alliance of electrical engineering, mathematics, and business faculty members who were interested in computing in the 1960's. Out of that alliance grew a new department and a new degree program, starting with the graduate degree and then, ultimately, the undergraduate degree in computer science (Figure 5). These faculty were not research-intensive faculty members but were simply interested in computing. There was no research momentum that came with the computer science degree or the computer science department when it was formed. As a result, at the time of the merger in 1993, there was a paltry \$100,000 a year going on in research in computer science at KU.

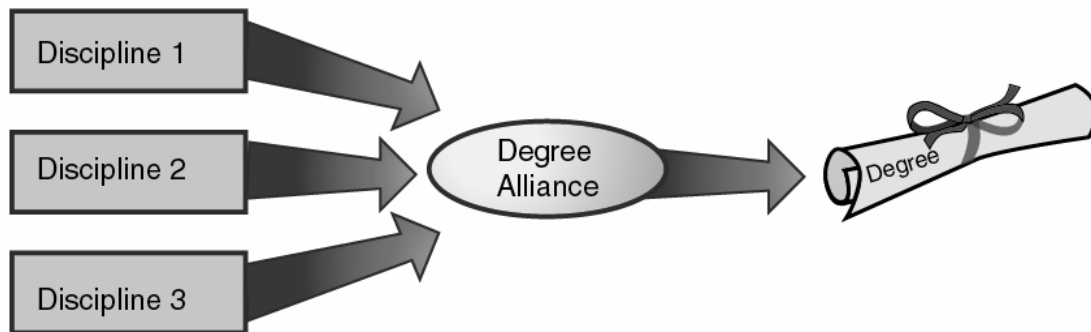


Figure 5. Degree Alliance Model for Interdisciplinary Degree Development

What I propose is that research centers afford us a tremendous opportunity for the development of interdisciplinary degrees based on the research momentum coming from these degree programs (Figure 6). Even though we do have models for interdisciplinary degrees in centers, they ultimately are administered by a college or school. We could create the situation where the graduate school really is the responsible authority for graduate degree programs, which in fact, it is on paper. Degree programs could either be in academic units or they can be in the centers. The key is that the faculty are the glue that holds this all together (Figure 7).

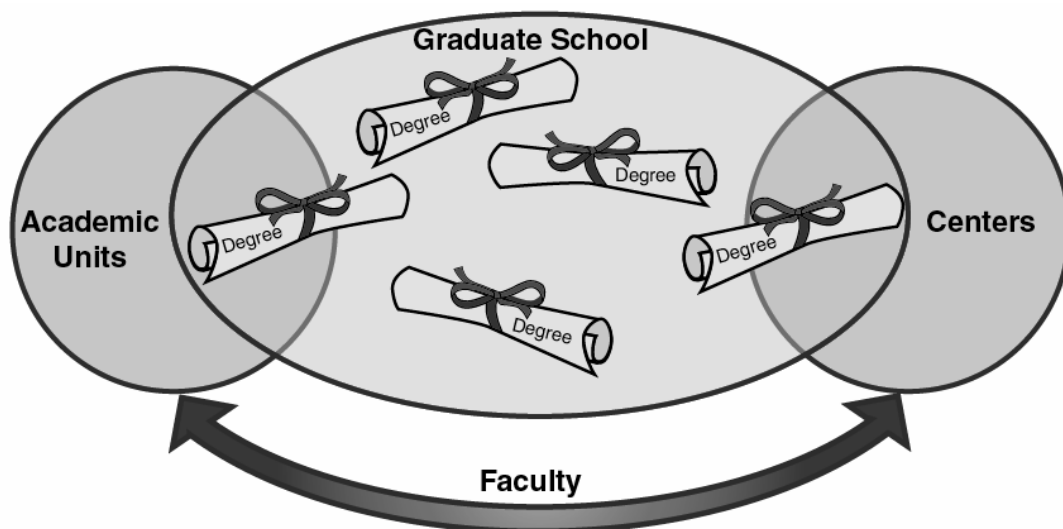
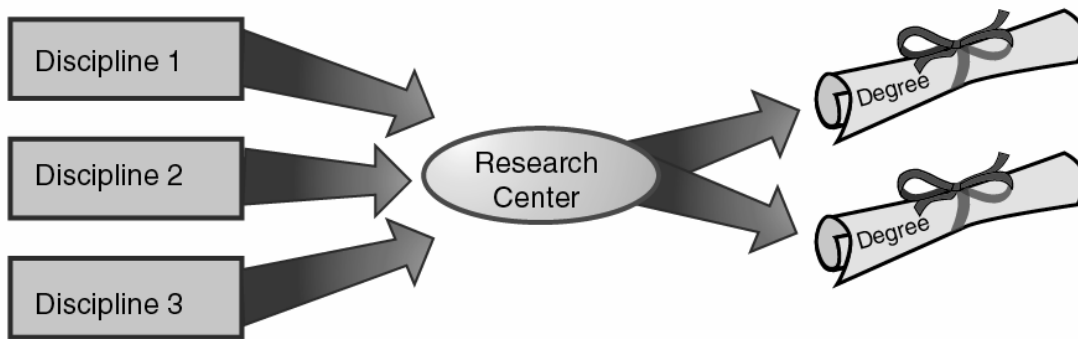


Figure 6. Research Center Model for Interdisciplinary Degree Development

Figure 7. The Big Picture

There could be a similar process for credit for these degrees, student credit hours, degrees produced, etc. We could double-count them just as we do research dollars. In a center-driven model, if a faculty member is a part of an interdisciplinary degree program in a center and has a master's or PhD student in the center, then the home department could still get credit for that degree in their degree total because of the faculty member's affiliation with the department. The research center could also count the degree, saying that some number of degrees was awarded in various interdisciplinary areas. This is shown in Figure 8.



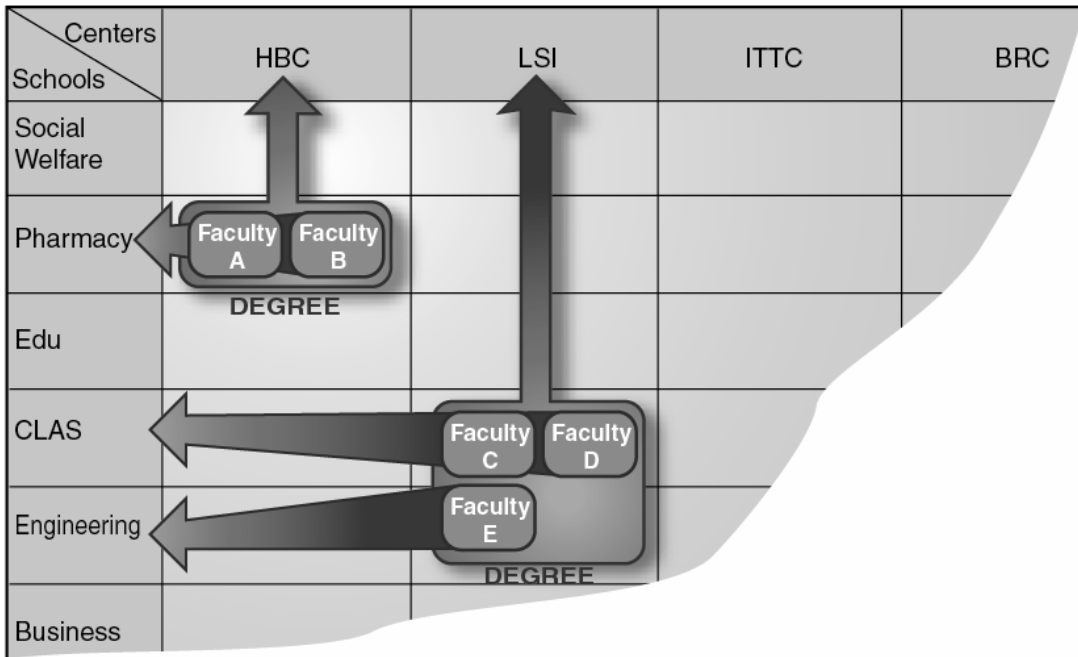


Figure 8. Credit for Degrees Awarded

A number of advantages accrue with this model. It makes more new degree programs available. Out of the research strengths, there is more flexibility for the creation of graduate programs through either traditional academic departments, through centers, or through coalitions. To force ourselves to be in a department or school equals a degree box. Building a degree program on a research strength creates a natural fit for such prestigious programs such as an Integrated Graduate Education Research Training (IGERT) program from the National Science Foundation, for example.

Although it is different from the way most universities have been doing it, there are significant advantages to this approach. The center-based system requires that the graduate school be reasonably strong. Then, if they are the only school overseeing the graduate program, they can do their job. It could lead to degrees that might come and go, but this is okay. Another thing that could happen is that an interdisciplinary degree could ultimately grow into a disciplinary degree. The degree could stabilize and simply become a stand-alone degree or part of a college at that point. The key is to make it flexible. In doing this, we must avoid diverting the center from its core research mission and thereby weakening it. The centers, for example, should not take on curricular matters; course creation should be left to departments. Cross-listing of courses is a useful tool. Again, faculty involvement is the key.

