Campus STEM Research Priorities Report

Tulane University

June 30, 2013

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School of Architecture

School of Continuing Studies

School of Liberal Arts

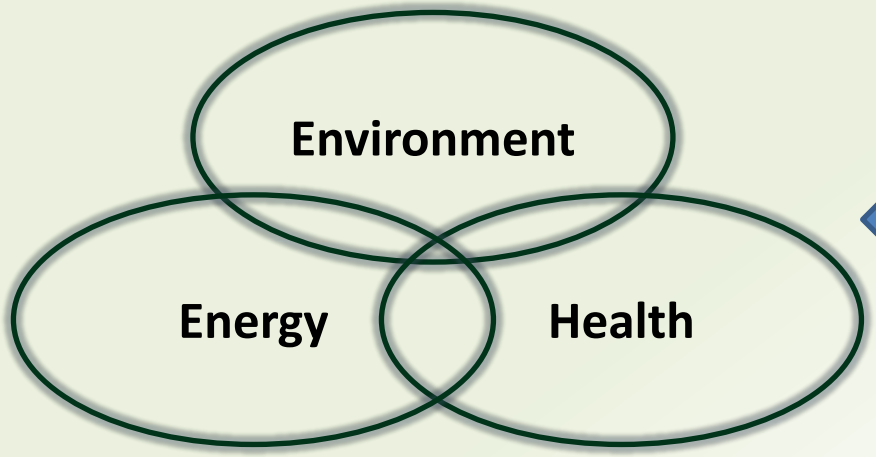
School of Social Work

A.B. Freeman School of Business

School of Science and Engineering

School of Law

Campus STEM Research Priorities



Enabling Technologies

- Materials Science
- Computing

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Section I: Identification and Definition of Priority Research Areas

Four research areas of national and international prominence are identified as Tulane University STEM priorities:

- **Water Remediation, Management and Coastal Studies**
- **Materials Science**
- **Health-Related Research**
- **Energy and Environmental Science**

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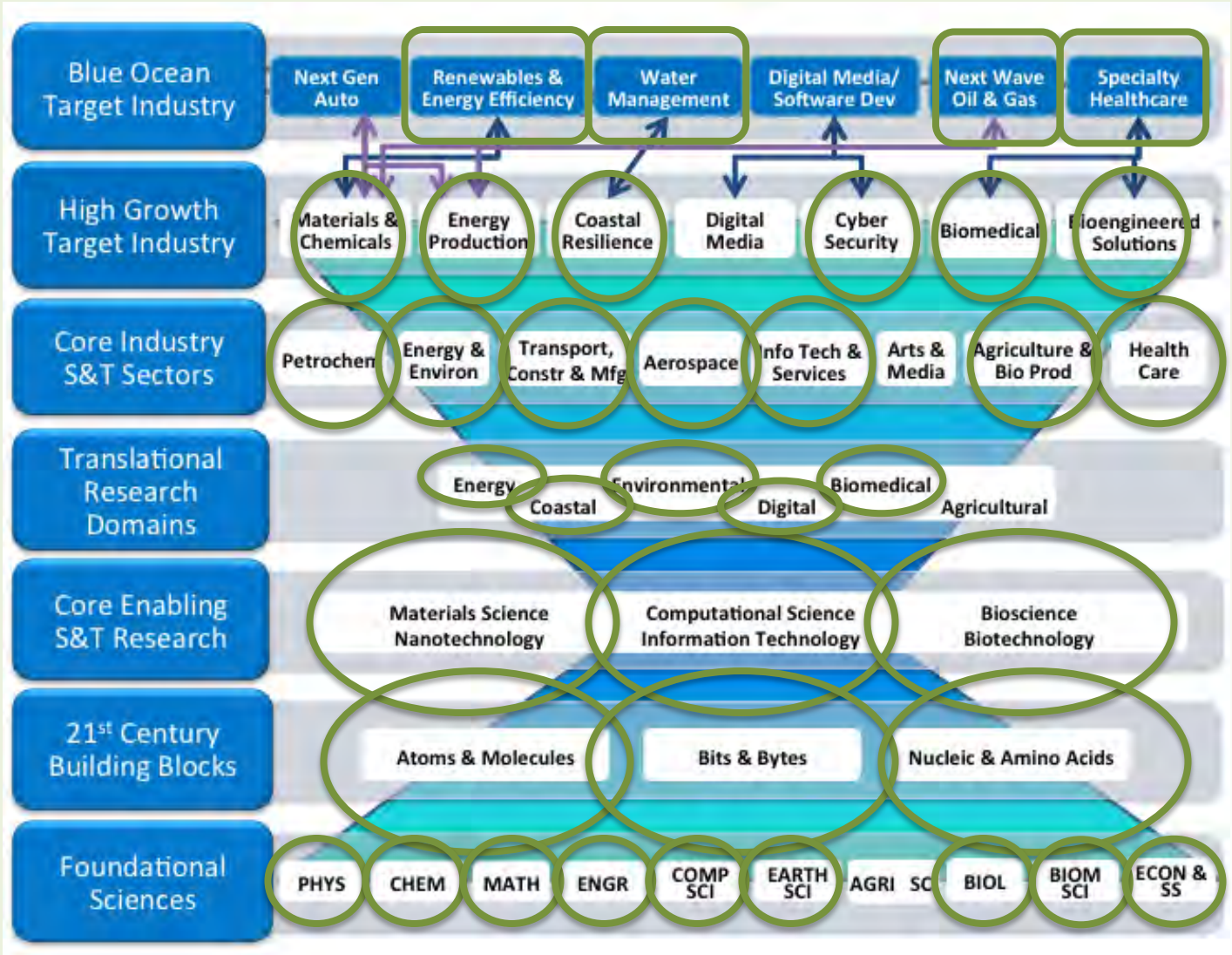
Priority Research Areas Align With FIRST Louisiana at All Levels



