DOCUMENT RESUME

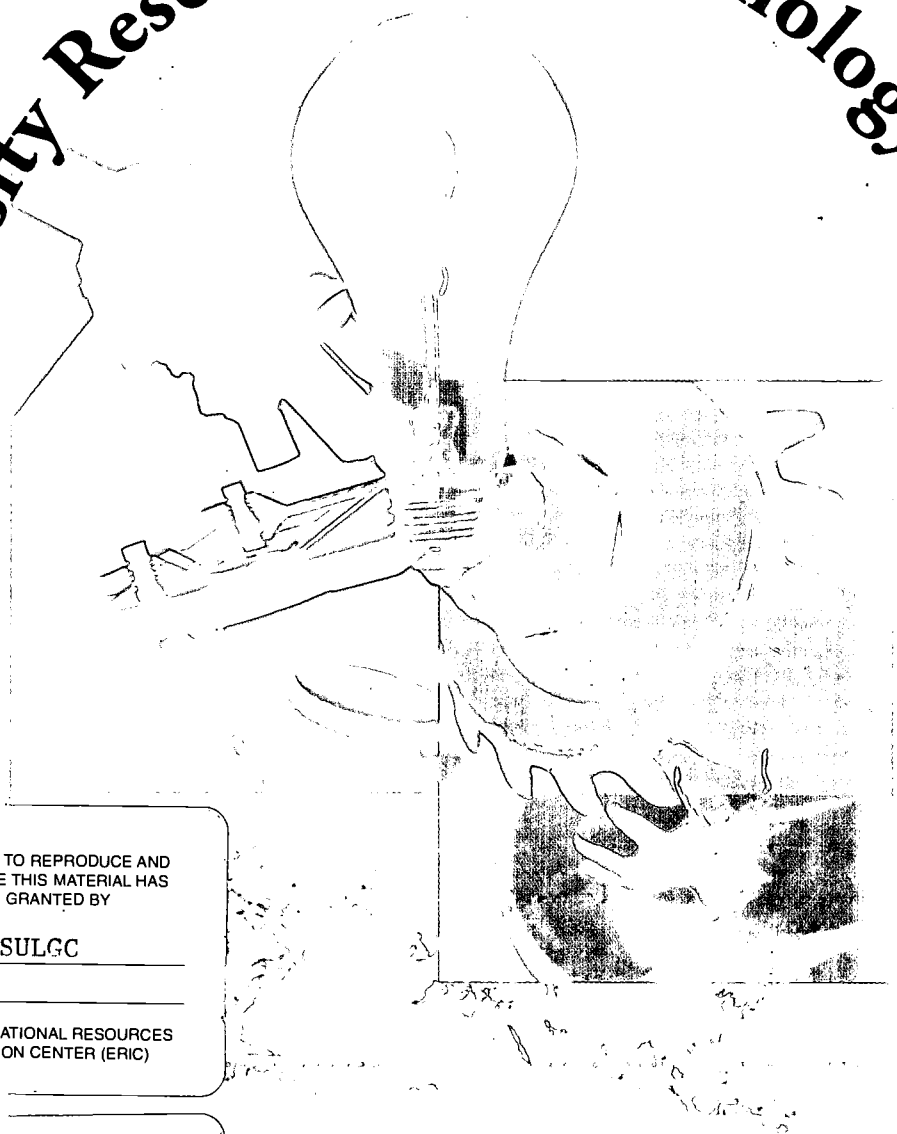
ED 430 501 HE 032 092

TITLE	University Research and Technology Transfer in a Changing World.
INSTITUTION	National Association of State Universities and Land Grant Colleges, Washington, DC.
PUB DATE	1998-00-00
NOTE	46p.; Summaries of a Workshop of the Council on Research Policy and Graduate Education of the National Association of State Universities and Land-Grant Colleges (St. Louis, MO, April 5-7, 1998).
AVAILABLE FROM	National Association of State Universities and Land-Grant Colleges, 1307 New York Avenue NW, Suite 400, Washington DC 20005-4702; Tel: 202-478-6040; Fax: 202-478-6046.
PUB TYPE	Collected Works - Proceedings (021)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	College Faculty; College Students; Cooperative Programs; *Entrepreneurship; Graduate Study; Higher Education; Institutional Administration; Institutional Role; *Partnerships in Education; *Research Administration; *School Business Relationship; State Colleges; State Universities; Strategic Planning; *Technology Transfer; Workshops

ABSTRACT

This document derives from a workshop that brought together members of the Council on Research Policy and Graduate Education to discuss models of administrative and support structures to provide a range of services that promoted the goals of faculty, students, and other university employees in research and entrepreneurial activities. Following the meeting agenda, the report presents the text of four addresses and summaries of workshop sessions. Presentations included the opening statement: "Summary, 'History of the Land-Grant and State Institutions'" (Manuel Pacheco, president University of Missouri System); the keynote address, "University Research in the Changing Environment" (Michael M. Crow, Columbia University); "Perspective on University/Industry Relations (Duke Leahey, Monsanto Company); and "Partnerships and the National Innovation System" (John Yochelson, president, Council on Competitiveness). The workshop sessions included: "Expectations from the Business Ventures of the Universities and Colleges"; "Model Institutional Structures for the Support and Management of Faculty Entrepreneurs"; "Model Structures/Faculty Support Programs"; "Model Structures, Corporate University Partnerships"; and "Do the Models (those presented as well as those developed at other institutions) Meet the Expectations?" Also included are lists of working group members and workshop participants. (CH)

University Research and Technology Transfer



in a Changing World

Summaries of a Workshop of

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St. Louis, Missouri • April 5–7, 1998

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{ *Contents* }

July 1998

Dear Colleagues:

The Council on Research Policy and Graduate Education annual meeting has always been an opportunity for vigorous discussion of contemporary issues in research and graduate education and, importantly, some of the ideas that emerge are translated into action. At last summer's meeting in Big Sky, Montana, a particularly provocative session on issues surrounding technology transfer, the ownership and management of intellectual property, small company start-ups and conflict-of-interest situations in Arizona universities revealed that many NASULGC universities are facing these same issues and managing them in a variety of ways. Others volunteered that they were only beginning to consider such issues and could benefit from the experience of their colleagues. Several CRPGE members volunteered to be part of a working group to review intellectual property and conflict of interest policies (at least) of NASULGC institutions with the goal of establishing a consensus "best practices" document that could be used as a guide for those who have yet to establish policies, are revising or refining an existing policy and as a model document, recognizing, of course, that the flexibility institutions have can be limited by federal, state, and institutional policy and/or law.

Policies from more than 60 institutions were collected and read. A summary outline of topics (e.g., copyright, patent and licensing, consulting) and issues (e.g., ownership of intellectual property, management of conflict of interest and conflict of commitment) was prepared to guide a meeting of the working group in Orlando. After a day's discussion of topics that ranged from the goals of the meeting to tenure (!), the group concluded that there was so much change in terms of our opportunities to do new and different things in research administration that to focus on policy alone would short change the ability to learn from each other about the innovations implemented to take advantage of the relationships created by the merging cultures of business and education, the connection between research and economic development, the entrepreneurial attitude of many faculty (and of universities themselves!) and the new partnerships among universities and with private enterprise and government. Universities have become more risk-taking as wealth-creation has been adopted as both a target and an outcome of our research enterprise. New ways of capturing value from our research and intellectual property are expected and bring with them expanded opportunity and responsibility.

The Orlando Working Group, therefore, proposed a framework for a conference or workshop that would bring together members of CRPGE with other relevant parties to discuss model administrative

and support structures that provide a range of services to promote the goals of faculty, students and other university employees in research and entrepreneurial activities and the guidelines and policies that have been developed to protect them and the interests of the public who supports our land-grant institutions. The title proposed for such a conference/ workshop was suggested to be "Creating a 'Robust' University Environment to Support Research and Technology Transfer in a Changing World."

The suggestion was then discussed at a CRPGE-sponsored working session during the NASULGC Annual Meeting in November, 1997 where it was recommended that the "conference" become an ongoing forum to discuss issues that are of immediate importance to the changing responsibilities of chief research officers in NASULGC institutions. Individual meetings would focus on specific topics that would be summarized by means of a proceedings. The general title (above) could be the framework for the series.

