

# *Campus Conversations*

## *Analyzing and Innovating Research at Rutgers*

**February 12, 2018 | 4:30 p.m. to 6:00 p.m.**

*Rutgers Academic Building, Lecture Hall 4225 | 15 Seminary Place, New Brunswick*

What is the university's research footprint? How does it compare to our Big Ten peers? What are our areas of research strength? Are there existing opportunities that we can leverage to enhance the research effort at Rutgers?

*Campus Conversations* is an interactive series where discussion and data come together to shed light on areas of strength, challenges, and opportunities for growth at Rutgers University–New Brunswick.



# Agenda

- Introduction – The Mission and Growth of Rutgers as a Research University
- Key Metrics for Assessing Research Performance
- Research Focus and Productivity
- National Recognition and Capacity
- Research Support
- Some Ideas to Spur Growth

# The American Research University

Wilhelm von Humboldt – architect of the Prussian education system

- Unity of research and teaching (Theory of Human Education, c 1793)

American research universities founded on the Humboldt model

- Land grant public research universities, 1862
- Association of American Universities, 1900



1767-1835

# Milestones in the Development of Rutgers as a Research University

- 1766** – Rutgers is founded as Queen’s College; the college is renamed Rutgers in 1825.
- 1864** – Per the federal Morrill Act, the state legislature chooses Rutgers (over Princeton) as New Jersey’s land-grant institution.
- 1880** – The New Jersey Agricultural Experiment Station, aligned with Rutgers, is founded.
- 1924** – Rutgers College officially becomes Rutgers University.
- 1956** – Rutgers and the State of New Jersey enter into a compact, still in effect today, that affirms Rutgers’ position as The State University and creates the Board of Governors.
- 1989** – Rutgers is invited to join the prestigious Association of American Universities, recognizing its status as one of the top research universities in North America.
- 2012** – The New Jersey Medical and Health Sciences Education Restructuring Act is signed into law, merging two medical schools and other entities of the former University of Medicine and Dentistry into Rutgers, effective summer of 2013.
- 2013** – Rutgers joins the Committee on Institutional Cooperation (CIC), a consortium of outstanding research universities. The CIC is renamed the Big Ten Academic Alliance in 2016.

## A Few Notes About This Presentation

A major focus of this presentation is on research spending, a measure of research activity in which comparative data is readily available through the National Science Foundation.

Emphasis is on spending in the science and engineering fields; significant investment by federal funding agencies.