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Priority Area I: Water Remediation, Management and Coastal Studies

Research Assets and Agenda

- Internationally recognized programs in wetlands restoration, disaster resilience, water resource policy, dispersant technology
- Major focus areas in river processes (hydrology, water law), Delta Processes (Wetland ecology), Ecosystem Services (Fisheries management), Human Dimensions (Disaster resilience, Public Health)
- Major institutional assets
  - Tulane Institute on Water Resources and Policy
  - Tulane Xavier Center for Bioenvironmental Research
- Multi-institutional collaborations with Louisiana partners through
  - Consortium for the Molecular Engineering of Dispersants - CMEDS
    - http://dispersant.tulane.edu
    - 43 investigators from 22 institutions
    - Funded by the Gulf of Mexico Research Initiative (GOMRI) www.gulfresearchinitiative.org

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Priority Area I: Water Remediation, Management and Coastal Studies

PRODUCTIVITY METRICS – FY12

29 extramurally funded Principal Investigators

45 Active Grants and Contracts totaling $14.2M

- 20 Federal awards totaling $2M
- 14 State of Louisiana awards totaling $0.9M
- 6 awards from non-profit Associations and Foundations totaling $10.6M
- 5 private-sector awards from industry totaling $0.7M

Major extramural sponsors

- National Science Foundation
- Office of Naval Research
- Environmental Protection Agency

Significant sources of commercialization:

- NanoFex, LLC
- Gulf of Mexico Research Initiative

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Priority Area I: Water Remediation, Management and Coastal Studies – SUCCESS STORIES

- **Mark Davis**

Professor, School of Law

Director, Tulane Institute on Water Resources and Policy

- **Mike Blum**

Associate Professor, Ecology and Evolutionary Biology

Interim Director, Center for Bioenvironmental Research

- **Vijay John**

Professor, Chemical and Biomolecular Engineering

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Mark Davis, JD

- Research Interests
  - Improving stewardship and understanding of how water resources law and policy shape both risk and opportunity
  - Studies how efforts to apply science, engineering, and resource management practices to meet our society's ecologic, cultural, and economic needs might be better served by enlightened law and policy
- Research Accomplishments
  - City of New Orleans, Mayor’s Environmental Advisory Board Member

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Mike Blum, PhD

- Research Interests
  - Application of hybridization and adaptive evolution to the study of land use, invasive species, and climate change impacts on aquatic ecosystems.
- Research Accomplishments
  - Over 40 peer-reviewed publications
  - National TV and radio appearances related to Gulf Oil Spill
- Economic Development Activities
  - $6.8M in research funding
  - Conducting projects on coastal restoration in Louisiana as well as coupled human-natural ecosystem dynamics to address issues of water sustainability, biodiversity conservation, and infectious diseases in disaster-prone urban landscapes.