Several models of this approach are already in operation around the country. One would be what I call the center-college model. In this situation,

there are interdisciplinary degrees that are administered by research centers, but they still report through a single school or college. An example is the Child Language Doctoral Program<sup>7</sup> at KU that Merrill Center Director Mabel Rice directs. The Life Span Institute administers the degree, but it still goes through the College of Liberal Arts and Sciences. It is an interdisciplinary degree program, but it is ultimately part of a college. There is also the alliance model that I mentioned earlier. An example is the development of computer science at KU. Next is an interdisciplinary graduate program that is administered by a council of deans wherein multiple schools administer the program. An example of this is the toxicology program at Texas A&M<sup>8</sup> that involves faculty and graduate students from 17 departments and colleges and three research laboratories. The final model is where there is an interdisciplinary graduate degree program, but the research center alone administers the degree with graduate school oversight. This is the model proposed in this paper. An example is Operations Research Center (ORC) at MIT.<sup>9</sup> ORC is the only interdepartmental center at MIT that both admits its own students and offers masters and doctoral programs.

In summary, the key to advancing graduate education is to ride the research momentum. When there is a successful interdisciplinary research center, the university needs to allow that center to develop graduate programs based on its research. The center can administer the degree programs, but the academic departments should develop curricula and administer instructional issues. The graduate school could oversee these degrees just like they do any graduate degree. It is possible to do double-counting so that both the academic unit and the research center gain credit.

The traditional academic units and the research centers are both important. This is not a situation where it is one or the other. The faculty can provide the linkages between the centers and the academic units. They may or may not have appointments in the centers. Successful centers work with joint appointments between the center and academic units. They also work with 100% appointments in the academic units, with the faculty voluntarily working in the center. But it is important again, just as with research credit, that this credit be shared, because we want the deans and department chairs to encourage faculty to work in interdisciplinary centers and to be innovative in terms of developing new graduate degree programs. When this happens, the students, the faculty, and the public are all winners.

## End Notes

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<sup>7</sup> Child Language Doctoral Program, [www.clp.ku.edu](http://www.clp.ku.edu).

<sup>8</sup> Texas A & M Toxicology program, [toxicology.tamu.edu](http://toxicology.tamu.edu).

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## ENGAGING FACULTY IN LEADING COLLABORATIVE RESEARCH

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### *Summary*

The University of Nebraska-Lincoln (UNL) has enjoyed a significant surge in research funding in the last four years. This can be attributed primarily to interdisciplinary collaborations, an infrastructure to support faculty in preparing large multidisciplinary research proposals, seed funding for collaborative research clusters and additional investments in faculty and operational support in targeted areas of strength, with increased expectations for leveraging these resources.

### *Introduction*

The last decade has seen substantial increases in the federal R&D budget. This has been especially significant for biomedical research, as the budget for the National Institutes of Health doubled and now is over \$28 billion. Many academic institutions have benefited from this increase in R&D investments, including the University of Nebraska-Lincoln, with research expenditures increasing from \$102.7 million to \$184.7 million, or 80 percent, in the past decade. Numerous factors have played an important role in this increase, the most significant being the development at the University of Nebraska-Lincoln of *Vision 2020: The Future Role of Research and Graduate Education at UNL*, and the faculty and administration buy-in to this vision. Although we have a long way to go toward our goal, this institutional emphasis on uncompromising excellence and quality has resulted in record research funding in FY2004 of \$91.5 million for the University of Nebraska-Lincoln and \$162 million for all four campuses of the University of Nebraska. For UNL, research funding has increased 86% in the last four years and NIH funding has increased 297% in the same period. Much of this increase has come from large federal grants based on collaborations across departments and colleges. In 2000, UNL held a handful of large multimillion dollar grants; today we have numerous collaborative multimillion dollar grants and centers funded through competitive grants from federal agencies. These grants encompass many disciplines, from the life sciences and physical sciences to the social sciences and arts and humanities.

## *Recent Successes*

Some of UNL's major projects and centers include:

- \$10.7 million Center of Biomedical Research Excellence grant to establish the Nebraska Center for Virology in 2000 from the National Center for Research Resources, National Institutes of Health
- \$4.5 million grant for the Center for At-Risk Children's Services from the Department of Education in 2001
- \$9 million National Science Foundation EPSCOR infrastructure grant to support bioinformatics in 2001
- \$10.5 million Center of Biomedical Research Excellence grant to establish the Nebraska Redox Biology Center in 2002, from the National Center for Research Resources, National Institutes of Health
- \$6 million Plant Genomics Center funded by the National Science Foundation in 2002
- \$5.4 million grant from the National Science Foundation for a Materials Research Science and Engineering Center in 2002
- \$1.8 million from the National Science Foundation to study the Nebraska Sandhills ecosystem in 2003
- W.M. Keck Center for Mesospin and Quantum Information Systems, established in 2003 with a \$750,000 grant from the W.M. Keck Foundation
- \$5 million from the National Institute of Child Health and Development in 2003 to develop strategies to enhance school readiness in children ages birth to age 5, in partnership with the University of Nebraska Medical Center, Lincoln Public Schools and the Lincoln Action Program
- In partnership with the DynPort Vaccine Company of Fredrick, Maryland, an \$11.4 million grant in 2003 from the National Institute of Allergy and Infectious Diseases for vaccine development.
- \$9 million infrastructure grant from the National Science Foundation EPSCoR in 2004, in part to support nutritional genomics studies of how complex chemicals in food influence growth and development in organisms
- \$5 million Teacher Institute grant from the National Science Foundation in 2004 for the Math in the Middle Institute
- \$750,000 from the National Endowment for Humanities in 2001 to establish the Great Plains Humanities Alliance.

It is worth noting that these large collaborative grants have not only been in the life and physical sciences, but include the environmental sciences, social sciences, education and the humanities.

## *Approaches*

Although initiatives supporting multidisciplinary collaborations, providing seed funding and infrastructure support for faculty, and grantsmanship seminars have been key in these successes, the most critical factor is faculty leadership. In all of these cases faculty conceived innovative ideas, and had the experience, desire and commitment to put together strong teams and prepare winning proposals. Incentives such as seed funding of research clusters and targeted retreats to bring together faculty from multiple disciplines also were important factors in building these successful collaborations.

Highlighted below are two such collaborations: the Nebraska Center for Virology, an established, thriving partnership; and the Water Resources Research Initiative, a budding initiative.

### *Nebraska Center for Virology*

The Nebraska Center for Virology at UNL is led by Dr. Charles Wood, the 3M/Lehr University Professor. Dr. James Van Etten, University Professor in Plant Pathology at UNL and a National Academy of Sciences member, and Dr. Howard Gendelman, an endowed Professor at the University of Nebraska Medical Center, serve as co-Directors, and Dr. Clinton Jones, a Bessey professor in Veterinary and Biomedical Sciences at UNL serves as associate director. The Center links faculty from the three major biomedical research institutions in Nebraska: the University of Nebraska-Lincoln, the University of Nebraska Medical Center (UNMC), and Creighton University. UNL faculty who are involved represent three departments in the College of Arts and Sciences and the Agricultural Research Division of the Institute of Agriculture and Natural Resources: Biological Sciences, Plant Pathology, and Veterinary Biomedical Sciences. The center reports to the Vice Chancellor for Research. Senior research officers from UNL, UNMC, and Creighton serve on an internal oversight committee and the center has an external advisory committee of distinguished virologists from around the country. The Center sponsors regular seminars and an annual symposium featuring presentations from the faculty, nationally-recognized guest speakers and the external advisory committee members. The center also has core facilities at both UNL and UNMC. The NCV has hired five new faculty lines with funding from the original grant and additional institutional support, plus four additional virologists, creating a critical mass of virology researchers in Nebraska. The NCV has leveraged these resources, recruiting established faculty with existing NIH funding and adding new NIH project funding and training grants. The Nebraska Center for Virology has served as a model in pursuing large grants and is a trendsetter in fostering collaboration across campuses.

### *Water Resources Research Initiative*

Water is a critical resource in Nebraska and nationally. Nebraska is the home of the Ogallala aquifer, 65 percent of which lies beneath the state. Because of the significance of water to the state, UNL has made significant investments in this area, and more than 70 faculty from four colleges (Arts & Sciences, Engineering, Agricultural and Natural Resources, and Law) have research interests related to water, including expertise in water quality and quantity, surface and groundwater hydrology, drought, and global climate change. Additional faculty are being recruited to further strengthen this critical mass in water research. The state also has made significant investments in state-of-the-art water quality instrumentation in the UNL Water Sciences Laboratory. To coalesce these resources around critical research topics, UNL launched a Water Resources Research Initiative in 2003, led by Dr. Kyle Hoagland, professor in the School of Natural Resources; Dr. Sheri Fritz, a professor in Geosciences; and Sandy Zelmer, professor of Law, working in concert with the Vice Chancellor for Research. The first steps in the Initiative were brown bag lunches and a faculty retreat to identify productive research areas, and sponsorship of the first *Water Law, Policy and Science Conference* in the spring of 2004. Faculty currently are pursuing several large funding opportunities as a result of these activities.

### *Conclusions*

At UNL we have found that faculty effort and institutional commitment are important for creating a culture that is supportive of research and capable of moving the institution forward. In the above examples, faculty leadership is the key – in developing innovative ideas, providing expertise and serving as the driving force in successfully launching these initiatives.

