Research, Innovation, and Collaboration Strategies

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A Warning

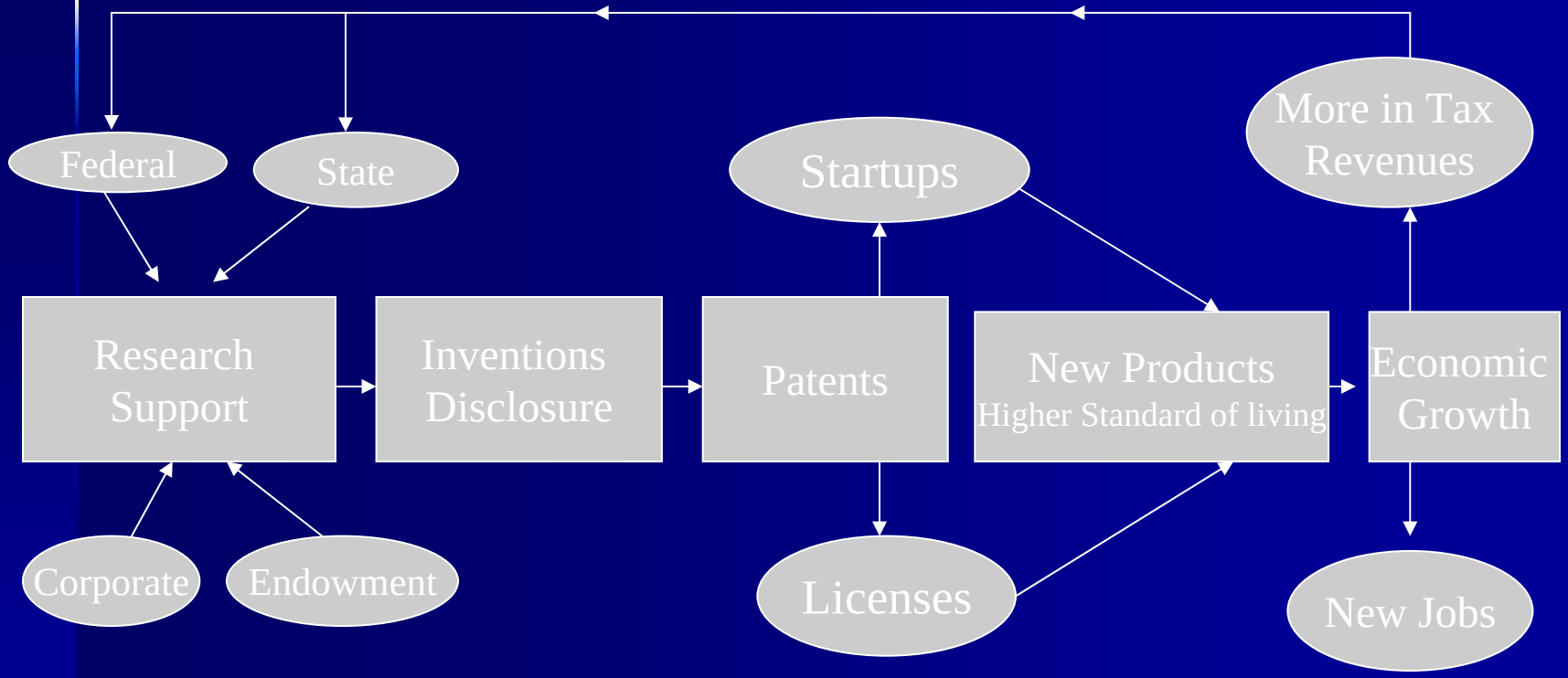
- "Most PowerPoint presentations are simply incomprehensible, mind-numbing, bloated discourses that are full of buzzwords and otherwise devoid of meaningful content. This is a serious problem and it is spreading like the disease it is."
  - *Arthur D. Levinson, CEO, Genentech*

National Academy of Sciences Recommendation on Incentives for Innovation

- Ensure that the United States is the premier place in the world to innovate;
  - About half of US economic growth since WWII has been the result of technological innovation.
- invest in downstream activities such as manufacturing and marketing; and
- create high-paying jobs based on innovation by such actions as
  - modernizing the patent system,
  - realigning tax policies to encourage innovation, and
  - ensuring affordable broadband access.