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Vijay John, PhD

- Research Interests
  - Microemulsion Systems
  - Clathrate Hydrate Thermodynamics
- Research Accomplishments
  - Over 160 peer-reviewed publications
- Economic Development Activities
  - Over $5M in external research funding
  - NanoFex, LLC; zero-valent iron for remediation

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Priority Area 2: Materials Science

Research Assets and Agenda

- Internationally recognized programs in nanotechnology, polymer science and engineering, electronic materials, energy storage, materials simulations
- Major focus areas of microemulsion systems, polymer physics, polymeric drug carriers, thin films and coating, nanomanufacturing
- Major institutional assets
  - Center for Computational Science
  - Coordinated Instrumentation Facility
  - Polymer Reaction Monitoring and Characterization (PolyRMC)
- Multi-institutional collaborations with Louisiana partners through:
  - Louisiana Alliance for Simulation-Guided Materials Applications (LA-SiGMA)

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Priority Area 2: Materials Science

PRODUCTIVITY METRICS – FY12

26 extramurally funded Principal Investigators

40 Active Grants and Contracts totaling $4.8M

- 26 Federal awards totaling $3.5M
- 11 State of Louisiana awards totaling $0.8M
- 2 awards from non-profit Associations and Foundations totaling $0.2M
- 1 private-sector award from industry totaling $0.3M

Major extramural sponsors

- National Science Foundation
- Office of Naval Research
- State of Louisiana

Significant sources of commercialization

- Advanced Polymer Monitoring Technologies, Inc.
- Polymer Reaction Monitoring and Characterization (PolyRMC)

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Priority Area 2: Materials Science – SUCCESS STORIES

- **Vijay John**

Professor, Chemical and Biomolecular Engineering

- **Wayne Reed**

Professor, Physics and Engineering Physics
Director, Tulane Center for Polymer Reaction Monitoring and Characterization (PolyRMC)

- **Doug Chrisey**

Professor, Physics and Engineering Physics

- **Scott Grayson**

Associate Professor, Chemistry

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Vijay John, PhD

- Research Interests
  - Self-Assembly and Nanostructured Materials
  - Polymer/Nanoparticle Composites
  - Biomolecular Materials
- Research Accomplishments
  - Over 160 peer-reviewed publications
- Economic Development Activities
  - Over $5M in external research funding
  - NanoFex, LLC; zero-valent iron for remediation

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Wayne Reed, PhD

- Research Interests
  - Polymer Physics and Biophysics
  - Discovering basic physical principals involved in their structures and interactions, as well as solving practical problems of immediate interest to such industries as pharmaceuticals, biotechnology, food, paints, adhesives, resins, coating, and water purification
- Research Accomplishments
  - Over 124 peer-reviewed publications
  - Sole inventor on seven patents issued or pending and co-inventor on an eighth
- Economic Development Activities
  - Licensed patent to Brookhaven Instruments Corporation (Holtsville, NY); devices based on it have earned BIC around $10M.
  - Licensed patents to Polymer Laboratories Ltd (Shropshire, UK), Varian (Walnut Creek, CA), Advanced Polymer Monitoring Technologies, Inc. (APMT, Inc, New Orleans, LA). (APMT) was founded in March 2012 as a spin-off from Tulane's PolyRMC
  - Over $2M in total funding from industries
  - Additional industrial collaborations include; Ecolab, Nalco, Arkema, Biogen Idec, Eli Lilly, Degussa, Clariant, International Specialty Products, Lion Copolymer, Firmenich S.A., Total Petrochemicals, Atofina, Elf Aquitaine, Sanofi Bioindustries, Solvay Advanced Polymers, Rubicon, Cytec Industries, Rhodia, Lipo Chemicals, Petrobras, Polymer Standard Services, United Technologies

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Doug Chrisey, PhD

- Research Interests
  - Novel laser fabrication of thin films and coatings of advanced materials for electronics, sensors, biomaterials, and energy storage
- Research Accomplishments
  - Over 400 publications
  - Edited or co-edited 15 books
  - 18 patents
- Economic Development Activities
  - Lead inventor of MAPLE (matrix assisted pulsed laser evaporation) processing technique
  - Scientific Advisor to Nanotherapeutics
  - Chief Technology Officer for Nano Solutions and is President of Omni-Metrics

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Scott Grayson, PhD

- Research Interests
  - Identification of polymers with unique properties and powerful potential in the biomedical arena, including amphiphilic star-shaped polymers which exhibit improved activity as skin-penetrating drug carriers and novel architectures of poly(ethylene imine) which exhibit improved activity for gene delivery agents, while simultaneously reducing toxicity
- Research Accomplishments
  - Over 70 peer-reviewed publications
- Economic Development Activities
  - Licensed and commercialized a pending patent for more accurate calibration of high mass mass spectrometers under the name "SpheriCal" by Polymer Factory (Stockholm, Sweden)