To provide incentives for faculty to take on these large and difficult but highly rewarding projects, we are also strategically investing internal funding. New funds have been allocated to about 20 priority programs that are either strong or are of strategic importance to the state and can be strengthened with additional investments. Core instrumentation facilities are essential, and seed funding has also been critical in bringing faculty together and in enabling teams to generate preliminary data. In addition to regular faculty seed grants, we have initiated strategic planning grants of two types: \$5,000 to \$10,000 over two years to bring faculty together to plan and develop initiatives; and strategic cluster grants of \$50,000 to \$100,000 to develop inter-disciplinary collaborations aimed at large funding opportunities. These funds have been provided competitively with an expectation that teams aggressively leverage these funds with extramural funding.

# SETTING PRIORITIES FOR BEHAVIORAL RESEARCH AT THE SCHIEFELBUSCH INSTITUTE FOR LIFE SPAN STUDIES

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Dick Schiefelbusch took over what was then called the Bureau of Child Research in the 1950's with a part-time secretary and one office with three rooms. Dick retired in the late 1980's and the Bureau was renamed the Schiefelbusch Institute for Life Span Studies in his honor. Before I discuss how we establish research priorities at the Life Span Institute (LSI), I'd like to provide you with an overview of our program. I think it's essential to understand what we are in order to understand how we set priorities. Achieving our mission – to discover or invent solutions to the problems of human and community development, disabilities and aging – depends entirely on the creativity of our investigators. It has always been that way. In this respect, we live by our wits. No one guarantees our future. Instead, our future depends entirely on the extent to which we can achieve our ambitious mission. We have a broad mission, which is an advantage, and it is manifested through the work of investigators affiliated with 12 different centers.

The Kansas Mental Retardation and Developmental Disabilities Research Center is our largest and oldest center (it is almost 40 years old). We share it with the KU Medical Center. It is one of the best examples KU has of a “one-university endeavor.” At any given point in time it has roughly 60 NIH R01 research grants and two or three large program projects clustered around a million dollar a year core grant from the NIH that is competitively renewed every five years. We could easily lose a core grant if we fail to keep our science on the cutting edge of basic and applied research relevant to mental retardation and developmental disabilities. Other universities with these core grants include Johns Hopkins, Harvard, the University of Wisconsin, Vanderbilt, UCLA and other elite research universities. Our center has been a long time source of strength for the Life Span Institute as a whole. Much of what has gone forward over the past four decades has either been a spin off of this center or done as part of it.

The Kansas University Center on Developmental Disabilities is nearly as old as our mental retardation research center and it is also large. The intent is to translate research relevant to disabilities into practice through training and technical assistance. This center spans the entire institute and operates at KU-Lawrence, at the Life Span Institute at Parsons, at the Juniper Gardens Children's Center, and at the KU Medical Center.



The Life Span Institute at Parsons is a research and development center focused primarily on the needs of citizens of the state with disabilities and their families. Research and development efforts done at the Parsons State Hospital over 40 years ago was the genesis of the founding of our Mental Retardation Research Center and our Center on Developmental Disabilities. The LSI at Parsons has evolved a great deal over the years. For example, because of efforts of LSI investigators at Parsons, the state of Kansas has one of the leading programs in the world in assistive technology. If you need a wheelchair because you came back from the war in Iraq seriously disabled, or if you have cerebral palsy – this program helps you to live independently. An estimated 54 million people in the US have disabilities, and for most of these persons, assistive technology allows a degree of independence while enhancing their quality of life. By the way, Senator Pat Roberts has taken a leadership role in helping establish these programs across the country probably in part because they are very cost effective. We just received a \$10 million dollar grant for one year – this is not research money. What we are doing in partnership with the state government and thousands of citizens is establishing co-ops/credit unions in Kansas so people can get money to buy the assistive technology they need. This one-time investment will create a permanent foundation for these low cost programs.

The Juniper Gardens Children's Project will celebrate its 40<sup>th</sup> anniversary this fall. It is located in Wyandotte County – traditionally the poorest county in the state and a place with many challenges. Juniper Gardens is unlike any other research center in the country. It focuses on education, parenting and community issues central to the healthy development of children in partnership with this challenged community. Ground breaking research has come out of this program over the years and has led to the formation of many highly effective intervention and education programs and a much deeper understanding of the impact of poverty and related issues on children's development.

The Beach Center on Disability was established in 1988 with a substantial gift from Ross and Marianna Beach. The Center also had a core grant from the National Institute for Disability Research and Rehabilitation. The Beach Center focuses on quality-of-life outcomes, human and social services; health policies and practices and a number of other issues of central importance to the lives of individuals with intellectual and developmental disabilities and their families.

The Research and Training Center on Independent Living, founded in 1980, focuses on the needs of adults with physical disabilities. This center also has a core grant from the National Institute for Disability Research and Rehabilitation as well as support from the Centers on Disease Control. One of the center's current grants is a result of the 9/11 disaster. When the World Trade Centers collapsed a number of people were killed because they were wheelchair users and could not be evacuated from the buildings in time.

The Gerontology Center was founded in 1976 and became part of the Life Span Institute in 1990. Its focus is on aging Americans – a fast growing segment of the population. This has enormous consequences. The Medical Center also does research on this topic, and increasingly there are links between the two campuses – one approach is behavioral and the other biomedical. The Gerontology Center also is home to an interdisciplinary doctoral program.

The Biobehavioral Neurosciences in Communication Disorders Center is our second NIH-funded center and is only 2 years old. It's the new kid on the block. Communication disorders are one of the leading impairments in the world. Speech, language, and hearing disabilities are almost always at the forefront of disabilities. This Center, like several others at LSI, grew out of the vision of one of our most successful senior investigators. Mabel Rice stepped up and said she thought we could get this center. So we successfully competed for it. This program is funded by the National Institute on Deafness and Communication Disorders. The growing number of NIH grants associated with it focus on issues relevant to the causes and treatment of communication disorders from infancy to old age.

The Child Language Doctoral Program was established in 1983. The Life Span Institute serves as its home because as an interdisciplinary program, it does not fit within a single academic department. This program focuses on interdisciplinary doctoral and post-doctoral training.

The Work Group on Health Promotion and Community Development was founded in 1976. This program truly has a world-wide reach. It will soon be designated a World Health Organization Collaborating Center. Over the years the Work-Group's research has resulted in the establishment of an online "community toolbox" that is used by individuals all over the world to learn how to create all kinds of "community tools" – from electing a city council to public health awareness campaigns. This is an important piece of intellectual property that is touching the lives of people world-wide on a daily basis.

The Center for Physical Activity and Weight Management is one of our newer centers. The Center is focused on obesity in children and adults – a problem that has grown to the level of a public health crisis. This center conducts clinical research and also provides treatment programs throughout the state of Kansas.

And last but certainly not least, you are all familiar with the Merrill Advanced Studies Center, our hosts of this conference. The Merrill Center was established by a generous gift from Virginia and Fred Merrill in 1990. This program serves as a major catalyst for scholarship on disabilities as well as policies that shape university research.

These 12 programs have quite a history. We currently have 87 Principal Investigators associated with the Institute. Our external awards have increased to nearly 20 million per year – and this doesn't include our partnership with the Medical Center. The combined footprint of the Institute, together with our shared programs at the Medical Center represents approximately 36 million dollars in research, development, training, and clinical activity in a given year. Dick Schiefelbusch working with many other creative scientists built the foundation for this program in the 1960's and 70's. So this is by no means a new program, which is an important point. We've been doing this for over 4 decades. And we leverage about 6 external dollars for every dollar we receive from the state of Kansas – a figure that is well above the national average for programs like ours. NIH is the largest source of our funding – 42% right now. Other major sources of support are Health and Human Services, the Department of Education, the state of Kansas, and foundations.

In a “mature center” like ours, what are the signs of vitality? What signs are there that we are still being truly successful and not losing our edge? Well, for one thing we have two new centers – BNCD and the Weight Management Center – and 40 new grants. Grants end all the time – the question is do new ones come online? This year we had 40. But the “competitive renewal” of ongoing programs is extremely important too. We have to go through competitive renewal next year with the Kansas Mental Retardation Center. These centers get knocked off all the time. The fact that you are an “old, established center” just makes you a bigger target. If we lost that center, it would have a massive impact on the Life Span Institute. The 60 R01's would continue at least for a while but the million dollars a year in infrastructure to the organization would disappear. We have cores in imaging and in research design and analysis that are critical. You can never take a renewal for granted. In the last three years, we have increased the proportion of our portfolio fund by NIH from 33 to 42% -- another sign of vitality. It's important to have a diversity of funding, but it is equally important to emphasize the “quality” of funding. In the “go-go 90's” we added some projects that may not have been funded from the most stable and reliable sources. Over time we have had some problems with some of these funding sources. As just one example, several small foundations supporting LSI grants went bankrupt, leaving us with our own financial challenges. As a result we are more conservative now about those with whom we will work and we ask more front end questions. With regard to recruitment and retention of top talent – this can be another sign of vitality. We've retained extraordinary scientific talent that is world class. It is not true that you can't compete when you are in the Midwest. We are competitive. We don't need special help or assistance to do this.