Rising Above the Gathering Storm (2006)

Stages of Technology Transfer: From Research Support to Economic Growth



Measuring the Impact of Technology Transfer in the Production Function

$$Q = f(K, L, R)$$

$$Q = \alpha K \beta L \gamma R \lambda$$

$Q = \text{Quantity of output}$

$\alpha = \text{intercept}$

$K = \text{capital input}$

$\beta = \text{rate of productivity of capital}$

$L = \text{labor input}$

$\gamma = \text{rate of productivity of labor}$

$R = R \& D$

$\lambda = \text{rate of technoogy transfer}$

What Does this Production Function Tell Us About Technology Transfer?

Investment in R&D is a necessary but not a sufficient condition for economic growth.

Increase in R&D expenditures must be accompanied by effective means to increase the elasticity of the R&D output.

Productivity gains only result from the natural diffusion of innovation to the marketplace (technology transfer).

Determinants of Successful Technology Transfer

Professional management of property rights and startup companies

Competitive venture capital market

Efficient capital market for initial public offering

Who Should Own the IP?

In the United States, the first patent was issued in 1790.

Less than 100,000 patents were issued in the first 200 years.

By 1980, the federal government had licensed only 4% of the 28,000 patents it owned. Up to this point, technology transfer was slow.

Passage of the Bayh-Dole Act in 1980 allowed universities and other non-profit entities, which had received government research grants and contracts, to retain the title to their inventions.

Implications of the Bayh-Dole Act

The pace of new patents issued has accelerated since 1980.

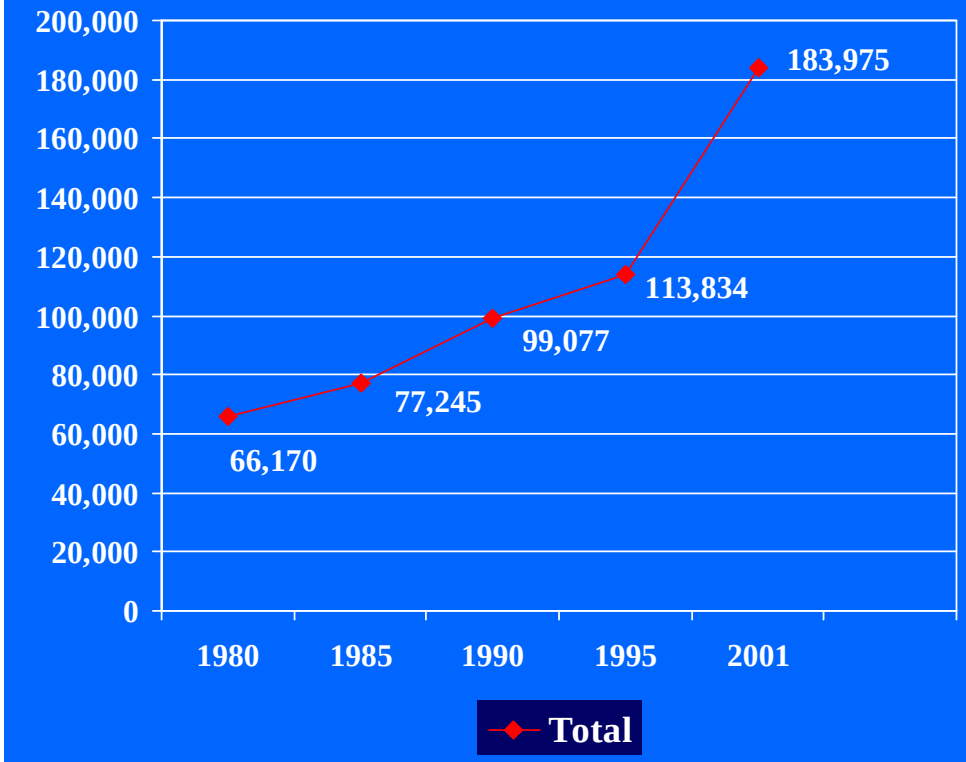
Between 1980 and 2001, the number of patents issued each year almost tripled (Figure 1).