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Priority Area 3: Health-Related Research

Research Assets and Agenda

- Internationally recognized programs in gene and drug delivery, tissue regeneration
- Major focus areas of tissue engineering, protein folding
- Major institutional assets
  - Center for Computational Science
  - Coordinated Instrumentation Facility
- Multi-institutional collaborations with Louisiana partners through:
  - Louisiana Alliance for Simulation-Guided Materials Applications (LA-SiGMA)

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Priority Area 3: Health-Related Research

PRODUCTIVITY METRICS – FY12

46 extramurally funded Principal Investigators

77 Active Grants and Contracts totaling $19M

- 49 Federal awards totaling $11.6M
- 21 State of Louisiana awards totaling $1.1M
- 6 awards from non-profit Associations and Foundations totaling $6M
- 1 private-sector award from industry totaling $0.3M

Major extramural sponsors

- National Science Foundation
- Office of Naval Research
- National Institutes of Health
- Bill and Melinda Gates Foundation

Significant source of commercialization

- Novate Medical Technologies, LLC license to SafeSnip for umbilical cord clamp/cutter device

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Priority Area 3: Health-Related Research – SUCCESS STORIES

- **Don Gaver**

Professor, Biomedical Engineering

Director, NSF-IGERT Program in Bioinnovation

- **Ken Muneoka**

Professor, Cell and Molecular Biology

- **Anne Robinson**

Professor, Chemical and Biomolecular Engineering

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Don Gaver, PhD

- Research Interests
  - Biofluid mechanics
  - Surfactant transport in lungs
- Research Accomplishments
  - Over 50 peer-reviewed publications
- Economic Development Activities
  - Over $3M in external research funding
  - NSF funded Innovative Graduate Education and Research Training (IGERT) program in bioinnovation for workforce training in biotechnology

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Ken Muneoka, PhD

- Research Interests
  - Discovering ways to enhance regenerative capabilities of mammalian limbs
- Research Accomplishments
  - Fellow, American Association for the Advancement of Science
  - Marcus Singer Medal for Excellence in Regeneration Research
  - Over 68 peer-reviewed publications
- Economic Development Activities
  - Directed DoD funded multi-institutional effort to induce regeneration in mammals, with particular emphasis on human regeneration.
  - Brought more than $20M in research support to Tulane University and the state of Louisiana

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Anne Robinson, PhD

- Research Interests
  - Fundamental interactions between molecules, both in isolation and in the complex environment of the cell
  - Investigating the determinants of protein folding and misfolding on the molecular and cellular levels
- Research Accomplishments
  - Fellow, American Institute for Medical and Biological Engineering
  - Three patents
  - Over 60 peer-reviewed publications

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Priority Area 4: Energy and Environmental Sciences

Research Assets and Agenda

- Internationally recognized programs in renewable energy sources, energy management, environmental sciences
- Major focus areas of biofuels, sedimentology, sea-level change, energy supply chain economics
- Major institutional assets
  - Tulane Energy Institute
  - Tulane University Biodiversity Research Center
- Multi-institutional collaborations with Louisiana partners through:
  - Clean Power and Energy Research Consortium (CPERC)
  - DOE National Institute for Climatic Change Research

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Priority Area 4: Energy and Environmental Sciences

PRODUCTIVITY METRICS – FY12

44 extramurally funded Principal Investigators

75 Active Grants and Contracts totaling $22.8M

- 36 Federal awards totaling $4.7M
- 19 State of Louisiana awards totaling $1M
- 15 awards from non-profit Associations and Foundations totaling $16.4M
- 5 private-sector awards from industry totaling $0.7M

Major extramural sponsors

- Department of Energy
- National Science Foundation
- State of Louisiana (BOR, DWF)

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Priority Area 4: Energy and Environmental Sciences – SUCCESS STORIES

- **Geoff Parker**

Professor, A.B. Freeman School of Business
Director, Tulane Energy Institute

- **Tor Tornqvist**

Professor, Earth and Environmental Sciences
Director, National Institute for Climatic Change Research Coastal Center

- **David Mullin**

Associate Professor, Cell and Molecular Biology

- **Henry L. Bart, Jr.**

Professor, Earth and Environmental Sciences
Director, Tulane University Biodiversity Research Institute