The Orlando working group evolved into a planning group and the meeting "The Research Business of the Land Grant/Public Institutions" was born as the first of a series of national workshops sponsored by CRPGE/NASULGC. The underlying theme for the meeting was: "Dealing with Opportunity—Taking and Managing Risk." The meeting was packed with valuable information, excellent discussion and an opportunity to learn about what works, what doesn't and how to think differently about what we do today and where we might go tomorrow. Planning and organizing was easy because the enthusiasm was so high and each section leader took the initiative to organize that segment of the program. The most difficult part was limiting the number of people who had a story to tell and would have been an asset to the program. The members of the CRPGE are particularly indebted to Dr. C. Peter Magrath and Ms. Jennifer Wingard for their willingness to sponsor and support this experiment. We hope the success of this meeting will be seen as a solid foundation for continuing this important series in the future.

Sincerely yours,

Karen Holbrook

Karen A. Holbrook,
Program Chair, Vice President for Research and
Dean, Graduate School, University of Florida

on behalf of the CRPGE Working Group

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{ *Meeting Agenda* }

Creating a "Robust" University Environment to Support Research and Technology Transfer in a Changing World

I. "The Research Business of the Land-Grant/Public Institutions"

The First of a Series of National Workshops
Sponsored by

the Council on Research Policy and Graduate Education of

the National Association of State Universities and Land-Grant Colleges

St. Louis, Missouri • April 5–7, 1998

AGENDA

The underlying theme for the meeting is: **"Dealing with Opportunity—Taking and Managing Risk"**

Related to this theme, the following questions can be addressed:

- What are these opportunities?
- How do we deal with them?
- Who benefits?
- What will we miss if we don't take advantage of them—and—what will we give up if we do?

Sunday, April 5

5:00–6:30 p.m. **Welcome**

- Jack O. Burns, University of Missouri-Columbia
- Douglas Wartzok, University of Missouri-St. Louis

Opening Presentation: **"History of the Land-Grant and State Institutions"**

The presentation and discussion will focus on the traditional missions of Land-Grant and state institutions which have always required us to provide outreach activities—some of which we might consider today (when they occur in nonagricultural or engineering colleges) to be entrepreneurial. The differences between the original goals and today's goals, however, are what need to be highlighted, i.e., the outcome of personal wealth, wealth-generation for institutions, etc.

- Manuel T. Pacheco, President, University of Missouri System

Session Recorder: Jack O. Burns, University of Missouri-Columbia

6:30 p.m. Reception

Monday, April 6

7:00–8:00 a.m. Breakfast

7:45–8:45 a.m. **Workshop Overview**

- Karen A. Holbrook, Program Chair, University of Florida

Keynote Address: Michael M. Crow, Vice Provost and Professor of Science and Technology Policy, Columbia University in the City of New York

Session Recorder: Karen A. Holbrook, University of Florida

8:45 a.m. **Session I: Expectations from the Business Ventures of the Universities and Colleges**

Two panels will be formed. The first panel on expectations will discuss the expectations of various constituencies who interact with the university in its entrepreneurial/business ventures. The second panel will address issues related to the need for changes in faculty culture and university reward structure.

Session Chair: Luis M. Proenza, Purdue University

Session Organizers:

- Richard K. Koehn, University of Utah
- Leonard K. Peters, Virginia Polytechnic Institute & State University
- Luis M. Proenza, Purdue University

Panel 1: Our External Partners—The Business Perspective (Corporate Partners and Venture Capital)

Speakers:

- Barbara Melera, President and CEO, Triad
- Michael J. Montague, Director, Research Operations, Monsanto Company
- Arnold L. Oronsky, General Partner, Interwest
- Michael P. Silvon, Vice President, Business Development, BAS Analytics

Panel 2: The University Perspective (Faculty and Administration)
Speakers:
- Alvin L. Kwiram, University of Washington
- Darrell W. Nelson, Executive Dean for Research, Institute of Agriculture and Natural Resources, University of Nebraska
- Sheldon M. Schuster, Director, Interdisciplinary Center for Biotechnology Research and Biotechnology Development Institute, University of Florida

Session Recorder: Leonard K. Peters, Virginia Polytechnic Institute& State University

10:45–11:00 a.m. Break

11:00a.m–12:30 p.m. **Session II: Model Structures**

Model structures created in our institutions from our academic/research enterprise to capitalize on new business opportunities have resulted in enhanced support for the institution's traditional missions. Each model will be presented as a case study intended to stimulate discussion. Each speaker will address the resources that were needed to create the activity, the problems encountered and the successes and failures.

Session IIA: Model Institutional Structures for the Support and Management of Faculty Entrepreneurs

This session is not intended to describe research parks and foundations and what they do in their traditional, well known roles, but to present models of both types of organizations that have "critical," unique, and/or innovative relationships and activities that promote the missions of the university—novel activities that have worked!

Session Chair: Richard K. Koehn, University of Utah

Session Organizers:
- Richard K. Koehn, University of Utah
- Luis M. Proenza, Purdue University

Speakers:
- *The Research Park: "This is the Place, but it's not the Program,"* Richard K. Koehn, University of Utah
- *Property Development with the Private Sector,* Harry R. Albers, General Manager, San Diego State University Foundation
- *The Role of the Business Incubator in the University's Program to Promote Entrepreneurs,* Francis (Pat) Hession, President, Long Island High Technology Incubator

Session Recorder: Richard K. Koehn, University of Utah

12:30–2:00 p.m. **Luncheon Presentation**

Introduction: Douglas Wartzok, University of Missouri-St. Louis

Speaker:
- Duke Leahey, Team Leader, Technology Alliances, Monsanto Company

Session Recorder: Douglas Wartzok, University of Missouri-St. Louis

2:00—3:30 p.m. **Session IIB: Model Structures/ Faculty Support Programs**

Session Chair: Joan F. Lorden, University of Alabama at Birmingham

Session Organizer: Joan F. Lorden, University of Alabama at Birmingham

Speakers:
- *Model Structures to Meet the Needs of Clinical Investigators,* Larry W. Moreland, Department of Medicine, Office of Clinical Research, University of Alabama at Birmingham
- *Model Structure for Support of Faculty Entrepreneurial Activity,* David L. Day, Interim Director, Research Foundation, University of Alabama at Birmingham
- *The New ARCH,* Thomas L. Churchwell, University of Chicago

- *Managing Conflict of Interest: Partnership or Lost Opportunity,* Peter E. Dunn, Purdue University

Session Recorder: Linda L. Brinkley, University of Memphis

3:30–4:00 p.m. Break

4:00–5:30 p.m. **Session IIC: Model Structures, Corporate University Partnerships**

Three university and three corporate presenters will examine model structures for corporate university partnerships within the framework of an examination on the mission and culture of university/industry R&D. Panelists will discuss the partnership process by addressing the following questions:

- What is the marketplace which drives creation of a new model or paradigm for R&D partnerships?
- What are the objectives each of us has for working with the other (universities and industry)?
- How is the process for collaboration and partnerships evolving? How are our roles being modified?
- Where does the process work well? Where do we clash?
- Where are our benchmarks for success?

Session Chair: Carolyn S. Sanzone, University of Massachusetts Amherst

Session Organizers:

- Carolyn S. Sanzone, University of Massachusetts Amherst
- Karen A. Holbrook, University of Florida

Speakers:

- *Corporate R&D Embedded in the Campus—The Centennial Campus at NC State,* Charles G. Moreland, North Carolina State University
- *UCSD and CONNECT,* Mary L. Walshok, University of California, San Diego
- *Tapping the Corporate Culture: Science and Technology Advancement,"* Carolyn S. Sanzone, University of Massachusetts Amherst
- *Corporate Perspectives on University Industry Partnerships*
  - Robert A. Berdine, University Relations Manager, Caterpillar, Inc.
  - Randolph J. Guschl, Director, Corporate Technology Transfer, DuPont Company
  - David P. Rice, Manager, External Research Programs, Proctor & Gamble

Session Recorder: Diane M. Jacobs, University of Central Florida

6:30 p.m. Reception

Dinner Presentation

Introduction: John K. Yost, University of Idaho

Partnerships and the National Innovation System, John N. Yochelson, President, Council on Competitiveness

Session Recorder: George E. Walker, Indiana University

Dinner

Performance by Harpist Erica Ball, University of Missouri-St. Louis

AGENDA

Tuesday, April 7

7:00–8:00 a.m. Breakfast

8:30–10:00 a.m. **Session IID: Model Structures/ Corporate-University**

Session Chairs:

- Robert E. Barnhill, University of Kansas
- Michael A. Cusanovich, University of Arizona

Session Organizers:

- Robert E. Barnhill, University of Kansas
- Michael A. Cusanovich, University of Arizona

Speakers:

- Steven G. Zylstra, Director, Business Development, Simula Technology Corporation
- *Other Public-Private Partnerships in which Universities are Involved,* Robert C. Gesteland, University of Cincinnati
- *Master Agreements to Facilitate University-Industry Partnerships,* Larry E. Pherson, Purdue University

Session Recorder: Robert E. Barnhill, University of Kansas

10:00–10:30 a.m. Break

10:30a.m.–12:00 p.m. **Session III: Do the Models (those presented as well as those developed at other institutions) Meet the Expectations?**

The final session will bring together the discussions that evolved from the first two sessions and analyze the outcome. This session could also include discussion of failed expectations and/or problems and an evaluation of successes—are they attributable to serendipity? Luck? An abundance of funds? And/or effective programs?