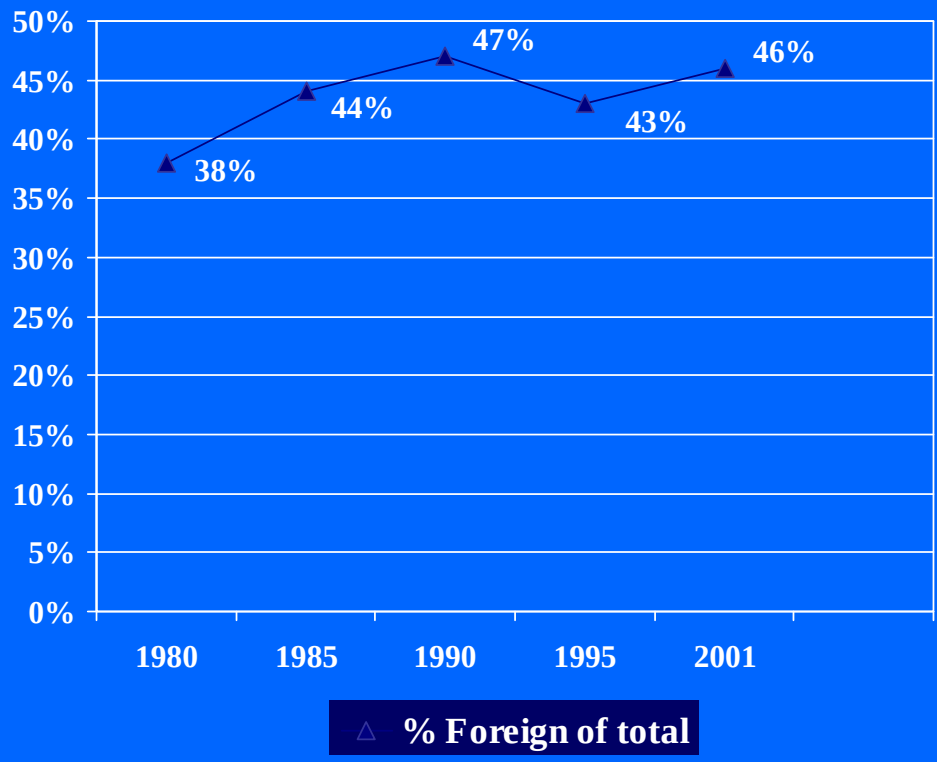
In 2001, the U.S. Patent Office issued 184,000 patents.

In 2001, 46% of all patents in the U.S. were issued to foreign individuals and entities.

Figure 1

U.S. Patent Statistics 1980 – 2001





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Universities and Technology Transfer