What are some of the important characteristics of our Institute? Stable leadership and a long history. I've been the director for the past four years, Steve Schroeder served as director for 11 years and Dick Schiefelbusch for 30 years before that. Our university leadership will often support some of our more

daring initiatives probably because we are a mature program rather than an upstart. Another characteristic is that we have investigators with all kinds of appointments – regular tenure-track, as well as many people who are appointed 100% by the Institute and not on tenure lines. But we also have many people on joint appointments – tenure line academic and research programs where the salary is split. Our history with this is important in terms of the university's willingness to support this degree of flexibility. We want to be in partnership with deans and the rest of the university – not competitors. Also because of our history we have many seasoned investigators that have seen research support fall, but because of their experiences they know that dips in funding are normal and don't mean the sky is falling. The confidence and ability of the group to survive down times is central to its success. We also have a stable but evolving infrastructure. We have good state support. This may not have been necessary at the start, but it has been important in the long run. I don't believe you can endure 40 years without some stable state support. This support isn't large compared to our overall budget, yet it is crucial to assuring a stable core to our program.

A paradox perhaps is that to be “stable” we have to evolve and change. We must keep up with technology. We must be administratively flexible. For this reason we essentially function as a federation of interests – not a top down hierarchy. Every director is autonomous to some extent. They report to me as well as jointly to a dean in some cases – but in any case they are given a reasonable amount of administrative flexibility. The LSI central office does not micro-manage. This allows us to change when the world changes. All of our directors are active scientists as well. None of us are just “administrators”. Consequently, even though I direct the Life Span Institute and our largest single center (the Mental Retardation Research Center), I maintain a lively program of research just like all other LSI investigators. This is important for my credibility both locally and nationally. So I'm impacted by the same things the PI's face. Thus, when I say to our center directors and investigators that “we” are all in this together, that's exactly what I mean. In this respect, we do not see the KU Center for Research, the umbrella organization that we are part of, in terms of “us and them.” We understand that our success is important to their success and vice versa.

What are the challenges we continually face? Evolve or die is the most basic one. Research centers often go away. They should die when they are no longer meeting their mission. Research centers should be seen as an intellectual tool – a way of organizing talent and resources to solve important problems. Right now the rapidly changing nature of science is a huge challenge for us. It has had a huge impact on behavioral science and this is central to us. We can't keep doing what we've been doing. There are changing federal research priorities – as there should be. We are stretching the infrastructure and our talent to meet these. In practice this is a little bit akin to the idea of rebuilding an airplane while you fly it. This is what we must do in a large mature program to

keep it moving forward. There is no time to simply stop and retool – you have to make changes on the fly.

What are our strategies? Create synergies is a basic one. The 12 centers are not silos. We experience collaboration among our centers and with many others at KU, throughout the state, nation, and world. Kim Wilcox, the Dean of Arts and Sciences, is one of our most important collaborators, for example. We want to collaborate where our mission overlaps with his. We are collaborating right now on recruiting a senior investigator with experience doing clinical trials in behavioral research – this will fit well with our neuroscience initiative. We are also collaborating on hiring a director for our Gerontology Center. Look at who our people work with now – they may be working with faculty at North Carolina, UCLA, or MIT. You'd be amazed at how much collaboration goes on if you looked at the grants and who is on them. About half are from the KU Medical Center, for example. Mabel Rice has a large NIH grant where much of the data is being collected in Perth, Australia. I could give dozens of other examples of collaborations our investigators engage in.

These are the key elements:

- Recruit, retain, mentor – our future is the young investigators.
- Evolve with the science.
- Diversify the portfolio while enhancing its quality. Don't depend on a single source of anything.
- Build from your strengths and don't go into an area where you have no strength.
- Measure and evaluate the effects of your policies and initiatives.
- Reinforce innovation, creation, and making a difference at all levels.

Most of our investigators are not interested in the size of grants they have. They got into this line of work because they want to make a difference at all levels – to have a meaningful impact on the problems of aging, disabilities, human development and communities. If they keep focused on the mission and they are typically successful – their work does have an impact, particularly if they keep it focused.

How do we set priorities? In the short-term, investigators and centers set the priorities – I don't. The process is often "opportunity driven." In the long term, strategic reinvestment is important. The behavioral sciences are changing rapidly. Rapid developments in biology are beginning to cause an increase in the value of some types of behavioral research. Much of what happens with aging and disability comes about because of interactions between biology, environment and behavior. Consequently, we increasingly have people studying gene-behavior interactions. Mabel Rice is doing research on specific language impairment. I am involved with colleagues studying Fragile X syndrome – a single gene disorder for which the gene was cloned in 1990. Fragile X is a fascinating disorder and it is attracting the attention of both basic and applied

researchers. The development of children with Fragile X is affected by the interaction between the environment and the genes. This world of “bio-behavioral science” is a rapidly shifting landscape. Today, the emphasis is on how the brain changes as development occurs. With transgenic mice, the genes are knocked out and we look at the environmental interactions. This research can actually lead directly to behavioral interventions. One of our investigators, Steve Fowler, has looked at how various mental health and mental retardation disorders are related in a number of genes. He uses measurement strategies with mice and rat models that are similar to the disorders being studied in humans.

What strategic investments should be made to reflect changes in science? We have some research positions and a reasonable state budget. Sometimes someone retires or leaves and then this opens up new opportunities. Kim Wilcox and I are recruiting a cognitive scientist to study interventions in terms of clinical trials. The government will clearly be supporting more of this research. We need talented scientists here at KU to help us participate in this important work. So the effort by Kim and I reflects a strategic reinvestment in our program. You saw the list of our centers – are they past their prime? Sometimes you see change and the need to move money from one group to another. If we don't do it, we won't have a future. When we go to recruit someone, we hire because we want to create synergies with new talent. It is important to build for the future and to support the next generation. Junior investigators must be well supported too. The challenge is to keep your focus. There are some things we do better than anyone in the U.S. or the world. That must remain our focus.

# RESEARCH CENTERS AND INSTITUTES: A SURVEY OF OUR SCHIZOPHRENIA

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## *Adieu to the Lone Ranger Researcher*

In September 2003, National Institutes of Health (NIH) Director Elias A. Zerhouni laid out a series of far-reaching initiatives known collectively as the NIH Roadmap for Medical Research. The NIH Roadmap represents an attempt to transform the nation's medical research capabilities and to accelerate both the discovery and the application of new knowledge. The Roadmap provides a framework of the priorities the NIH must address in order to optimize the organization's entire research portfolio. Significant opportunities are identified in three main areas: new pathways to discovery, research teams of the future, and re-engineering the clinical research enterprise.

The concept that the twenty-first century research workforce will consist of collaborative teams rather than individual investigators is fundamental to all three foci of the NIH Roadmap, as is the recognition that the traditional divisions within the biomedical research community can impede the pace of scientific discovery. To discourage artificial barriers and promote collaboration, a series of new awards have been established to support: the training of scientists in interdisciplinary strategies, the creation of specialized centers to help scientists forge new disciplines from existing ones, and the initiation of conferences designed to catalyze collaboration among the life and physical sciences. In addition, the NIH plans to create and support National Centers staffed by highly multi-disciplinary scientific teams to stimulate technological progress in proteomics, imaging, membrane protein production, and biomedical computing. The NIH also will promote new partnerships among organized patient communities, community-based physicians and academic researchers, in an effort to transform and reenergize the clinical research workforce.

Recent initiatives at the National Science Foundation (NSF) and the United States Department of Agriculture (USDA) mirror the NIH imperative for increased collaboration and "bigger science". The nation's leading research universities, medical schools and teaching hospitals have also acknowledged these challenges. In response to a question about the most important trends in biomedical research, the Association of American Universities, the National Association of State Universities and Land Grant Colleges and the Association of American Medical Colleges cited: increasing complexity and reliance on

shared resources, growth in multi- and cross-disciplinary research, and accelerating translation of basic science to clinical applications, public health and underserved communities.

Clearly, the cartoon equivalent of the successful academic researcher is no longer the Lone Ranger, but instead, a member of the Justice League.<sup>1</sup> How will principal investigators and public research universities respond to this challenge?

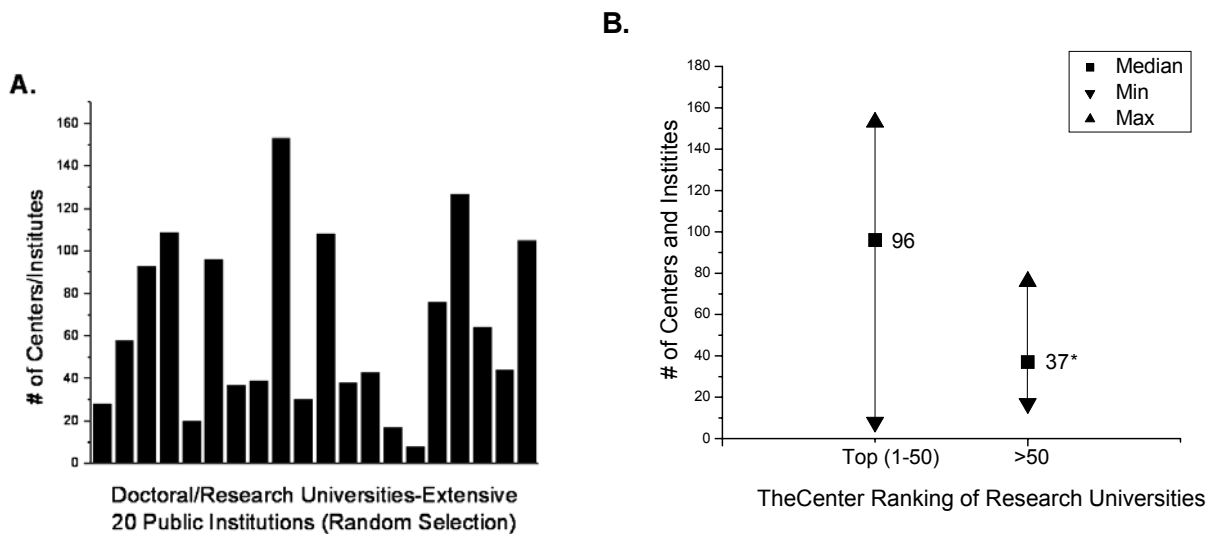
### *An Abundance of Centers and Institutes*