Session Moderator: Arnold A. Heggestad, University of Florida

Special Participant: Thomas H. Moss, Director, Government-University-Industry Roundtable (GUIRR)

Session Facilitators: Session chairs will identify individuals from the list of those who register for the meeting and invite them ahead of time as well as include individuals who were speaking in the expectations sessions.

Session Recorder: Barbara Wingo, University of Florida

Summaries of Workshop Sessions

{ *Opening Presentation* }

Summary, "History of the Land-Grant and State Institutions"

Manuel T. Pacheco, President, University of Missouri System

Recorder: **Jack O. Burns**, Vice Provost for Research, University of Missouri-Columbia

We must occasionally remind ourselves of our land-grant roots, especially in these changing times, if we are to remain true to our heritage and to our public obligations. A Land-Grant university is supposed to be doing whatever it is that somebody says your school is currently not doing, or not doing enough of, and should start doing right away!

The Morrill Act, which created Land-Grant universities, was passed by Congress and signed into law by President Lincoln on July 2, 1862 in the midst of America's Civil War. The creation of Land-Grant Colleges was mostly the result of pressure from agricultural societies, farm journals, and other agricultural support groups. States were offered 30,000 acres of land for each of their members in Congress. The endowment was an incentive to create universities with a mission to support agriculture and mechanical arts through teaching and research. The Hatch Act of 1887 added experiment stations at Land-Grant institutions to enhance scientific knowledge. The Smith-Lever Act of 1914 further charged Land-Grant Colleges with taking the results of scholarship and discovery directly to the people. The purpose and effect of these pieces of federal legislation were to put public institutions of higher learning to work doing research and providing learning of benefit to the nation's changing economy.

In 1890, the second Morrill Act moved to apply a portion of the endowments to the education of African-Americans. Many people educated at Black Land-Grant schools went on to dismantle legal segregation in American education.

Today, our mission remains to educate people of all classes and races, to bring them both practical and philosophical understanding. Our primary mission continues to be the creation and dissemination of knowledge to the nation. We do this through our extension agencies and through partnerships with business and industry.

Although our fundamental obligations remain the same, their execution calls for change. But, universities tend to be among the human institutions most

resistant to change. The world is moving faster, technologies are more sophisticated, our economy has become global, and communication has become instantaneous. As one result, research has become more demanding, more competitive, more expensive, more voluminous, and more necessary to our nation's economic security and survival. Universities must engage in entrepreneurial partnerships with the private sector, which are sometimes at odds with the cultural linguistics of the university campus.

The playing field has changed, the environment has changed, the pace has changed, and the players have changed. But, our assignment has not changed. We remain accountable to the people whose tax dollars pay a significant portion of our costs. We've always relied on the private sector to help meet the rising costs of research. We've always been expected to contribute to the economic welfare of our constituents and to maintain our academic credentials. We surely must continue to do all these things.

{ *Keynote Address* }

University Research in the Changing Environment

Michael M. Crow
Vice Provost of the University and Professor of Science and Technology Policy, Columbia University

Universities and the New Manifest Destiny: Organizational Principles for Strategically Realigning American Research Universities

1897

One hundred years ago, the rapidly evolving enterprises were not based on what universities do, but the political power was based around certain industries:

- Machine Tools
- Fire Arms
- Clocks
- Sewing Machines
- Agriculture Implements
- Bicycles
- Steel
- Electrification
- Telegraphy/Telephony

1997

In contrast with one hundred years earlier, the fastest growing industries today are:

- Microelectronics
- Biotechnology
- New Materials Sciences Industries
- Telecommunications
- Computer Numerically Controlled Tools and Robots
- Civil Aircraft Manufacturing
- Computers (Hardware and Software)

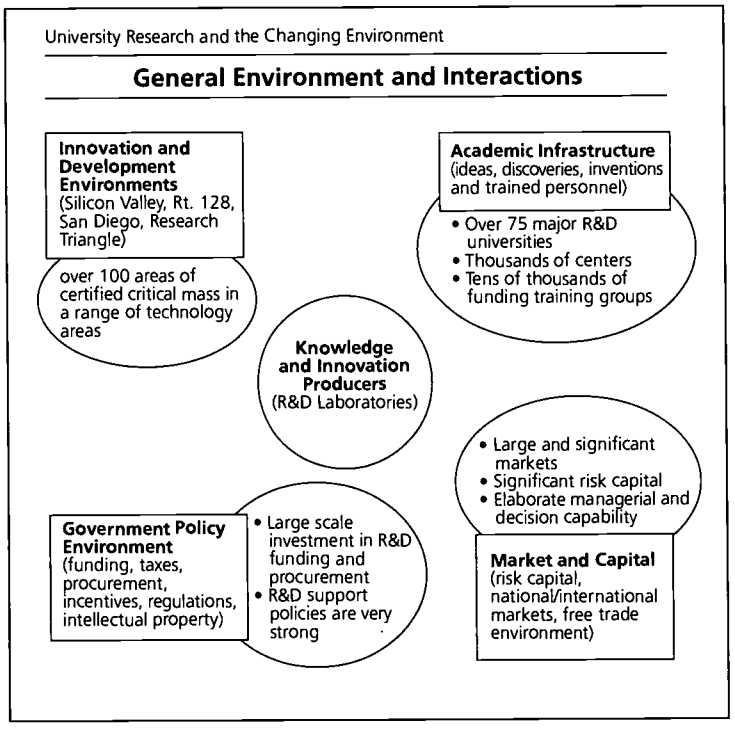
This is what universities are made of and here, too, is the political power. As goes the industrial growth environment, so goes politics.

2027

Can we predict the future growth companies? They may look like this:

- Nanotechnology
- Biomimicry
- Biomaterials
- Bioelectronics
- Biocomputing
- Artificial Intelligence
- Knowledge Management
- Planetary Management
- Green Power Technologies

This is a dynamic time in the transformation of politics. Science and technology are driving our economy and it is this fact that is driving the logic behind the federal increases in R&D funding. But, it needs to be recognized that The National Innovation System has a set of rules, procedures, systems, guidelines, institutions and culture. The American



system has a number of forces at work (see diagram) in our present the environment where interactions are concentrated on science.

Knowledge and Innovation Producers

The knowledge and innovation producers are the R&D Laboratories across the nation, in the private sector and in universities. These labs are concentrating the political force in a few areas.

Innovation and Development Environments
(Silicon Valley, Rt. 128, San Diego, Research Triangle, etc.)

There are over 100 identified areas of critical mass that span a range of technology bases. These "knowledge communities" are privileged environments, typically developed around universities where the knowledge and technology are generated. There will be more of them and they are politically powerful. These regions represent the leading edge of technology and economic growth and more wealth will become concentrated in such sites in the future.

Market and Capital
(Risk capital, national/international markets, free trade environment)

Market and Capital are also an important force. This world of finance is reaching into our academic world of science, engineering and technology to make things happen with money! New businesses, like genomics, are coming out the scientific enterprise, funded by significant science-directed risk capital and supported by elaborate managerial and decision capability. There is also greater market globalization—risk capital is coming from all over the world, not simply within our nation. The political power associated with this money is massive, and this group is predominantly anti-government. Market and Capital makes the game more complex, the rules more fuzzy, and the role of the university more central!

The Government Policy Environment
(funding, taxes, procurement, incentives, regulations, intellectual property)

The role of the government as a permanent part of this enterprise is not debatable, but there is a debate as to who can and will spend more of it. This debate will lead to increased oversight of the academic research community because the expectations, with the investment, will be much higher. We can expect a range of policy issues, both national and international, related to topics such as the ownership and cost of intellectual property. For example, a letter from the leaders of Pfizer, Merck, Bristol Myers Squibb et al., argues that their taxes have

already paid for intellectual property developed in universities, why should they pay again through license fees? Other policies will be more restrictive and more demanding.