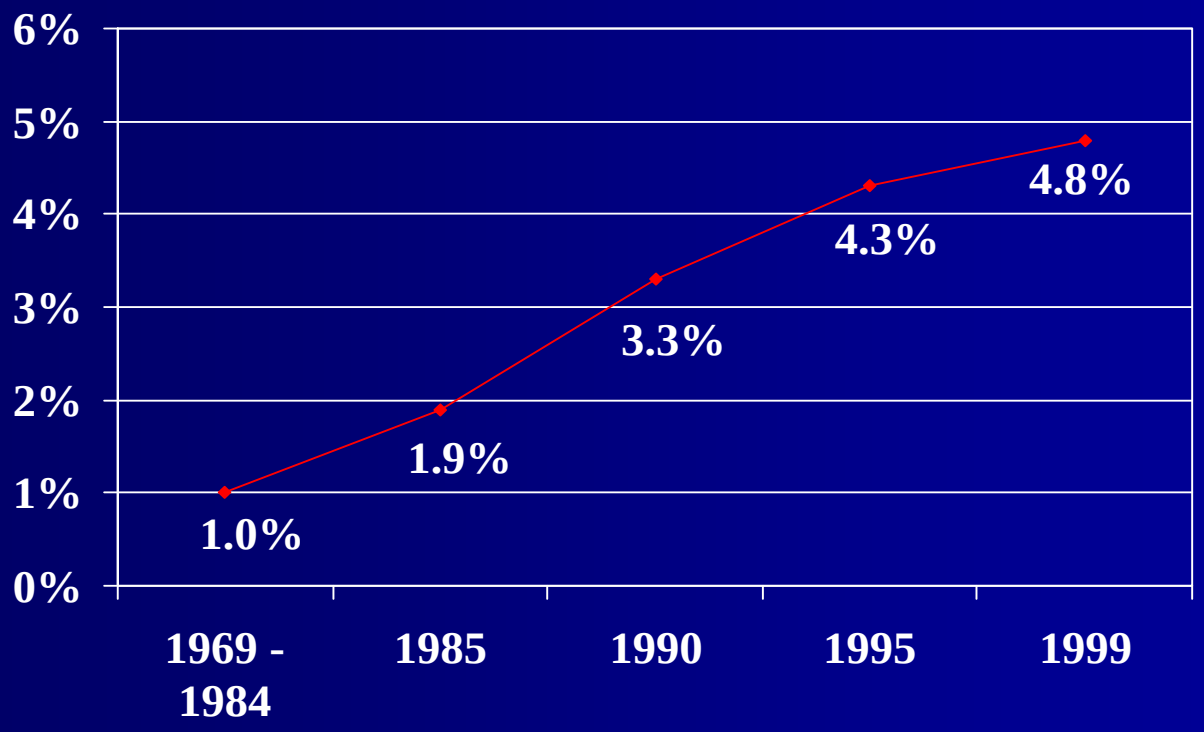
The share of university-owned patents increased from less than 1% in 1980 to about 5% in 2006 (Fig. 2).

According to a survey of 200 U.S. and Canadian universities, royalties from licensed products from technology developed by these universities exceeds $1 billion.

Since 1980, almost 4,000 new businesses have been created, with 2,200 still in operation.

Universities now hold equity positions in 70% of their startups.

Figure 2
Utility Patents Assigned to U.S. Universities
University Patents as % of
U.S. Corporate-Owned Utility



Importance of Professional Management in Technology Transfer

While scientists with important discoveries are the intellectual backbone of the startups, generally they are not equipped with sufficient expertise to run a startup.

Solution: Universities must train managers with expertise in running startup companies (i.e., MBAs with emphasis in tech transfer and commercialization).

A Competitive Venture Capital Market

Attributes of a successful venture capital firm:

- Expertise in technologies used by startups
- Willingness to take the higher risk imbedded in startups in exchange for a residual claim
- Ability to mitigate incentive problems between entrepreneurs and suppliers of capital
- Geographic diversification to reduce the risk of regional economic fluctuations
- The inherent discipline in a venture capital firm with finite life cycle (i.e., 10 years), which dictates a clear investment exit plan within a relatively short period of time

Venture Capital, IPO & Efficient Capital Market

Some sectors are more volatile then others. For example, from 2000 through 2002, information technology sector funding dropped by 80%. During the same period, the healthcare sector saw only 45% drop in investment (Figure 3).

Successful exit for a venture capital firm and access to more capital for a startup often depend on favorable conditions in the stock market and feasibility of an IPO (Figure 4).