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Geoff Parker, PhD

- Research Interests
  - Design and performance of energy markets
  - How firms coordinate their supply chain activities across corporate and national boundaries
  - Information markets; network economics
- Research Accomplishments
  - President, Industry Studies Association, 2013–2015
  - Senior Editor, *Production and Operations Management*, 2003–present
- Economic Development Activities
  - Funding from the National Science Foundation, the Department of Energy, the Louisiana Board of Regents, and multiple corporations, including AT&T, Microsoft, and SAP and advises a number of startups including Barter, ReactWell, and The Receivables Exchange

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Tor Tornqvist, PhD

- Research Interests
  - Evolution of rivers, deltas, and shallow oceans in response to climate and sea-level change
  - Current fieldwork activities are focused on the Mississippi Delta and the adjacent US Gulf Coast
- Research Accomplishments
  - Work has appeared in journals such as *Science* and *Nature Geoscience*
  - Author or co-author of six papers in *Geology*, a leading journal in the field
  - Co-authored a review paper on river responses to climate and sea-level change, which is currently one of the most frequently cited papers in the area of sedimentary geology
- Economic Development Activities
  - Over $2.8M in external research funding

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David Mullin, PhD

- Research Interests
  - Liquid fuels that are gasoline replacements made from renewable non food agricultural waste materials
- Research Accomplishments
  - Featured on television (Fox News, MSNBC), radio (National Public Radio, and other public and commercial radio stations), newspapers, *USA TODAY Green Living* magazine, and several European magazines (*Science Illustrated Internationa*l (Denmark), *Recycling Magazin* (German), and others)
  - Work on fuels recently appeared in a magazine distributed to high school and middle school students called "Scholastic Math"
  - Awarded "Most likely to change the world" by public radio science show (2012)
  - Cinematography students from Berkeley and Columbia made a movie about fuel project in the summer of 2012

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Henry L. Bart, PhD

- Research Interests
  - Taxonomic diversity
  - Ecological diversity
  - Diversity of environmental adaptation
- Research Accomplishments
  - Over 55 peer-reviewed publications
- Economic Development Activities
  - Over $4.5M in externally funded research

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Section II: Institutional and External Support for Priority Research Areas

The priority areas reflect the Tulane University mission and vision as:

-articulated by school deans in unit strategic plans.

-realized through establishment of university-wide research Centers and doctoral education programs.

-realized through faculty hiring and graduate student recruitment into the priority areas.

-fostered through the co-location of interdisciplinary research clusters in newly constructed STEM buildings such as Flower Hall.

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Section II: Institutional and External Support for Priority Research Areas

The priority research areas relate to existing and potential external funding in that:

- they are highly relevant to the economic development in Louisiana;
- they are highly relevant to the health of the citizens of Louisiana;
- they are highly relevant to the security of our coast wetlands and ecosystems;
- they produce a highly trained workforce.

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Section II: Institutional and External Support for Priority Research Areas

Representative Institutional Investments Over the Past Five Years

Water Resources, Management and Coastal Studies: 2 new faculty hires; faculty start-up packages and new faculty salaries totaling $0.5M

Materials Science Research: 7 new faculty hires; faculty start-up packages and new faculty salaries totaling $6.1M

Energy and Environmental Science Research: 10 new faculty hires; faculty start-up packages and new faculty salaries totaling $3.7M

Health-Related Research: 9 new faculty hires; faculty start-up packages of $5.2M

Space renovation in several campus buildings has totaled over $1.8M over the same time period impacting all Priority Research Areas

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Section III: Research and Economic Development Data

R&D Expenditures as Reported to NSF Survey

Academic Year	All Expenditures	Federal Expenditures	Industry Expenditures
FY08	$25.4M	$19.9M	$0.199M
FY09	$24.6M	$19.0M	$0.130M
FY10	$39.6M	$21.4M	$0.108M
FY11	$40.4M	$19.6M	$0.145M
FY12	$34.9M	$14.3M	$0.254M

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Section III: Research and Economic Development Data

Technology Transfer Performance Metrics

Academic Year	Invention Disclosures	Patents Filed/Issued	Licenses and Options Signed
FY08	10	3/1	0
FY09	4	4/0	0
FY10	9	5/1	1
FY11	9	7/3	0
FY12	21	16/1	1

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Section III: Research and Economic Development Data

Technology Transfer Performance Metrics

Academic Year	Licensing Revenue	Start-up Companies	Industry-sponsored Research Agreements
FY08	$10,253	0	7
FY09	$92,011	0	4
FY10	$29,018	0	5
FY11	$23,100	2	3
FY12	$35,223	2	4

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