The Academic Infrastructure
(ideas, discoveries, inventions and trained personnel)

There are 75 world-class research universities, thousands of centers and tens of thousands of funded training groups. This is in contrast to the days of Vanevar Bush (1945) where there were about 5 major universities and the stage was set for an economic policy formulated around the benefits of science and technology. Today's universities are a substantial engine of the economy, but the external forces will have an impact on how we will look in the future. We will not all be the same!

- There will be a decrease in research intensive universities overall.
- We can expect the emergence of megauniversities—knowledge cities—perhaps concentrated in existing universities such as UCLA or Michigan.
- More money will go into research at our institutions.
- We can expect to see the emergence of niche universities, that is, universities that will identify their specific areas of excellence, consciously making choices.

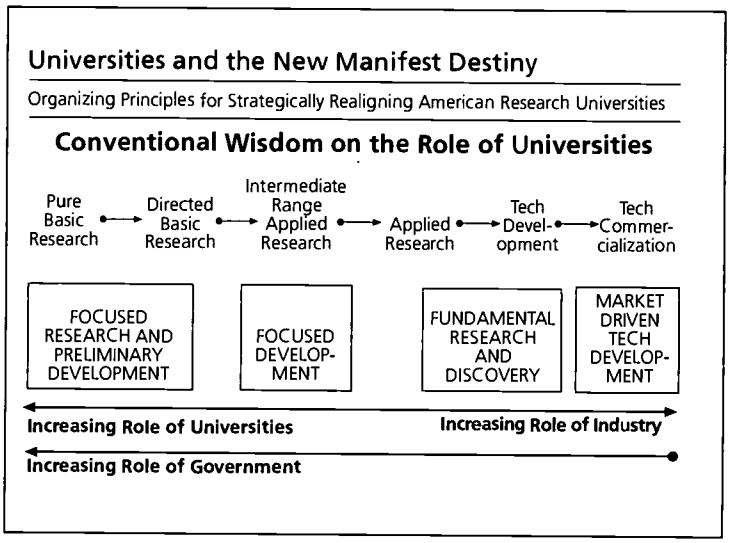
But, universities will continue to emerge as a significant political force because they are engaged in the production of science and are the producers of individuals who will continue to produce science.

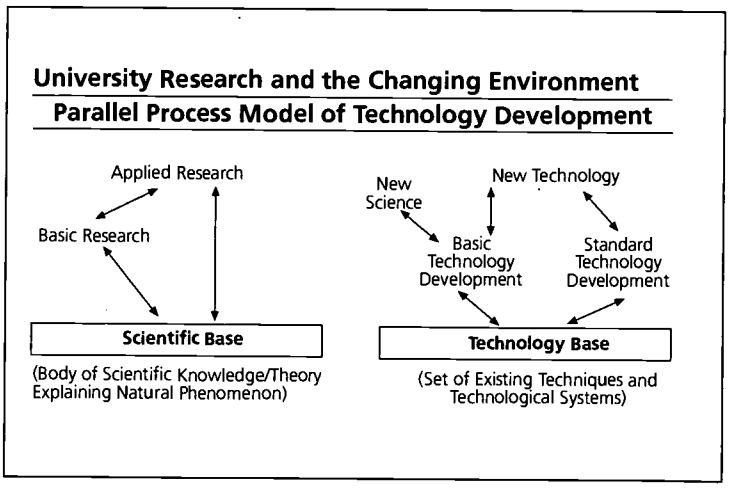
In the past, universities have believed in a linear model for the development of basic research, to applied research, to technology commercialization (see diagram, upper left).

In today's environment, a parallel process model of technology transfer reflects the situation more accurately (see lower diagram below).

The Science Policy
Freeman's "Three Phases of Science Policy"

- *Phase I: Military S & T Policy*
  - Science policy is directed towards military purposes, promoting the development of new weapons systems for global superiority and the





modification of existing technology for local regional application

- *Phase II: Commercial S & T Policy*
  - Science and technology policy is devoted to developing and maintaining the national economy, focusing on key technology industries.
  - There is a national strategy that targets specific interests for either direct or indirect technology development and protection.
  - Trade policies, financial policies, and/or government financed research institutes assist in technology development
- *Phase III: Comprehensive S&T*
  - The national objective is to use science and technology for sustainable growth, environmental quality, and general quality of life (Crow, 1994)

The Vanevar Bush policy no longer works. The allocation model of resource distribution (peer review) is subject to re-evaluation because of a new focus, and new politics that bring in a range of constraints and increased oversight on universities. While universities will be front and center in the new science policy, there will also be a political tension as we move into this position—and, we are not together in this movement. There is also a range of scientific and technological uncertainties. We're reshaping science, and science is shaping the future—so we will be responsible. We can expect "science and technology shocks." Someone WILL clone the first human!

We, in universities, need to improve our political sophistication inside and outside of the university. The world is changing. . . and then, there is our faculty! It is going to be even harder to manage inside our own environment. There are spies on campus, there is insider trading, and venture capital fund people who have no knowledge of university culture but want university products. Universities evolve and adapt slowly and have complex internal policies. Those that are flexible and act fast will survive. Those that do not will not survive as research universities in this new environment. And, universities must guard again becoming arrogant in their new position!

{ *Session I* }

Expectations from the Business Ventures of the Universities and Colleges

Session Chair: **Luis M. Proenza**, Vice President for Research and Dean, Graduate School, Purdue University

Recorder: **Leonard Peters**, Vice Provost for Research and Dean, Graduate School, Virginia Polytechnic Institute and State University

Panel 1

Barbara Melera, President and CEO, Triad

- Purpose and goal is to shorten the time it takes to commercialize a university technology
- Corporation pays cash for rights to use a technology
- It is development—not research—that venture firms are interested in
- Sponsored industrial research—grant, long term
- Technology commercialization financing
  - Product development
  - Tangible deliverables
  - Managed like a business (results oriented)
  - Relationship is short term
- Expectations
  - Short-term
  - Technology must be proprietary
  - Usually cannot publish results
  - Funding is small dollars ($25K–$100K)
  - Timing is critical, no turn-over in personnel (can be a problem with post-docs and graduate students)
  - Must be relevant, not necessarily interesting
  - Failure is not rewarded
  - Rewards are long-term
- Venture capitalists who are going to be around do not say "I have $50M and want to get into this gene thing."

Q. Why do universities want to work in these arrangements if one cannot publish results? It is a revenue stream that will support faculty, students, etc.

Arnold L. Oronsky, General Partner, Interwest

- Interwest has invested $6M in starting businesses
- Interwest has investment portfolio of $700M
- Receive 150 business plans unsolicited each year
- Case study with a major research university
  - Interwest was interested in a technology
  - January 7: non-disclosure agreement was signed
  - January 14: met with investigators
  - January 21: investigators met in Menlo Park to meet with venture capitalists
  - Submitted naïve business plan
  - Interwest rewrote business plan by mid-February
  - March 1: had draft agreement (terms and conditions)
  - March 14: legal team meeting: there were some patent issues, possible infringements

- April 1: formulated revised strategy
- About to sign: evaluation of company at $6M
- Will be new company around May 1

- Technology needs to be proprietary
- There needs to be a business plan
- There needs to be commitment from university to develop technology
- Well defined policy at university for rewards and conflict of interest
- Need to be innovation funds to advance university technology for commercialization

Gerald R. Galluppi, Senior Director of Pharmacokinetics, Monsanto Life Sciences Company

- 16-year-old agreement with Washington University
- Monsanto and Washington University are partners in total process
- Purposes
  - Create a program to shorten time for commercialization
  - Provide a framework for collaboration
- Funding is approximately $15M/year—total investment $100M through 1994
- Washington University faculty submit proposals, peer reviewed
  - Publications reviewed prior to submission
  - Monsanto has first rights for development of discoveries
- Agreement is working
  - Scientific excellence, mutual trust/cooperation, geographic closeness, institutional commitments, collaborative
- Things to consider
  - Purpose of agreement
  - Administrative structure
  - Project selection
  - Details of financing, termination, indemnification, confidentiality
- Over 100 patent filings during the 15 years
- Cannot quantify benefits, no composition of matters on market yet

Michael P. Silvon, Vice President, Business Development, BAS Analytics

- BAS started by Purdue faculty member, is 24-year-old company
- Supplier of electroanalytical equipment
- About 5 years ago, moved from just supplying equipment to doing blood analysis
  - Analysis work growing at 30–40 percent per year (from 100 to 200 employees)
- Went public in November 1997
  - Growing rapidly
  - Investing in infrastructure
- Signed master agreement with Purdue recently
  - Need assistance from Purdue
    - Chemistry
    - Pharmacy
    - Veterinary Medicine
    - Biochemistry
    - Business
    - Computer Science
    - Psychology
  - No up-front money from BAS to Purdue
  - Purdue expects economic development, opportunities for employment
  - Small grants, consultancies
- Purdue and BAS are highly compatible and "price is right" for BAS