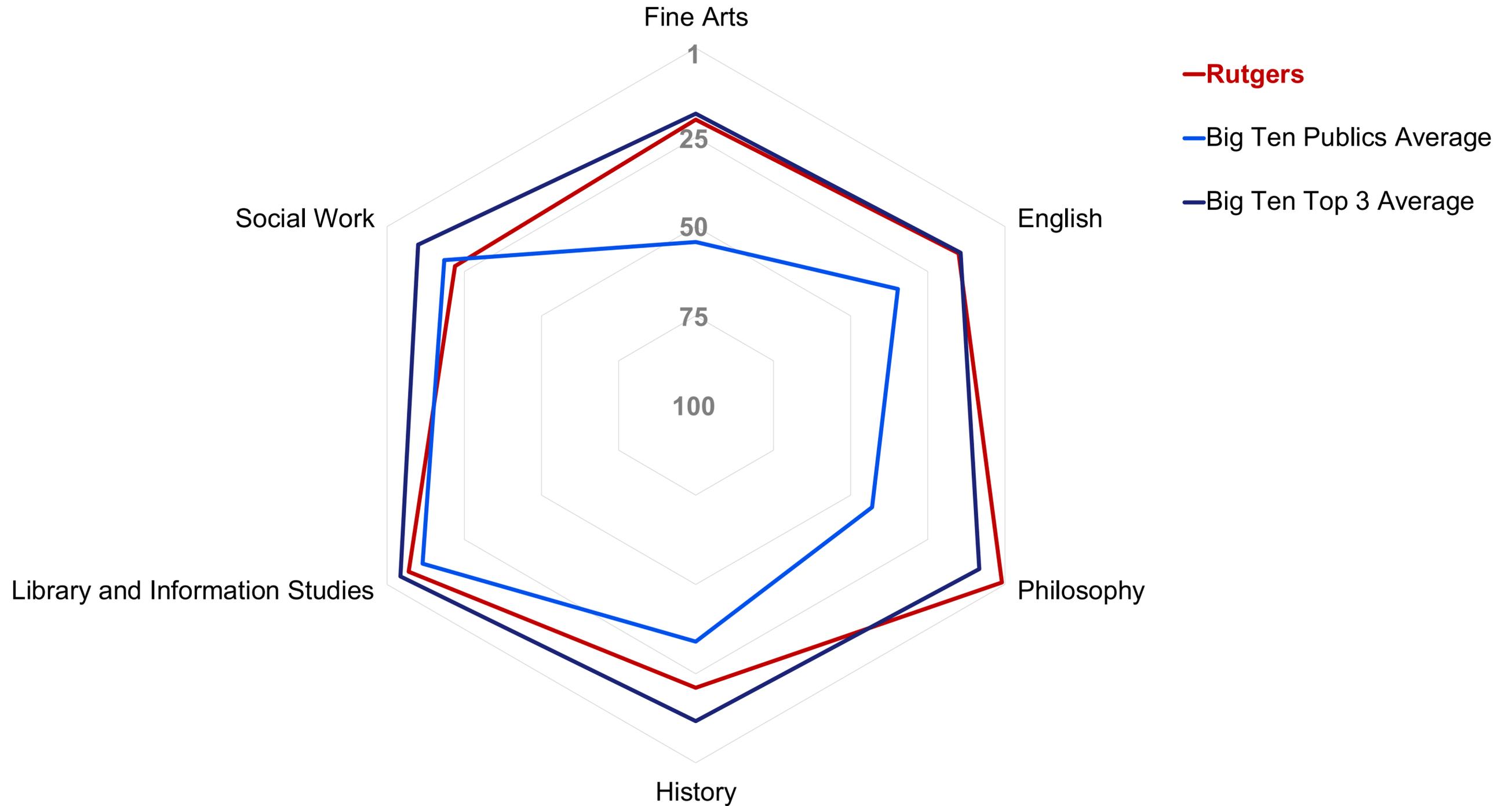
Excellent work being done at Rutgers in non science and engineering; some of the most distinguished departments at Rutgers are in fields outside of science and engineering.

*“It would be folly to set up a program under which research in the natural sciences and medicine was expanded at the cost of the social sciences, humanities, and other studies so essential to national well-being.”*



**Vannevar Bush**  
Science the Endless Frontier  
1945

# Non-S&E Graduate School Rankings



Source: All subject rankings reflect 2017-2018 U.S. News Best Grad Schools rankings, except for Philosophy which reflects 2010 NRC Rankings.  
 Note: Averages based on schools and programs ranked; some schools and programs are not ranked.

# Scholarship Activity of Rutgers–New Brunswick Faculty in Non-S&E Fields Over the Last Five Years

Category	Count
• Reviews	240
• Articles in Refereed Journals	1,968
• Books	207
• Other Publications	623
• Works in Progress	486
• Articles in Non-refereed or General Journals	359
• Other Scholarship	185
• Electronic Publications, Refereed	168
• Published Conference Proceedings	52
• Edited Books, Anthologies Collections, Bibliographies	194
• Electronic Publications, Not Refereed	126
• Textbooks	166
• Professional Awards and Honors	15