The Roadmap builds on a 45 year old tradition of NIH-directed funding to research centers for the purposes of facilitating interdisciplinary collaboration and fostering the translation of basic science to patient care. Recently, a committee assembled by the Institute of Medicine evaluated the approximately 1200 centers currently supported by NIH. They found not only that the portfolio is diverse, but also that the procedures for defining, establishing and evaluating research centers are inconsistent and highly variable. The committee report endorsed the use of centers to promote collaborative research by multi-disciplinary teams, while at the same time finding that it is difficult to assess and/or compare the efficacy and productivity of the currently funded research centers. To this end, the committee put forward specific recommendations that would make the processes for classifying, establishing, and evaluating centers more explicit and systematic.

Research universities have also embraced the notion that the establishment of research centers and institutes is an effective means for promoting multidisciplinary collaboration and stimulating new research directions. Like the NIH, universities have been inconsistent in establishing uniform definitions, policies, and expectations for research centers and institutes. A web-based survey of public research universities confirmed that academic planning and policy-making have not kept pace with the proliferation of research centers/institutes.

Standard sampling procedures were used to select randomly 20 of the 102 public institutions classified by the Carnegie Foundation for the Advancement of Teaching as Doctoral/Research Universities-Extensive<sup>2</sup> (Table 1). Eleven of the selected institutions were among the Top 50 American Research Universities, as determined by *TheCenter*<sup>3</sup> in 2003. All 20 institutions provided a web-accessible list of centers and institutes. The number of research centers and institutes per institution ranged from 8 to 153 (median = 51); the top 50 research universities featured a significantly higher number of centers and institutes than their counterparts (Figure 1).





**Figure 1.** Frequency of centers and institutes at 20 randomly selected public research universities (see Table 1) for all sampled institutions (panel A) and for the eleven universities in the Top 50 compared to the nine others (panel B).

**Table 1**

<b>Random Sample Public Universities</b> (20 of 102 Doctoral/Research- Extensive)	
Auburn University	State University of NY at Stony Brook*
University of California-Berkeley*	University of North Carolina at Chapel Hill*
University of California-San Diego*	Ohio University main campus
University of Georgia*	University of Oklahoma, Norman campus
University of Maryland Baltimore County	Pennsylvania State University, University Park*
University of Massachusetts*	University of Pittsburgh, Pittsburgh Campus*
Western Michigan University	University of Texas at Arlington
University of New Hampshire	University of Utah*
Rutgers, The State University of NJ*	University of Vermont
City University of NY Graduate Center	Virginia Polytechnic Institute and State University*

\*Top 50 TheCenter Ranking

One center or institute was randomly selected for each of the 20 universities sampled (Table 2). Interestingly, a majority of these centers were thematically consistent with the foci of the NIH roadmap. Content analysis of the mission statements and web sites for all 20 centers/institutes revealed a strong orientation toward promoting multidisciplinary research, public-private partnerships, and economic development (Table 3). Centers/institutes involving more than one department were more common than centers/institutes involving more than one college or university.

**Table 2**

<b>Selected Centers and Institutes</b>
Pulp and Paper Research and Education Center (Auburn)
QB3: Quantitative Biomedical Research (UC Berkeley)
Center for Comparative Immigration Studies (UCSD)
Complex Carbohydrate Research Center (U Georgia)
Center for Women and Information Technology (UMBC)
Center for Neuroendocrine Studies (U Mass)
Nanotechnology Research and Computation Center (W Michigan U)
Biomolecular Interaction Technologies Center (UNH)
Center for Communication and Health Issues (Rutgers)
CUNY Institute for Software Development and Design
Center of Excellence in Wireless and Information Technology (Stony Brook)
Institute of Marine Sciences (UNC)
Nanoscale and Quantum Phenomena Institute (Ohio U)
Institute for Applied Surfactant Research (Oklahoma)
Materials Research Institute (Penn State)
Automation and Robotics Research Institute (UT Arlington)
Thomas E Starzl Transplantation Institute (Pittsburgh)
Nora Eccles Harrison Cardiovascular Research and Training Institute (Utah)
Center for Sustainable Agriculture (Vermont)
Virginia Bioinformatics Institute (VT)

**Table 3**

<b>Content of Mission Statements and Web Sites of Selected Institutes</b>	
<b>Item</b>	<b>Frequency</b>
Strengthen Multidisciplinary Research	100% (20/20)
Outreach/Extension	95% (19/20)
Public-Private Partnerships	75% (15/20)
Economic Development	70% (14/20)
Graduate Education	80% (16/20)
Undergraduate Education	60% (12/20)
Multi-Departmental	90% (18/20)
Multi-College	65% (13/20)
Multi-University	60% (12/20)
Defined Criteria for Success	20% (4/20)
List of Accomplishments	85% (17/20)

*If Centers and Institutes are the Solution, What are the Problems?*

The websites of 17 of the 20 randomly selected centers and institutes summarized major accomplishments. In contrast, only 4 specified any criteria for measurement of success. This disparity may reflect the broad and varied goals, structures and activities of centers/institutes, as well as the difficulties inherent to assessing their value added, outcomes and impacts.

University policies regarding the establishment of new centers/institutes were freely accessible from two of the 20 institutions examined, the University of Maryland Baltimore County and the University of Oklahoma. Similar policies were referenced on websites of two additional institutions, the University of Georgia and Virginia Polytechnic Institute and State University, and these were made available to the author upon request. All four of the policies 1) provided for subclassification of multi-disciplinary units based on the complexity of interactions (ex: group, lab, center, institute); 2) required that forming centers/institutes specify a purpose and plans, including statements regarding the vision, mission, objectives, participants and clients, bylaws, governance, reporting structure, funding plan, and resource implications; 3) required periodic formal review with the potential for recommending reorganization or dissolution.

Major differences in the policies were noted with respect to autonomy, accountability, and incentives. Specifically, centers/institutes at the four universities differed regarding: the ability to offer credit courses and degree programs, the role in appointment/evaluation of tenure-track faculty, the expectation for generation of operating expenses, the position in the organizational chart, the extent of the annual reporting requirements, and the

interval for formal periodic review. Only one of the four university polices provided an obvious financial incentive to participants in interdisciplinary centers/institutes, by allocating additional sponsored research overhead to the center in an amount equal to that assigned to the collaborating colleges and departments.<sup>4</sup>

Although all four policies mandated justification for establishment and maintenance of centers/institutes, only one framed the associated questions explicitly in terms of value added: “what can it [the center or institute] do programmatically that cannot be done at least as well without it?”<sup>5</sup> Again, this may reflect the difficulties inherent to assessing the contributions of centers and institutes. Centers may have complex missions. The desired outcomes such as enhancing translation of basic science to clinical application may take a long time. It is difficult to partition credit for grants, publications and other accomplishments between centers/institutes and their affiliates. Overall, the value added by centers and institutes may be intangible. In any case, evaluation of centers and institutes will require new tools.

A set of questions has been developed by the NSF specifically for evaluating the outcomes of research center programs designed to address long-term complex problems, to advance a team-based, cross-disciplinary research and education culture, and to develop public-private partnerships that foster innovation; these are shown in Table 4. The organizational elements model (OEM) framework developed by Roger Kaufman could also be applied to research centers and institutes in order to determine the value added.

In Kaufman’s model (Figure 2A), there are three levels of performance improvement planning and impact: mega, macro, and micro. There are also related results, primary clients and beneficiaries, processes, and inputs. The framework is used to link planning and results, to ensure that everything an organization uses, does, and delivers will add value to external clients and society. In addition, the inclusion of expectations and criteria for measuring success at the mega level provides a “proactive framework for improvement” that encourages thought about “what could be” as well as “what is.” Again, a major challenge is determining the cost-efficiency gains associated with centers/institutes compared to traditional investigator-oriented research units.

**Table 4**

<b>Questions for Evaluating Programs of Research Centers</b>
<b><i>Research</i></b>
Do centers develop new perspectives that reflect the organized character and collaborations they encourage? (Are they actually studying distinctively different kinds of problems that are more complex, broader or long term?)
Are problems formulated in novel ways; does research move in directions that it otherwise could not have? (Do the centers fill a special niche in their research field?)
<b><i>Education</i></b>
Do the “learners,” be they students, faculty, or industrial partners, acquire the insights and competencies necessary to perpetuate the scientific field?
To what degree are learners bringing practical benefits to the university or industry they work in or to the intellectual environment of the center itself?
<b><i>Knowledge/Technology Transfer</i></b>
How is the program designed to make an impact, and who is the customer?
What is industry getting from the centers that it could not get from individual investigators?
What is the evidence that the centralized, multidisciplinary structure of centers makes university/industry collaboration more efficient?
<b><i>Institutional Impact</i></b>
What organizational or policy changes occurred in the parent institutions as a result of creating centers?
What broader changes (e.g. in the culture of research) can be attributed to a program of centers or to the funding of center programs generally?

from McCullough J. 1992. Draft Report of the NSF Program Evaluation Staff Workshop on Methods for Evaluating Programs of Research Centers.