Panel 2

Alvin L. Kwiram, University of Washington

- Challenges
  - Ownership of IP
    - Corporate sponsorship
    - Graduate student
    - Company employees at university
  - Publication delays and UBIT (if publication delays are too long, may look like extension of corporate laboratory)
  - Consulting and inappropriate transfer of IP
  - Proprietary work, confidentiality, and non-disclosure agreements
  - Control of patent prosecution and protection
  - Character of negotiations and protection
    - Mutual trust
- Feels that the message has been heard and now there may be a message to assist entire university

Sheldon M. Shuster, Director, Interdisciplinary Center for Biotechnology Research and Biotechnology Development Institute, University of Florida

View from a faculty entrepreneur

- Universities look at small companies with suspicion, distrust
- Universities unprepared to deal with small companies, only know how to deal with large companies
- Universities have inflated value of their own technologies
- Universities are inflexible
- Unsophisticated IP personnel in universities
- Universities are slow, and small companies don't have time
- Administrators mistakenly view all faculty as unsophisticated in IP's, new ventures, start-ups
- Mistake to think industry money corrupts faculty
- Can entrepreneurism reinvigorate faculty?
- These activities make faculty more relevant

Darrell W. Nelson, Executive Dean for Research, Institute of Agriculture and Natural Resources, University of Nebraska

- Agricultural scientists have had a long tradition working with industry— since Hatch Act passed in 1887
- Transfer of genetic streams, plant varieties, etc. has been ongoing
- Situation has changed in last 10-15 years
  - Pressure on universities to change attitudes toward economic development
  - More graduates going into industrial labs
  - Encourage faculty to start business
  - Increased number of adjunct appointments from industry
- AES Directors are becoming more sophisticated in dealing with IPs, legal counsel, faculty entrepreneurs
- Faculty are becoming familiar with non-disclosure agreements, publication delays, royalty-sharing agreements
- Consortium of land-grant universities to discuss technology transfer, IP agreements

Q & A

- Quality of disclosures/patents—Oronsky: more expertise may be needed in IP offices, what patent counsels to use. Shuster: suggests getting companies involved earlier in process.
- Equity in start-ups—Kwiram: takes equity in every startup; no problems in negotiating equity.
- Industry relations—Silvon: greater mutual appreciation of one another's goals; universities must move faster. Galluppi: faculty attitudes can change with experience.

- How flexible should universities be in changing times?—Shuster: work together as team.
- Competition among universities—Shuster: faculty are not being told about the realities—corporations are spending lots on R & D.
- Can we lose core values?—Nelson: We aren't there yet. Kwiran: most of the time it works well, but there are no protections against a good faith decision made years earlier; we are in an evolutionary process.
- Is there some preferential treatment of faculty-driven business?—Silvon: that has not become a problem. Proenza: could learn about it sooner, but there would not be a contractual preference.
- Who does one work with in equity?—Prefer to work through an outside entity.

{ *Session IIA* }

Model Institutional Structures for the Support and Management of Faculty Entrepreneurs

Session Chair and Recorder: **Richard K. Koehn**, Vice President for Research, University of Utah

Richard K. Koehn, Vice President for Research, University of Utah

Presentation of general structural models involving universities, new corporations, university foundation and research parks.

Review of University of Utah Research Park, UURF, origins and characteristics of space, industrial mix, etc. Major benefits to both university and corporate tenants was reviewed. Unique benefits involve two research support programs that are supported by funds from UURF.

Francis Hession, President, Long Island High Technology Incubator

Hession is President of the Long Island High Technology Incubator, Inc. (LIHTI), formed in 1987. Reviewed characteristics of LI with a population of 2.5 million, 21 colleges and universities, 4 research centers and 2,000 high technology companies.

LIHTI occupies acres on the SUNY at Stony Brook campus. Land is leased from NYS, which required a special act of the NYS Legislature. Presently is 42,000 gsf, or 33,250 net, plus a 20,000 ft2 bioprocessing facility.

One anchor tenant is critical to balance sheet.

Incubator was financed with $1.2 million in NYS grants, $2.3 M NYS loan, and $2.675 million bank loan.

Operating budget will have $50,000 deficit this year, which will have to be covered by university.

Harry R. Albers, General Manager, San Diego State University Foundation

UCSD Foundation has a Board consisting of faculty, senior administrators and community members. Originally conceived to find a solution to the university's space problem.

Albers described the "College Community Redevelopment Project" which is intended to control land for UCSD, support research, provide student housing and provide an alternative for private donations. Objectives intended to enhance the image of UCSD, cure urban blight and create a residential campus. Originally had developer lead project, but after expenditure of $2 million, he went broke. UCSD assumed all assets and is pursuing project.

Essentially no mention of research park component or relationship of it with the university's research mission.

Questions

On subjects of conflict of interest, actual corporate structure and decision making structure of park, incubator and foundation governance.

{ *Luncheon Presentation* }

Perspective on University/Industry Relations

Duke Leahey, Team Leader, Technology Alliances, Monsanto Company

Recorder: **Douglas Wartzok**, Associate Vice Chancellor for Research and Dean, Graduate School, University of Missouri-St. Louis

Duke compared his experience as the Head, Technology Transfer Office at Washington University with his current position as Team Leader, Technology Alliances, at Monsanto Company.

Although the Bayh-Dole act was passed in 1979, Washington University didn't create a licensing office until 1985, and then didn't fund the office until 1992.

Technology Management Offices (TMO) established three goals for internal benchmarks, but these goals quickly became external pressures as well. The first is regional economic development. There is increasing pressure from state governments for universities to assume a larger role in regional economic development.

The second goal is to provide faculty with personal rewards for their creative activity and intellectual property. The Bayh-Dole act provided a minimum of 15 percent of the royalties for the faculty member. Universities have increased the amount up to 50 percent in some cases. Also faculty now often obtain an equity interest in companies spawned from their technology.

The third goal is to help finance the research enterprise of the university. In addition to the traditional research based funding, the federal government provides funding through several programs directed toward moving university research into the market place, including NIST/ATP, SBIR and STTR programs.

Monsanto provides $10 million annually for university research. They are not primarily funding new inventions, but rather new knowledge in areas of Monsanto interest. They expect that this new knowledge will lead to new products in the future, and it will certainly lead to well-educated new employees.

The research enterprise of the university is very substantial. Between 1991 and 1996, there were 13,000 new licenses (64 percent to small businesses and 19 percent to new businesses), $2.4 billion in royalties, $20.6 billion in product sales, an annual investment of $4.2 billion, and 121,000 high wage and high skill jobs. In spite of this extensive university research enterprise, only 10 percent of the faculty participate.

There are several problem areas that raise concerns. The first of these is ownership of intellectual property. Although typically the university legally owns the intellectual property, the faculty need to feel that they participate in decisions regarding how the property is developed and licensed. The university makes a mistake if it markets the property to the highest bidder with no participation by the faculty member who may not feel the best fit for future development of the technology resides with the

highest bidder. At Washington University it took ten years to develop policies that protected both the faculty and the institution.

Between 1985 and 1995 Washington University had 20 startup companies. Overall, the return to the university and the faculty member from these startup companies was no more than could have been obtained through licensing. However, in some instances the technology was too far ahead of the field for there to be licensing opportunities. In other cases, the faculty member actually wanted to start a company.

There are the issues of Conflict of Interest and Conflict of Commitment. In the former case, it is much better to manage Conflict of Interest than it is to try to avoid a Conflict of Interest. On the other hand, Conflict of Commitment is very difficult to discern, and thus difficult to address.

One difference Duke has noticed between the academic and corporate sector is that within the academic sector we share ideas, policies and what we have learned much more so than do individuals in the corporate sector.

It is important for the TMO to recognize the difference between marketing, which it can do, and sales, which can be done effectively only by the faculty. The TMO can make the corporate sector aware of the general range of faculty resources, but the faculty members must make the sale by speaking directly with their counterparts in industry. There is somewhat of a parallel between a Research Office and NIH or NSF. The faculty has to convince NIH or NSF to fund the research. The Research Office has no influence on the decision. Similarly, it is the faculty who sell the credibility of their ideas to industry, not the TMO. At Washington University, 60 percent of the deals completed with industry were entirely faculty generated, 10–15 percent were the result of general marketing by the TMO, and 10–15 percent were the result of personal contacts between the TMO and individuals in industry. The majority of the latter instances were ones which built upon prior cases of faculty generated sales to those individuals.