Figure 3

Equity Financings for US Venture-Backed Companies, by Industry Group

Amount Invested

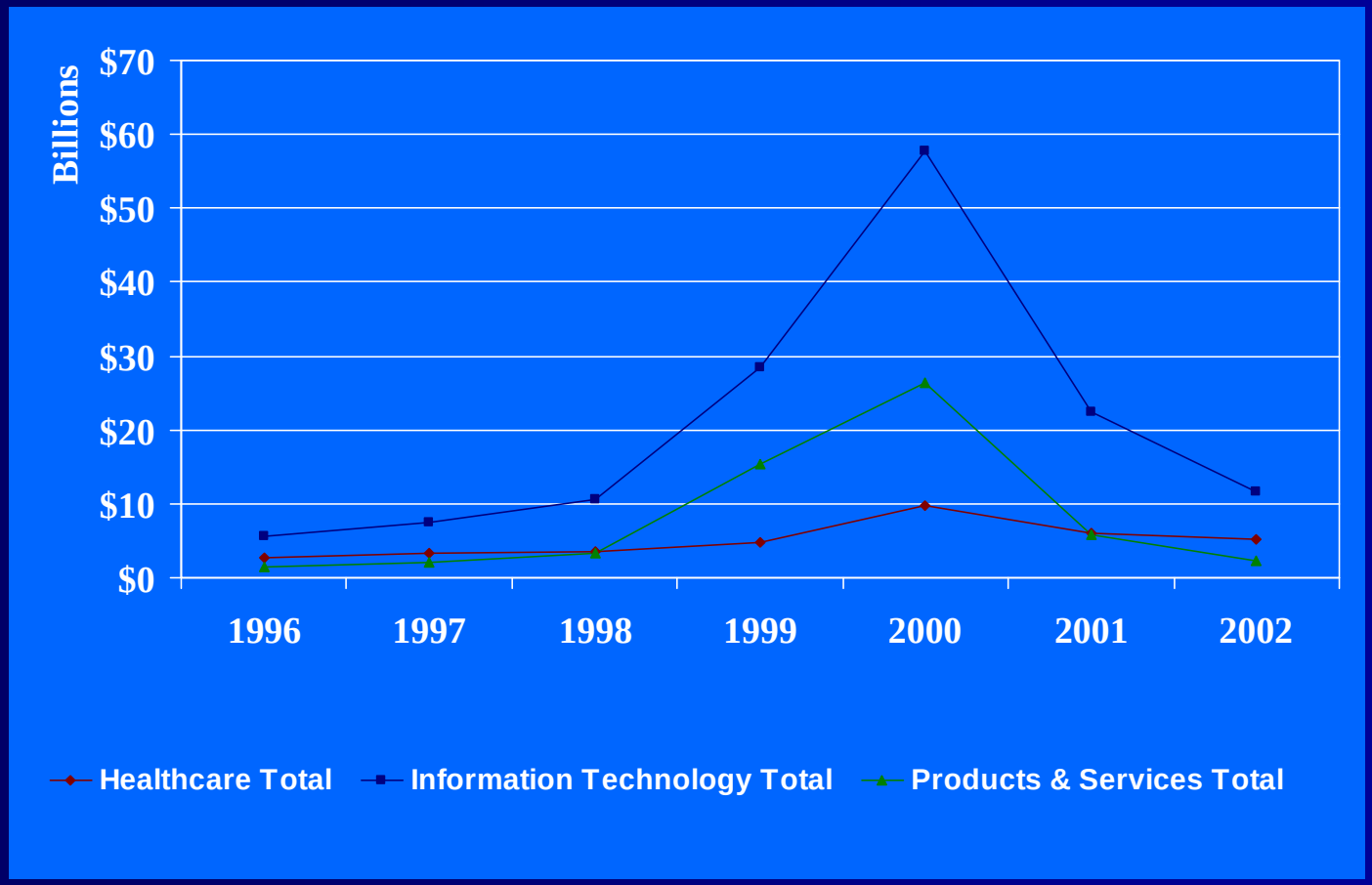


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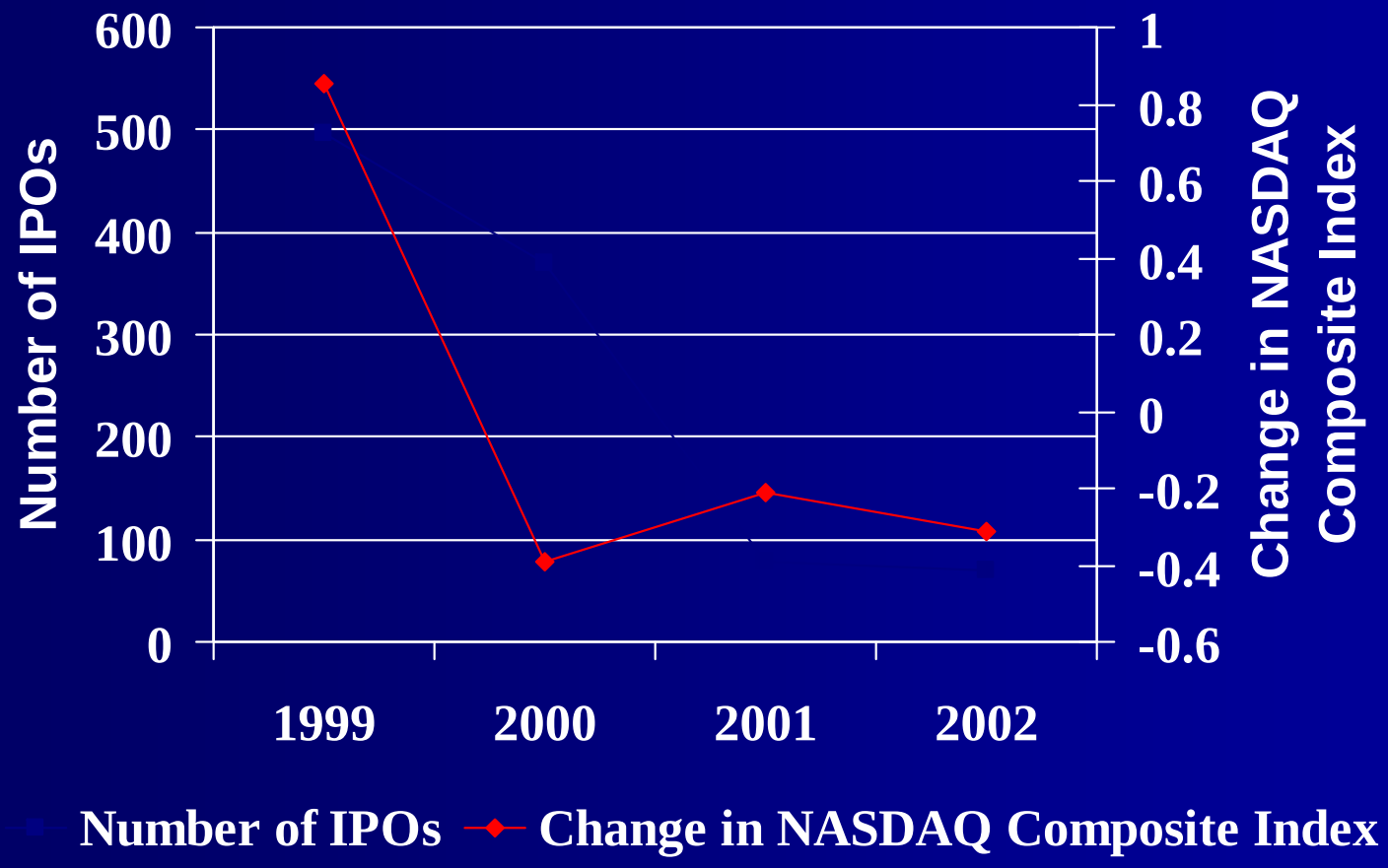
Figure 4
IPO & NASDAQ Composite Statistics 1999 – 2002



University of Missouri – St. Louis Research Profile

- Carnegie Doctoral/High Research Activity
- 1200 faculty and research staff
- Student Headcount: 16,000; 2,600 Graduate Students

Academic Units Involved in Plant and Life Sciences Research

- Biology
- Chemistry and Biochemistry
- Physics and Astronomy
- Nursing
- Optometry

Partnerships in St. Louis in Research and Tech Transfer

Donald Danforth Plant Science Center

Washington University in St. Louis

Center for Emerging Technologies

St. Louis Technopolis

(CORTEX)

St. Louis University

Missouri Botanical Garden

University of Missouri St. Louis

St. Louis Zoo

Future Plans to Expand Life Sciences Capacity

- Research Park Adjacent to the Campus
- IT Incubator

Collaborative Spotlight: Center for NanoScience (CNS)

- Our vision is to advance nanoscale science and technology to serve regional needs through basic and applied scientific research.
- Our mission is to enhance research capacity of our faculty and students through research and technology transfer, cooperative and educational outreach programs and workforce development.
- The distinguishing characteristic of our center is in its focus on strong cooperation between university and industry.

Center for NanoScience (CNS) Research Platforms

- Nanocharacterization and Molecular Imaging
- Nanoscale Materials and Systems
- Theoretical/Computational Nanoscience
- Membrane and Cellular Function
- Emerging Platforms

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