*Alternatives to Centers and Institutes?*

The attention concentrated currently on the evaluation of centers and institutes is important for the reasons cited previously. However, this emphasis also distracts from serious consideration of alternative means to minimize institutional barriers to multi-disciplinary collaborations, and to encourage translational research and public-private partnerships.

**A.**

<b>Level of Planning</b>	<b>Level of Result</b>	<b>Primary Client and Beneficiary</b>	<b>Processes</b>	<b>Inputs</b>
Mega	Outcome	Society and External Clients	Activities, programs and interventions designed to meet needs at all three results levels	Human, physical, and financial resources that an organization can use to meet needs and deliver useful results.
Macro	Outputs	The Organization Itself		
Micro	Products	Individuals or Small Groups with the Organization		

**B.**

<b>Level of Planning</b>	<b>Level of Result</b>	<b>Primary Client and Beneficiary</b>	<b>Processes</b>	<b>Inputs</b>
Society	Basic knowledge; Advances in medicine and public health; Educated workforce; Technology transfer; Economic development; Social renewal	Civil society; Legislators; Employers; Workforce; Patients	Research efforts; Incentive schemes; Business incubators; IP commercialization; Public-Private partnerships; Training programs; Promotion & tenure	Faculty; Trainees; Laboratory space; Equipment; IT; Venture capital; Start-up funds; Grants; Gifts/Endowments Tuition
Center University	Multidisciplinary collaboration; Grants; Patents; Partnerships; Graduates; Certifications; Recognitions	Center/ Institute University		
Partners Faculty Trainees	Manuscripts; Individual awards; Course offerings; Satisfied participants	PI's Postdoc's Students		

**Figure 2:** The three level organizational elements model (OEM) framework is based on five equally important elements that must be addressed by all organizations and their related projects and programs. Panel A shows the general model, while panel B features elements specific to the university research centers/institutes. The framework provides a basis for aligning what is used, done, produced and delivered with external value added in both planning and impact assessment processes.

At the present time, the formation of multi-disciplinary research teams at public research universities is limited by mind-set, and by misalignment of goals, strategies and rewards. Institutional culture inspires conceptual limitations: the attitude that communication with colleagues outside the department or college is difficult and unrewarding; and the belief that the cost (broadly defined) of collaboration exceeds the value. The physical and organizational infrastructure at public research universities does not support multi-disciplinary interactions. Meaningful rewards for multi-disciplinary interactions are rare; in fact, issues related to credit and resource allocation often serve as disincentives to investigators, department heads and deans. These problems can be addressed either by additions to the existing organizational structure or by large-scale reorganization. The former include not only research centers/institutes, but also information clearinghouses, interdisciplinary administrative units, interdisciplinary training programs, and targeted funds for new collaboration. Their efficacy is uncertain.

One successful example of large scale reorganization has been well-documented: the restructuring of biology at the University of California-Berkeley. In the early 1980's, Berkeley recognized that "the study of living things has matured into a quantitative science with a substructure of overlapping component disciplines which no longer have the precise disciplinary lines familiar in the past".<sup>6</sup> The institutional response to the revolution in biology was not to create new centers/institutes or training programs, but rather to undertake a campus-wide planning process aimed at transforming and revitalizing the life sciences. This process included an inventory of biologists and their activities, an evaluation of existing strengths and weaknesses, and the development of strategies for both radical reform of the intellectual program and construction of new facilities.

Major changes resulted from the deliberate, extensive and expensive planning and implementation processes. The departmental structure of biological sciences was altered to reduce the number of departments, loosen departmental boundaries, and increase departmental permeability to change. The procedures for faculty appointment and promotion were altered to increase the emphasis on scientific merit over departmental loyalty. Substantial investments and improvements were made in facilities as well as in faculty recruitment and retention. These reforms made it easier for biologists of various kinds working on related problems to find each other and work together. The institutional culture at Berkeley was permanently changed to make departmental lines irrelevant to doing science.

The transformation of biology at Berkeley reflected strong academic leadership and institutional will to tackle a major problem in a systematic and coherent fashion. Replicating this manner of operation, while riding the momentum of research, represents a significant challenge to public research universities.

## *Conclusions*

Over the past few years there has been a growing national trend, strongly fostered by federal funding agencies, for scientists and institutions to collaborate on multidisciplinary research teams. One outcome of this trend has been the establishment of multidisciplinary and multi-institutional centers and consortia devoted to specific scientific problems and research areas. It is generally assumed that these arrangements enhance research capability by providing significant financial and human resource support that would not be available through traditional mechanisms. However, there are limited data to support this assertion. Furthermore, there are unresolved and ambiguous issues related to university centers and institutes that pose significant challenges for the associated trainees, faculty and administrators. These include organizational structure, reporting requirements, educational mission, appointments, accountability, credit, and incentives.

Although, the definition and collection of useful data may be difficult and controversial, there can be no excuse for not attempting to ask and answer questions about what centers/institutes contribute: to the society, to the university and to its faculty and students. It will be critical to develop criteria for determining the value added of research centers/institutes. At the same time, it will be important to determine if there are effective means other than centers/institutes for encouraging multidisciplinary collaborations and translational research.

*“To solve the problems of today, we must focus on tomorrow.”  
~ Erik Nupponen*



### *End Notes*

1. The Justice League is a core group of comic book superheroes (Superman, Batman, Wonder Woman, Green Lantern, Flash, Hawkgirl, and J'onn J'onzz (also known as the Martian Manhunter) who work together to fight evil and injustice. Frequently, these seven principals are joined in their never-ending battle by other notable avengers – a group ranging from classic icons like Green Arrow, Aquaman and Captain Atom to more obscure heroes such as Aztek, B'wana Beast, and Vigilante.
2. <http://www.carnegiefoundation.org/Classification/CIHE2000/Partfiles/DRU-EXT.htm>
3. <http://thecenter.ufl.edu/index.html>
4. University of Oklahoma,  
[http://research.ou.edu/policy/Institutes\\_Centers\\_Policy.htm](http://research.ou.edu/policy/Institutes_Centers_Policy.htm)
5. University of Georgia, Academic Affairs Policy Statement No. 7,  
[http://www.uga.edu/ovpi/curriculum\\_systems/academic\\_policy.htm](http://www.uga.edu/ovpi/curriculum_systems/academic_policy.htm)
6. University of California, 1983

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# BUILDING ON STRENGTHS: THE DEVELOPMENT OF AN INTERDISCIPLINARY RESEARCH CENTER

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Issues facing children, families, and schools have reached unprecedented levels. More than ever before, there are complex and formidable challenges that society and its members must address everyday. Indeed, there are social, developmental, and ecological atrocities facing many children and youth. To understand children and their unique circumstances, it is necessary to understand the systems within which they live: the family, classroom, school, and community contexts from which they come and which they impact every day. An effective and efficient way of supporting children is by working across disciplines to forge connections and linkages among all these major systems in a cooperative, collaborative fashion. This is what the Nebraska Center for Research on Children, Youth, Families and Schools is about.

The purpose of this paper is to describe the building of the Center, from the ground up. We are hoping that through this research center, we will change the knowledge and practice base and hence, the lives of many children, youth, families and schools. I will use a building analogy to represent the diverse efforts going into its development. Indeed, it is a work in progress that follows a general blueprint, is built upon a foundation, uses its strengths to define its foci, and continues to build upon its capacities with tools and mortar that hold the efforts together.

## *The Blueprint: Mission, Goals, and Objectives*

The mission of the Nebraska Center for Research on Children, Youth, Families and Schools (Center for CYFS) is to improve through cutting-edge interdisciplinary research, our understanding of optimal ways that parents, teachers and other service providers in family, school and community contexts can promote the intellectual, socio-emotional, physical and behavioral adjustment of children and youth. Central to all of this is enhancing our understanding of how these systems can all work together to support the future of our nation.

The long-term goal of the Center is to become a nationally recognized center of excellence in research related to children and youth, and the multiple

interrelated contexts in which they function (i.e., families, schools, and communities). In particular, we expect to enhance the scope, quality and prominence of Nebraska's research related to children, youth, families and schools; create, nurture, and develop an interdisciplinary academic environment that will foster new basic and applied research in all areas related to children, youth, families and schools; and position the University of Nebraska-Lincoln (UNL) to become a vital and vibrant research institution and collaborator in research of national and international prominence. Specific objectives are listed in Table 1.

**Table 1**

Objectives of the Nebraska Center for Research on Children, Youth, Families and Schools

- 1 Generate, Submit, and Secure Competitive Research Grant Projects
- 2 Foster Interdisciplinary Research
- 3 Provide Opportunities for Interaction with National Researchers
- 4 Increase Visibility of the Center and Center Faculty
- 5 Ensure Center Supports are Responsive to the Needs of Faculty

*The Foundation: Administrative Support*

The Center idea began through a series of discussions in response to a call from the University of Nebraska Board of Regents for programs across the university system to promote excellence and establish institutional priorities. During the 2002-03 academic year, the Nebraska Research Alliance on Children, Youth, Families and Schools was one of 14 priority programs at UNL to receive Board of Regents support as a "Program of Excellence."