No one really reads the technology transfer catalogs the TMOs produce, either in hard copy or on the Web.

It is the responsibility of the TMO to close the business deal. Duke's motto is "take the money and run." I.e., it is better to make as many deals as you can rather than spending an inordinate amount of time trying to maximize one particular agreement.

In the cases when a startup company is the best way to go, there need to be clearly defined policies in place for ownership, Conflict of Interest, and Conflict of Commitment. If these policies need to be worked out at the same time you are trying to establish a startup company, too much time is lost getting the intellectual property into the marketplace.

One problem that will likely receive more attention in the future is "pipelining." Pipelining is when the federal government provides funding to the university for the research done by a faculty member, and the university then turns around and grants an exclusive license to the faculty member who did the research. Federal auditors will be looking for pipelining more closely in the future and will expect universities to prevent it.

A primary function of the TMO is to provide an alternate route for funding of faculty research. If the TMO operates entirely on soft money, then there is a primary motivation to obtain licenses which provide up front money but this may not be the best arrangement for long-term support of the faculty member's research.

Speaking from the corporate side, but remembering the academic side, Duke warned against capitulation to industry attempts to thwart academic freedom. He considers any publication ban that extends a year or more to be one which should be resisted. Also, don't trade a higher royalty, or more

up-front funding, for an arrangement which will lead to potential future liability for the university.

University technology transfer agents are at a disadvantage in bargaining with their industrial counterparts. There is a relatively short history of university technology transfer and no effective training other than on the job for technology transfer agents. The good agents are often bought away by industry, and in any case a university technology transfer agent cannot come to the table with the extent background research and documentation available to the industry negotiator.

Industry technology agents need to inform industry project managers that research proposals coming from university scientists should include salary for the faculty member (thereby buying a commitment from the faculty member), money for graduate students (thereby helping to train future employees of the company), travel (thereby indicating the expectation that the research will be informed by attendance at conferences), page charges (thereby confirming the expectation of publication of the results), and facilities and administration charges (thereby recognizing the real university costs of doing research).

Similarly university technology transfer agents need to inform their superiors that royalty income is unlikely to be a major revenue stream for the university. The vast majority of universities with royalty income receive less than $500,000 annually.

Universities need to maintain reasonable expectations of the likely financial return. They are too ready to litigate perceived violations of their intellectual property rights without realizing the extent to which faculty routinely violate industrial patent rights. If the academic sector is quick to litigate, then companies are likely to respond in kind, and litigate against university infringement. I.e., if universities act like competitors, companies will treat them like competitors. Duke is trying to get Monsanto to provide academic research licenses for patented technologies which universities routinely use without consideration of infringement. The formal process of providing the academic research license will make faculty aware that they are indeed infringing on patented technologies.

How do we prevent an erosion of the public trust in the universities? Right now the involvement of faculty in the university research enterprise is limited (50 percent of the engineering faculty are involved and 10 percent of the medical school faculty, but only 1 percent of the arts and sciences faculty). As more of the faculty from arts and sciences, which is considered the academic core of the university, become involved in the research enterprise, universities must have in place policies requiring full disclosure of financial interests and potential conflicts of interest. Anything less will lead to an erosion of public trust.

{ *Session IIB* }

Model Structures/Faculty Support Programs

Session Chair and Organizer: **Joan F. Lorden**, Associate Provost for Research and Dean, School of Graduate Studies, University of Alabama at Birmingham

Recorder: **Linda L. Brinkley**, University of Memphis

Four presenters provided information on experiences and models at their institutions that address such clinical and non-clinical faculty concerns as entrepreneurial activity and conflict-of-interest. Joan Lorden, substituted for Larry Moreland, who was unable to attend.

Summaries of the sessions are presented below.

Model Structures to Meet the Needs of Clinical Investigators, **Joan F. Lorden**

A patient-oriented research task force was constituted to identify the needs and concerns of clinical investigators involved in clinical trials, as a prelude to designing a better system to facilitate them. A survey of faculty needs and opinions revealed that the crucial issue in conducting these studies was time. Clinicians conducting these trials are under industry pressure to obtain all of the requisite approvals and enroll patients as soon as possible. A second concern was the lack of opportunity for physicians to receive training in conducting clinical research. The third concern was the need for improved electronic access to patient databases. UAB responded to this report by creating an Office of Clinical Research (OCR) run by physicians with a permanent, clinical director. This office, housed in a newly acquired local hospital, conducts clinical research training for physicians, provides start-up support for new faculty to get into clinical trials, and provides access to experienced nurse-coordinators who are vital to the success of such studies. In conjunction with these activities, clinical departments provide summer short courses for beginning clinical trials researchers on such topics as compliance issues and statistics. In support of the OCR, the research administration offices at UAB have also sought ways to increase efficiency and reduce turnaround time. UAB has developed more master agreements with major industry sponsors and umbrella agreements with private practitioners to facilitate their participation in university-conducted clinical trials. The UAB IRB has also added an additional monthly meeting for review of industry-sponsored protocols.

Model Structure for Support of Faculty Entrepreneurial Activity, **David L. Day**, Interim Director, Research Foundation, University of Alabama at Birmingham

The University of Alabama Research Foundation (UABRF) created to maximize the economic development impact of university technologies, provided the model for this presentation. Six critical

factors required for this to take place have been identified: 1) strong diverse research programs; 2) a vehicle for technology transfer; 3) business start-up facilities; 4) a research park; 5) access to venture capital; 6) knowledgeable management of start-ups. The university itself provides the first ingredient through its faculty. Faculty at UAB are specifically recruited for their entrepreneurial qualities and emphasis on interdisciplinary interactions. To keep such entrepreneurial faculty at UAB, the Foundation provides the vehicle for technology transfer and the means through which they can create their own companies while staying in tenure track appointments. The UABRF structure allows flexibility and rapid response, as it is a separate non-profit, self-supporting corporation without the restrictions of a public university. It is supported through a share of technology transfer-related revenues. UABRF handles all aspects of technology transfer and industry relationships and serves as the umbrella organization for the university's economic development activities. It holds equity in UAB spinoff companies as well as others. Business start-up facilities are managed through the Office for the Advancement of Developing Industries. Experience with an initial incubator revealed that most 'graduates' of the incubator did not stay in the local area. In response to this finding, the Research Park was created to encourage start-up companies to stay in the local area after they outgrow their start-up quarters. UABRF, recognizing the need for access to venture capital, initiated a fund and raised additional capital from local utilities and companies. The need for skilled, professional management has been addressed in several ways. Emerging Technology Partners (ETP), a for-profit company owned by UABRF and other universities in the state, was formed. The state's largest corporations provided the initial endowment. ETP is a venture management company that designs high tech enterprises with an early stage combination of managerial and scientific talent. They form equal partnerships with the scientists and license the technologies from the universities for a 20 percent equity share.

The New ARCH, **Thomas L. Churchwell**, President, ARCH Development Corp., University of Chicago

ARCH, the development arm of the University of Chicago and Argonne National laboratories, provides an alternative model to that seen at UABRF. It is a not-for-profit affiliate of the University of Chicago with a mission to commercialize intellectual properties from the university and Argonne National laboratories. ARCH has specific goals to return revenues from technology transfer and start-ups to the University and to facilitate sponsored research. It is only chartered to create the best return to the university on commercialized technologies. Since the university is private, economic development is not an issue. All of the arrangements made by ARCH are licenses whether they are to external companies or to a start-up. They are also similar, regardless of with whom they are made. In fact, faculty entrepreneurship is actively discouraged as experience has shown that faculty are not skilled businessmen. Several lessons have been learned about start-up companies. First, that success or failure is not about money, rather management is the key issue. In their experience, the more money into the deal at early stages, the less likely it is to succeed. It is important to lightly capitalize in order to provide management an incentive to be flexible and creative. CEOs for start-ups are actively recruited with small equity positions in the company. One rule of thumb ARCH adheres to: Never put money into a start-up unless you can find a CEO who is interested. Faculty inventors are rewarded with non-voting equity in the start-up. As a private university, the University of Chicago has considerable flexibility in crafting arrangements at all stages of technology transfer.

Managing Conflict of Interest: Partnership or Lost Opportunity, **Peter Dunn**, Assistant Vice President for Research, Purdue University

Purdue University has over 30 years' experience operating a research park. A review of the facility in the early 1990s revealed that few university-technology related companies had developed through that facility. Subsequent investigation by a newly formed advisory committee revealed that the university made it difficulty for faculty-owned start-ups. A "Committee on Faculty Owned Businesses," including some members who owned those businesses, was formed. Their chief criticism related to the problems associated with moving through the university offices and administration. Subsequently they developed a manual for faculty trying to start a business at Purdue. A copy of this manual was sent to all university faculty with a cover letter from the president of the university. Thus sending a strong message that the climate for faculty start-ups had changed. Purdue developed explicit policies and procedures that enable faculty to identify and manage possible conflicts of interest along with an explicit statement on faculty-owned businesses. A memorandum of understanding (MOU) is developed addressing several possible areas of conflict. Those issues include: conflict of interest, objectivity of research, employment of trainees by the faculty-owned business, diversion of grants and contracts from the university to the business (competition), use of university facilities and services and faculty consulting or inadvertent or specific transfer of expertise. The MOU is then reviewed and signed by the Chair and Dean, the slowest part of the process, then by the Executive Vice President for Academic Affairs. Acknowledgement of the value of intellectual properties and technology transfer to the university has begun to be evidenced by some positive statements relative to faculty entrepreneurism during the promotion and tenure process.

Successful models that capitalize on new business opportunities in universities all involve finding ways or creating entities that increase institutional flexibility and reduce bureaucracy for entrepreneurial faculty. Providing access to requisite expertise, be it for clinical trials or business management of a spin-off business is also critical. Partnering with other institutions and corporations to create a critical mass, whether of expertise or of venture capital is also common to such models.

{ *Session IIC* }

Model Structures, Corporate University Partnerships

Session Chair: **Carolyn S. Sansone**, University of Massachusetts, Amherst

Recorder: **Diane M. Jacobs**, University of Central Florida

Corporate R&D Embedded in the Campus—The Centennial Campus at NC State, **Charles G. Moreland**, North Carolina State University

Centennial Campus is integrated into NC State Campus. Factors necessary for success are integration into campus and presence of a master plan for building academic/corporate/government community

- Programmatic Features
  - connected to university
  - development of partnerships of specialists
  - thematic clusters, but no fixed boundaries
  - themes are main university research initiatives, but not all are complete
  - educational cluster will have a magnet middle school and a high tech high school
- Partnerships
  - some university research centers have industrial members
  - 18 different departments involved and one entire college
  - goal is to have all campus (old and new) integrated with industry members
- Buildings
  - research buildings with university research centers
  - Partner's building—rented to university researchers, governmental agencies and small businesses
  - one privately owned building with business in advanced communications
- Financing the enterprise
  - some buildings paid by state
  - some buildings financed using overhead as collateral—all in these building pay rent
  - some land bought with endowment and sold to private co.
  - much future development will be private but programmatically connected

UCSD and Connect, **Mary L. Walshok**, Associate Vice Chancellor, University of California, San Diego

- Identified need to develop entrepreneurial capabilities in school
- Developed program to focus on need to understand culture high tech businesses to provide services: technical know-how, access to capital, legal and regulatory know-how, marketing know-how, management.
- Tech transfer office operates in parallel to optimize return to campus
- Social infrastructure—expertise—needed to support growth of enterprises. CONNECT uses network of 600 business and technical specialists. Hosts many events and promotes these meetings.
- Have high tech national Financial forums and international capital forums.

Helps build a community of trust and self-confidence

Tapping the Corporate Culture: Science and Technology Advancement, **Carolyn S. Sansone**, University of Massachusetts, Amherst

- Office serves research and advancement
- Goal is to make it easy for companies to do business with university by providing a gateway to the research of the university
- Markets faculty expertise in niche areas to companies
- Customer focused resource working for UMass
- Puts teams together to help meet company needs—acts as facilitator
- Treats companies as if they are major donors
- Works with other offices in university in related areas, such as sponsored research, tech transfer.

What matters is need to think creatively, and create a seamless process.

Corporate Perspectives on University Industry Partnerships, **Robert A. Berdine**, University Relations Manager, Caterpillar, Inc.

Caterpillar has a strategic model for Strategic Partners with whom they have a high level of interaction and plan a long-term relationship based on a master agreement.

- Three main universities—Purdue, U of Ill, Carnegie Mellon—meet regularly
- Master agreements establish a framework and cut down on costs
- Assign a campus manager to each campus to act a matchmaker and facilitator
- Research projects are based on commercial needs and academic strengths; directed by university faculty and company program managers, student learning opportunities

A good partnership is a balance between needs of the company and those of the university. Intellectual property and publishing process are jointly managed. The partnerships are built on mutual value received.

Randolph J. Guschl, Director, Corporate Technology Transfer, DuPont Company

- Looking for proven technology, and want to do business
- Key is partnerships
- DuPont has 18,000 patents they want to license
- Looking for overlapping strengths in core competencies
- Must be mutually rewarding

David P. Rice, Manager, External Research Programs, Proctor and Gamble

- Common ground:
  - desire to develop talent
  - desire to develop knowledge
  - desire to help communities
  - desire to be globally competitive
- Issues
  - Use of knowledge from sponsored research for comparative advantage
  - Global environment

Underlying feature is trust.

{ *Dinner Presentation* }

Partnerships and the National Innovation System

John Yochelson, President of the Council on Competitiveness

Recorder: **George E. Walker**, Vice President and Dean, Indiana University

John Yochelson reviewed the National Innovation Summit. He pointed out that it was important for the Summit to take place despite gains in such areas as:

- the cost and quality of manufacturing;
- the commercialization of research and development activities;
- the Federal budget deficit;

because we currently face new and important challenges. For example, United States competitiveness depends on innovation to create high value products and services (developing unique products, features, and processes) to stay ahead of global technology diffusion.

The goals of the Summit include:

- emphasizing the vital U.S. stake in innovation; assessing U.S. strengths and weaknesses (vulnerable areas);
- setting priorities for maintaining long-term U.S. leadership and generating momentum for follow-up.

Discussion at the Summit included international comparisons of areas such as:

- talent pool
- research base
- capital vitality
- market vitality
- international market access

Areas of relative U.S. strengths appeared to be the following:

- entrepreneurial rather than top-down system
- ready availability of capital
- unique relationship between universities and industry
- pay-off from long-term defense R&D investment
- Pragmatic leadership at the state level

Some concerns regarding the future included:

- the American talent pool
- level of federal investment in research
- intensified international competition

There is concern regarding the decreasing ranking of the U.S. in terms of world-wide patents/million people. The talent pool concerns need to be addressed in both the long-term and short-term. For the long-term, there must be attention to the quality and supply of American science and engineering graduates (starting with the K–12 pipeline). For the short-term, immigration policies should be maintained.

{ *Session IID* }

Model Structures: Corporate University Partnerships

Session Chairs and Organizers:
Robert E. Barnhill, Vice Chancellor for Research and Public Service, University of Kansas
Michael A. Cusanovich, University of Arizona

Recorder: **Robert E. Barnhill**, University of Kansas

Breaking Down Barriers to University/Industry Research Collaboration and Technology Transfer: The Arizona Experience, **Steven G. Zylstra**, Director, Business Development, Simula Technology Corporation, Phoenix

During the summer 1997 NASULGC CRPGE retreat, Bob Barnhill and Mike Cusanovich presented the Arizona Experience in Intellectual Property Rights from the point of view of the research universities. The Arizona effort was chaired by Steve Zylstra who was invited to this CRPGE meeting to present the industrial side of the same effort.

A convenient starting point for recent Arizona university/industry collaborations is the Governor's Strategic Partnership for Economic Development (GSPED), begun in the late 1980s. A key concept was Michael Porter's "economic clusters" of geographically contiguous industries with common themes. There are 10 Arizona economic clusters, the high tech ones being the following: computer software, optics, bioindustry, environmental technology, and high-technology industry. The high-technology industry cluster includes aerospace, electronics, semiconductors, computer hardware, and telecommunications and companies such as Motorola, Intel, Lockheed Martin, AlliedSignal, Boeing, Raytheon, Honeywell and others. High tech cluster companies provide 56 percent of all manufacturing jobs in Arizona, 83 percent of the state's total exports ($8.2 billion), with the average salary for AZ high-tech workers being $46,700 compared to the overall state average of $26,100. The direct output of high-tech industry in AZ (1996) was $14.7 billion, a direct employment of 110,000, indirect employment of 422,000 in a state of total population 3.5 million. Focus areas of the high-tech cluster includes school-to-work programs at pre-university levels and joint ventures/partnerships with the three major universities, the University of Arizona, Arizona State University and Northern Arizona University. The impetus for change included industry's perceptions of outmoded technology transfer policies of the AZ Board of Regents, which oversees all three universities. The "Technology Transfer Summit," led by Zylstra, first met in October 1995. An executive group consisting of three industry representatives including Zylstra and the Research VPs Barnhill and Cusanovich had many subsequent meetings to craft a modern AZ Board of Regents "patent policy." Two key ingredients were "fully burdened indirect costs" in return for IP rights and a "windfall provision" to expedite contract negotiations. As a result of the group's work, the entire ABOR patent policy is being

revised, with appropriate industrial and university personnel input. Perhaps the most important outcome of the deliberations has been the journey, that is, that industry/university personnel have developed collaborative processes for mutual profit.