An interdisciplinary research retreat was held in October of 2002, attended by 31 UNL faculty members, three deans and two vice chancellors. This day-long retreat served as a working meeting wherein areas of institutional strength were identified and interdisciplinary teams developed that served as a foundation for Center-based research. Many research partnerships formed and continued to collaborate actively as an outcome of the retreat. Some grants were submitted and funded, providing an excellent start up and demonstrating the potential of the Center to be a leader in research productivity at UNL. In February, 2004, the University of Nebraska Board of Regents approved the establishment of the Nebraska Center for Research on Children, Youth, Families and Schools, recognizing the opportunity to achieve prominence through the interdisciplinary research initiative. With capitol support provided by the

Chancellor of UNL, remodeling of the existing building is underway and will provide a central location for interdisciplinary research meetings, grant support activities, and future Center development functions.

### *The Building Blocks: Faculty Strengths*

The building blocks of the Center, or those resources that ultimately build its strength and capacity, are faculty whose expertise fall into four main thematic areas. These areas define the scope of research currently underway by faculty within the Center. They are *Early Childhood Education and Intervention*; *Academic Interventions and Learning*; *Youth Risk Factors and Behaviors*; and *Child and Youth Health Promotion*. The thematic strengths of the Center are further represented by individuals and groups of researchers whose expertise cuts across multiple specialty areas. Specifically, research expertise is evident in the areas of social development in children and adolescents; early childhood development, early literacy, and play skills; bullying and school violence; adolescent risk-taking behaviors and outcomes; homeless and runaway youth; immigrant and migrant families; culturally relevant social, educational, and familial topics; school-family connections; families and step-families; mental health; academic interventions and reading; school environment; dual-language programming and outcomes; adults; and teacher preparation and professional development.

### *The Tools and Mortar: Center Supports*

The capacity of UNL faculty to compete broadly and successfully for extramural funding is strengthened to the extent that faculty affiliates are supported in their efforts. The Center on CYFS assists faculty in grant writing and proposal development in numerous ways, including scouting grants, summarizing grant opportunities, maintaining a grant library, and providing support in grant writing and budget development.

Scouting grants and informing faculty affiliates of federal and foundation funding opportunities is one way of supporting faculty by identifying appropriate and relevant sources of support. In this capacity, staff in the Center research the latest federal grants and foundation priorities and funding opportunities, and ensure that faculty affiliates receive the most up-to-date information. Federal grant announcements and foundation funding opportunities are summarized for faculty to ensure that pertinent information is shared in a relevant and succinct manner. Internet notifications of all federal and foundation funding opportunities, specific to research interests, are then sent to faculty affiliates on a bi-weekly basis.

A large grant library is housed at the Center to further support faculty and provide relevant samples and resources. Electronic and hard-copy files are kept of all grant announcements and summaries. Previously funded grants are

archived and available to faculty affiliates as sample proposals. In addition, information is provided on specific types of grants and federal initiatives to educate faculty affiliates about relevant issues and priorities of funding agencies.

An additional support activity provided by Center staff is assisting with providing information necessary to the development of grant proposals. For example, useful statistical information and needs data are researched by Center staff and stored in the Center library. Monthly e-mails of relevant statistics and needs data that support grant proposals are disseminated to faculty affiliates via Center-wide listserve distribution.

### *Reviewing the Plans: Outcomes by Objectives*

**Objective 1: Conceptualize, generate, submit and secure competitive research grant projects.** UNL's ability to make significant strides in important research on children, youth, families and schools rests in large part on the external grants secured by its teams of interdisciplinary researchers. The Center staff actively assist faculty affiliates in conceptualizing, generating, submitting and securing competitive research grants.

Assistance early in the grant conceptualization and writing process is necessary for some faculty affiliates to develop appropriate research foci. Center staff meet with faculty affiliates to discuss their research ideas, and help them identify funding sources for faculty research projects. Between October 2003 and May 2004, Center staff members met individually with 27 faculty affiliates to discuss their research ideas and grant proposals. Twenty-eight distinct projects were discussed during these meetings. Of the 28 projects discussed, 16 were submitted for funding as of this writing.

In addition to early concept development, Center staff assist faculty researchers with developing grant budgets to accompany research proposals. Among the type of assistance provided, staff help faculty affiliates develop budget items and calculate costs, assist in completing budget forms, and coordinate efforts with the Office of Sponsored Programs.

Among the most important functions of the Center is providing assistance with writing, editing, and assembling proposals. Prior to grant application deadlines, Center staff receive, review and edit sections of grant narratives and provide sometimes extensive feedback to researchers. To assist with the final stages of grant submission, final documents are compiled and copies made by the Center for submission to the funding agency. As a result of these efforts, numerous federal, foundation and local grants were submitted in 2003. Some large-scale federal grants were funded in 2003. Specifically, three grants were awarded totaling \$6,561,727. Across 2003-2004, an additional 19 grants were submitted, totaling \$13,895,580.

**Objective 2: Foster interdisciplinary research.** The collective strength of the Nebraska Center for Research on CYFS is found in its interdisciplinary, collaborative endeavors in research and scholarship. Thus, an integral function and central objective of the Center is to bring together faculty from diverse backgrounds and disciplines to address broad and far-reaching issues through joint, collaborative research partnerships. Faculty affiliates of the Center share expertise around a number of specialty areas, increasing the potential for interdisciplinary collaboration. Table 2 identifies the research themes and specialties of the faculty affiliates.

Opportunities for interdisciplinary networking occur in part through Center-sponsored research events. In its first year of existence, a series of luncheons were held to introduce faculty to the Center, provide opportunities for faculty to meet and interact around mutual research interests, and inform research teams about potential grant opportunities.

**Table 2**

Research Specialties of the Nebraska Center for Research on Children, Youth, Families and Schools

- Social development in children and adolescents
- Early childhood development, early literacy, and play skills
- Bullying and school violence
- Adolescent risk-taking behaviors and outcomes
- Homeless and runaway youth
- Immigrant and migrant families
- Culturally relevant social, educational, and familial topics
- School-family connections
- Families and step-families
- Mental health; academic interventions and reading
- School environment
- Dual-language programming and outcomes
- Adults
- Teacher preparation and professional development

**Objective 3: Provide opportunities for interaction with national researchers.** Reaching out to scholars nationally and internationally is an important feature of the Center’s work, which includes increasing dialogue with

prominent researchers in the areas of children, youth, families and schools. Likewise, increasing the opportunity for Center faculty and students to interact with top researchers is essential in staying abreast and keeping UNL at the center of important research dialogues. The Center provides opportunities for interaction with national researchers through its series of “Spotlights on Research,” held approximately quarterly. In its first year, four such spotlights were conducted.

**Objective 4: Increase visibility of the Center and Center faculty affiliates.** The recognition of UNL as a premier research institution in children, youth, families and schools requires increased visibility and outreach to national and international audiences. Thus, an important objective of the Center on CYFS is the assurance of opportunities to increase visibility of faculty affiliates and their projects. A website was developed ([www.cyfs.unl.edu](http://www.cyfs.unl.edu)) and launched in September, 2004. Several panel presentations at the University, community, and national levels provided opportunities to share information about the Center and its mission, goals, objectives, and activities.

**Objective 5: Ensure Center supports are responsive to the needs of faculty.** Formative evaluation procedures are used to ensure that the Center is responsive to the needs of faculty affiliates. Specifically, input and feedback is solicited at various times throughout an academic year to assess needs, desires, and goals. Specifically, information about potential support activities and research presentations is collected. The activities identified by faculty affiliates as desirable are in Table 3.

**Table 3**

Percentage of Faculty Affiliates Endorsing Grant Support Activities

Grant Support Activity	Percent Endorsing
Email Grant Opportunities	95
Budget Development	77
Relevant Website Notification	73
Internal Review	68
External Review	59
Grant Library	55



Social validation procedures are used to collect faculty perceptions of Center support functions and activities. Information is collected following research presentations and "spotlights," and following grant submissions. Participants attending the research spotlights complete brief evaluation surveys. Information regarding helpfulness, interest, and preference is collected. One hundred percent of faculty in attendance at the spotlights reported that the topic was of interest to them. Ninety one percent indicated that the format was appropriate, and 83% indicated that the spotlight was helpful or somewhat helpful in their research efforts.

Similarly, information is collected from faculty affiliates who submit grants through the Center. We solicit information about perceptions of their experience and the usefulness of Center support services. Feedback data are in Table 4. Of note, 100% of the faculty affiliates indicated that "I had such a positive experience in working with the Center, I would work with them again in future grant submissions." Additionally, 42% of the faculty affiliates indicated that "I was pleased that I submitted the grant through the Center and believe the potential funding of this grant was enhanced due to their assistance." None of the faculty affiliates indicated they "did not find the assistance provided by Center staff very helpful in the grant development and/or submission." Furthermore, none of the faculty affiliates indicated that they "did not think [they would] ask for help in the future from the Center Staff when submitting a grant proposal."