Other Public-Private Partnerships in which Universities are Involved? **Robert C. Gesteland**, Vice President for Research and Advanced Studies, University of Cincinnati

The focus was on facilitating SBIR and STTR possibilities. The KTEC (Kansas) model was discussed. [KTEC is a State government supported organization which helps match university-and other-groups with private capital possibilities. Examples of university centers supported by KTEC are the Higuchi Biomedical Sciences Center and the Institute for Telecommunications Technology Center at the University of Kansas. There are additional centers at Kansas State University and Wichita State University. The university centers must have significant state technology transfer activities.] The University of Cincinnati solution is named BioConcepts, Inc., which is a for profit corporation with a business savvy leadership which has brought in a management team. The goal of BioConcepts is to produce spinoff companies. One component leading to BioConcepts was the underutilization of academic SBIRs [this is an opportunity, nationally]. Conflict of interest pitfalls were cited as a particular problem to be overcome.

Master Agreements to Facilitate University-Industry Partnerships, **Larry E. Pherson**, Director, Sponsored Program Administration, Purdue University

The focus was on "a contractual foundation for facilitating university/industry partnerships." A particular example of Motorola and Purdue University was discussed. Some innovative recommendations included: budget options, fast track procedures, and master agreements. In more detail: a budget option is to burden each component of a contract separately, rather than over the whole contract, which is more acceptable to sponsors. Fast track procedures refers to offering acceptable terms ab initio, rather than via protracted negotiations [The motivation here is similar to the Arizona windfall provision clause.] The summarizing principle is to keep the contracts simple. Master agreements achieve this by negotiating terms and conditions in advance. Of course, this procedure works best with longstanding partners, hence the introductory example. [These are sometimes called "strategic partners".]

Columbia University and Innovation: A Case Study, **Michael M. Crow**, Vice Provost for Research, Columbia University

The research scale at Columbia University is a $300 million enterprise with 1600 research groups, 60 percent medical/biomedical and 20 percent earth science. The tenor is the change of name from Technology Transfer Office to the Office of Innovation Enterprise, that is, Columbia University as an entrepreneur. Columbia's patent portfolio includes 51 classes of patents of which half are in 4 (or 3) areas. [The point is to focus on a small number of areas of true expertise.] The Columbia Innovations Enterprise includes 15 employees with specialists in the relevant disciplines. Research and licensing

revenues were $50 million in 1995–96, $62 million in 1996–97 and are expected to be over $80 million in 1997–98, of which 28 percent is research per se. [A point: Count research contracts as well as royalties etc. in technology innovation totals.] The top five private universities in terms of net royalties received are the following: 1. Columbia 2. Stanford 3. Harvard 4. Tulane 5. MIT. Columbia started 16 new companies during the past two years. Columbia accepts fewer than half its patent possibilities. A recent consortial example is the creation of a worldwide digital communication consortium involving Columbia, Mitsubishi, Phillips (Netherlands), Sony, and American companies, a consortium which took three years to set up. Some other examples: Genome Center, Pharmacopia, 4D Technology. A note: Columbia's 1600 faculty includes fewer than 100 doing this type of innovative activities. Columbia uses some of its revenues from these activities to be an "Intrapreneur" by means of its Strategic Research Fund, currently at $14 million. This Fund is "not more tech transfer" and, among things, "buys the good will of the faculty."

Crow's keynote talk for the meeting, "University Research and the Changing Environment," emphasized several general themes that are illustrated by the Columbia examples. In particular, modern technology moves forward based in large part on university discoveries, a complete turnaround from the situation a century ago when universities were not the sources of most nationally significant inventions. Another important concept is the "parallel process model of technology development." Those familiar with Donald Stokes" Pasteur's Quadrant can think of the scientific base and the technology base as forming two parallel sets of quadrants, named, respectively, after Bohr, Pasteur, Edison and anonymous ("birdwatchers' quadrant-Crow). It is well known that the old linear model of technology transfer is outmoded and the logic of Pasteur's Quadrant applies to explain some of the inadequacies of the linear model, for example, modern technology innovation is multidimensional, not unidimensional (linear).

These and related topics were presented at the AAAS R&D conference: The Future of Science and Technology in Arizona, March 27, 1998, for which Crow's slides are available at url http://www.columbia.edu/cu/research/ovp/03-27-98/sld001.htm

{ *Session III* }

Do the Models (those presented as well as those developed at other institutions) Meet the Expectations?

Session Moderator: **Arnold A. Heggested**, Associate Vice President for Research and Technology, University of Florida
Special Participant: **Thomas A. Moss**, Director, Government-University-Industry Roundtable (GUIRR)

Recorder: **Barbara C. Wingo**, Deputy General Counsel, University of Florida

Arnold Heggestad, University of Florida, introduced the session with the observation that many options as to the "research business" of universities had been presented throughout the workshop. He referred to the keynote address by Michael Crow, Columbia University, which indicated a realignment for universities in the economy. The universities must produce research and be accountable in different ways. It is a time of substantial opportunity and challenge. For example, Heggestad stated that the workshop presentations would indicate that intellectual property appears to be the current measure of research productivity. He cautioned that universities might learn from the savings and loan business issues of recent years. The savings and loan business explored many options in the 1982–1990 period, yet those who "stuck to their knitting" were the institutions that ultimately survived.

Heggestad noted the differences between the ARCH model of creating business spin-offs from university technology and the model presented by Sheldon Schuster of the University of Florida. The ARCH model was selective in its decisions to support companies (discouraging faculty start-ups) while the Schuster model was one of freely allowing faculty members to start businesses. Heggestad noted that various universities had differing amounts of money at risk in their ventures. At the same time he stated that all the universities discussed had developed ways to get the market involved in these decisions.

Thomas Moss, Government-University-Industry Research Roundtable, National Academies of Sciences and of Engineering and The Institute of Medicine, then addressed the question of whether technology transfer models meet expectations. He posited as pivotal in answering that question the question of: Whose expectations? He pointed out that the framers of the Bayh-Dole Act, as well as the designers of policies formulated as a result of that act, were concerned with bringing the products of the federal investment in research to public use-not necessarily with making money or with regional economic development. Are there now expectations of "university income, faculty wind-fall, or regional development"? As the models were presented, was the goal of technology transfer for the public good addressed?

As a practical question, how are the technology transfer "models 'sold'"? How are they presented to faculty, trustees, regional leaders, industry participants, students, and so forth? How are the purposes of these models conveyed? Moss continued: "What are the expectations of these major stakeholders?" He indicated that we cannot necessarily "sell" these purposes to the entire faculty and that different stakeholders have different expectations that need to be anticipated. He noted the differing expectations of large companies, university technology managers, universities that put their money at risk, regional leaders and parents. He further pointed out the various risks, such as litigation, involved. Finally, he stated that we need to consider the initial purposes of the various programs.

Comments from the audience were wide-ranging. For example, it was pointed out that technology transfer has a number of objectives, yet there was much talk about royalties. Another issue mentioned was that of the economic sustainability of technology transfer offices at universities. In addition, it was noted that there may be too much emphasis placed upon the monies received from licensing-since realistically these are going to be small in the university's overall budget base.

That there are competing expectations was reiterated in the participant comments. Also noted from the business side was the importance of the students educated. A reminder of the federal government's investment in the intellectual property was made. The Arizona model presented in a previous session was discussed in relation to this consideration as well as to the issue of rights to data. It was also noted that companies and institutions differ; for example, some have a greater tolerance for secrecy in research.

Moss noted that he worried about conflict of interest as the Achilles heel in these models and also noted that tuition rates need to be watched. Others continued with the theme of the public/taxpayer as a stakeholder. A number of goals and products come from these models. What is important to your institution, and how are these goals conveyed to the various stakeholders?

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