**Table 4**  
Perceptions of Faculty Following Grant Submission

Grant Support Activity	Helpfulness Rating
Concept Formation	4.85
Identification of Funding	4.57
Development of Grant	5.0
Submission of Grant	5.0

### *The "Messy" Stages of Building: Challenges and Next Steps*

The early formation of the Center has not been without its challenges. Continual redefinition of the Center's identity and foci, and strategic planning around strengths and growth are always central. It will be very important to assure that the mission of the Center and projects supported therein are consistent and serve to strengthen each other. Thus, although it may be tempting to invite all faculty to work with the Center for all grant projects, it will be necessary to maintain a focus on those most germane to the overarching mission of children, youth, families and schools. Likewise, issues of balance are always present. For example, there is an ongoing balance between the diverse levels of faculty needs and what is reasonable for Center staff to provide. There is a need to balance interest in supporting all faculty members in their efforts at grant writing with staff availability and priorities on quality and competitiveness.

In all interactions with faculty and administrators, the priority of establishing a "win-win" experience has been emphasized. Issues such as internal credit for grant submissions and distribution of fiscal and administrative (F&A) returns are paramount, particularly given the interdisciplinary nature and cross-unit, cross-campus emphasis of research generated through the Center.

Although the Center leadership and staff believe initial goals and objectives are being attained, new opportunities are on the horizon. Enhanced opportunities to support faculty researchers at all stages of experience will be necessary, as will more and varied opportunities for interdisciplinary networking and meaningful dialogue. Importantly, increased interactions within the university and across regional, national, and international circles will serve to strengthen research efforts and yield the broadest and most positive outcomes for children, youth, families and schools.

## CONFERENCE REACTION AND PLAN

David Shulenburger  
Provost and Executive Vice Chancellor  
University of Kansas – Lawrence campus

At this conference we have heard about the impact of our institutions on people and the quality of life. We've heard the mission statements of the universities. Mary Sue Coleman repeated over and over the importance of our missions having top priority. She is now at a large university in a state with a large population. She gave us a formula for success: look for faculty initiatives and provide institutional support. She talked in numbers, the magnitude of which could make us blush – \$2 billion in research dollars. She has matched this amount with \$900 million in support from the state of Michigan. In addition to a lot of support that was directed and targeted – helping the faculty build and organize, doing some cheerleading – there was also some serendipity involved in the receipt of a \$25 million dollar gift.

Harvey Perlman talked about a larger piece of serendipity in Nebraska. It fell into the pattern of the formula – faculty initiative plus institutional support – directed in a functional way to produce an objective. Even in institutions with so many resources and of such scale, what Mary Sue Coleman talked about were five core centers developed in cooperation with other universities in Michigan and funded by the \$2 billion dollar initiative. Not only were these resources shared among universities, but they were also shared with individuals in Michigan. Note that if there is any institution of sufficient scale and wealth to be self-sufficient, it is the University of Michigan, but a big part of its success is choosing not to be self-sufficient and self-contained. The University of Michigan is willing to work with its neighbors to bring in useful resources.

The presentations that followed Dr. Coleman's repeated the theme of faculty initiative with institutional support. It was interesting that Richard Schiefelbusch did a word count on "passion" in the last talk – that word describes his life. If we had done a word count on "collaboration" we would have rung the meter. We talked a lot about collaboration – how to sustain it and how to imagine new ways to collaborate. I'm glad that Susan Sheridan is here since she is starting a new center – there were lots of examples of success at this conference. George Wilson's account of the continuum of multidisciplinary research, tech transfer, big science, economic development – these efforts cry out for collaboration. They are too big to be accomplished by a single individual.

If collaboration is good within an institution, if it is good within a group of colleagues that share your discipline or share your area of focus from the center point of view, maybe we should consider formal collaboration within the group of states that Robert Barnhill, borrowing liberally from geography and geometry,

calls the “four-corner” states. It is a virtual corner and that’s fine. We share a geographic affinity, and over time, a greater affinity than that.

Since 9/11 our states have begun to see us as economic drivers more than ever before. This is less the impact of 9/11 and more the fact that we can’t rely on the usual bases of economic growth and vitality. We need more. If you need something different, you look to the university – we are about as different as you can imagine. We are good for economic growth. Legislators have this idea now and we can nourish that idea and make it grow, or we can squelch it. Robert Hemenway talked about the bioscience institute that will give us a lot of fuel over the next 10 years. If we use it correctly, it can have a huge impact on the economy and the state’s resources for doing good in the future.

Unlike the University of Michigan, at least three of the states represented here are low population states. Each of our universities is moderate in scale. We don’t have the scale of California, Michigan or Illinois schools. Could we benefit from sharing resources and realizing economies of scale by working together? That is the question. I’m an economist and economists don’t usually want to produce cooperation; instead they believe in competition. I’m rare. The conservative king Milton Friedman once touched my head and said, “I forgive you, son!” It’s from that perspective that I want to talk about cooperation.

If you are going to have cooperation, you are going to have to come to the table as partners. Being partners often means you must have the ability to contribute to the relationship. Our partnership must include research-extensive universities and publicly-funded, research-extensive medical schools, some of which are separate from the universities. Given that NIH is where the money is, we need to include medical schools.

Suppose we hired a research team to do a SWOT analysis on this set of schools in our four states, looking at the strengths, weaknesses, opportunities, and threats. A team also could produce a Presidents’ plan for faculty and facility coordination. That plan would do the following:

1. Identify the major research opportunities that might be available to us, but which our resources don’t enable us to seize. Given our strengths, what is it we can’t quite do?
2. Identify the existing faculty, facilities and expertise that would be useful for addressing those problems and would be more useful if shared. For example, at KU we are developing a structural biology center. We probably would benefit more if there were complementary investments elsewhere in the region and we had the ability to share our center with others in return for access to their unique research facilities.
3. Identify the facilities and the faculty we don’t have, but could be more effective if we did.
4. Recommend where such facilities and expertise would best be located among the universities in the region.

Here are the ground rules: the recommendations would have to improve the research funding potential for all schools. The recommendations could include improving research funding potential for each school, and for the collective arrangement of schools, and involve redistribution of resources across the system. It is not research funding that we are interested in as much as the capacity to deal with real problems that fit the mission of these institutions in ways that will end up affecting the viability of our states.

We should create a prospectus that the universities could use with their individual state legislatures, with their federal delegations, with donors, and with foundations to obtain funding and fill in the gaps to make us more effective. The prospectus should talk about cooperation we are unlikely to achieve if we are limited to the resources a single state can muster. We must convince the legislators across the region to invest regionally instead of uniquely in their own institutions.

If we believe in cooperation, we have a couple of choices: to use this scheme to create complementarity among institutions as we develop plans; or to create interdependence among institutions so that in the long-term, we focus on the really big problems one can only address through cooperation. That is a step too far now, but I don't want to begin down a road without asking how much we value cooperation. The study I call for would show us the value of cooperation.

Steps:

1. Refine the proposal.
2. Send it to the presidents and chancellors of the institutions that fit the set of universities collaborating.
3. Let the presidents and chancellors decide whether they think it is worth proceeding and, if so, have a meeting of presidents, chancellors, provosts, and vice provosts for research.
4. Issue an RFD.
5. Pay for the work to be done.
6. Make a decision based on the results of the study.

## CONFERENCE PARTICIPANTS

2004

### **Keynote Speaker**

Mary Sue Coleman, Ph.D., President, University of Michigan

### **Iowa State University of Science and Technology**

James R. Bloedel, Ph.D., Vice Provost for Research

Robert C. Brown, Ph.D., Professor and Director, Office of Biorenewables Programs

### **Kansas State University**

Lisa Freeman, DVM, Ph.D., Associate Professor of Pharmacology, Veterinary Medicine, and Director of Mentored Training

Ron W. Trewyn, Ph.D., Vice Provost for Research and Dean of the Graduate School, and President, KSU Research Foundation

Jon Wefald, University President

### **University of Kansas**

Barbara Atkinson, M.D., Executive Dean, School of Medicine, and incoming Executive Vice Chancellor – KU Medical Center

Robert E. Barnhill, Ph.D., Past President and Senior Scholar, KU Center for Research, and member of the Merrill Board

Robert Hemenway, Ph.D., Chancellor

Kathleen McCluskey-Fawcett, Ph.D., Senior Vice Provost and Merrill Board member

Mabel L. Rice, Ph.D., The Fred and Virginia Merrill Professor of Advanced Studies and Director of the Merrill Center

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Richard Schiefelbusch, Ph.D., Director Emeritus of the Life Span Institute and the Merrill Center, and member of the Merrill Board

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Steven F. Warren, Ph.D., Director, Schiefelbusch Institute for Life Span Studies, and member of the Merrill Board

Kim A. Wilcox, Ph.D., Dean, College of Liberal Arts and Sciences and Merrill Board member

George Wilson, Ph.D., Higuchi Professor of Chemistry and Pharmaceutical Chemistry, and Associate Vice Provost for Research

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Harvey Perlman, J.D., Chancellor

Susan M. Sheridan, Ph.D., Willa Cather Professor and Professor of Educational Psychology, and Director, Nebraska Center for Research on Children, Youth, Families and Schools

**Other Participants**

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Robert Woody, KU Counsel in Washington, D.C.

Keith Yehle, Legislative Director, Office of Senator Pat Roberts