# An Example of Faculty Excellence in a Non-S&E Discipline: Mason Gross School of the Arts Faculty

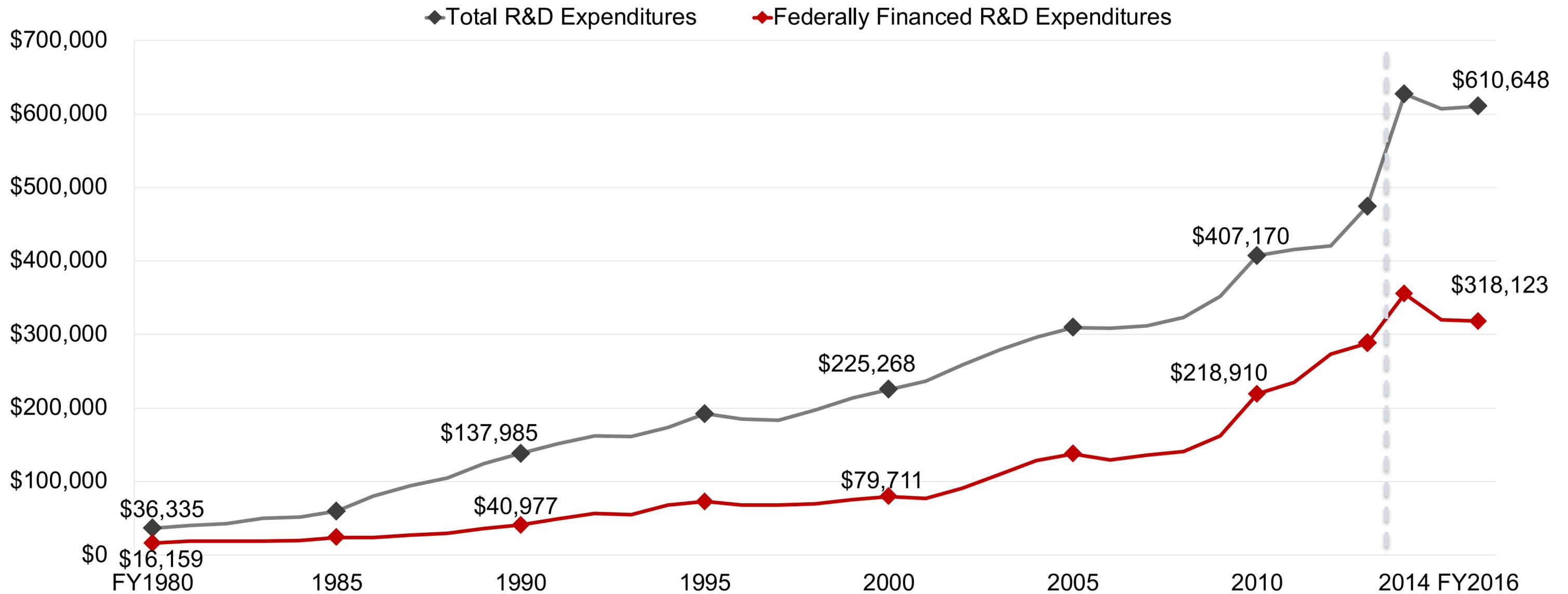
Major Academic and Achievement Awards	
• ACLS Fellowships – 2	• <b>Guggenheim Fellowships – 13</b>
• <b>American Academy of Arts and Letters – 3</b>	• IREX Fellowship – 1
• Apexart Franchise Program Award -1	• Jerome Robbins Award – 1
• Avery Fisher Career Grants – 2	• MacArthur Fellowships – 2
• Bambi Award – 1	• Naumburg First Prize – 2
• Baryshnikov Fellowship – 1	• NEA Fellowships – 2
• Bessie Awards - 3	• NEH Fellowships – 3
• Bogliasco Fellowship – 1	• OBIE Award -1
• Doris Duke Award – 1	• Rockefeller Fellowships – 2
• Foundation for Contemporary Art Award – 1	• Rome Prizes – 2
• <b>Fulbright Fellowships – 10</b>	• <b>Tony Awards – 2</b>
• <b>Grammy Awards – 10</b>	• <b>Tony Nominations - 12</b>
• <b>Grammy Nominations – 22</b>	

# Key Metrics for Assessing Research Performance

# S&E Research Expenditures Over Time

## Rutgers–New Brunswick

(\$=Thousands)

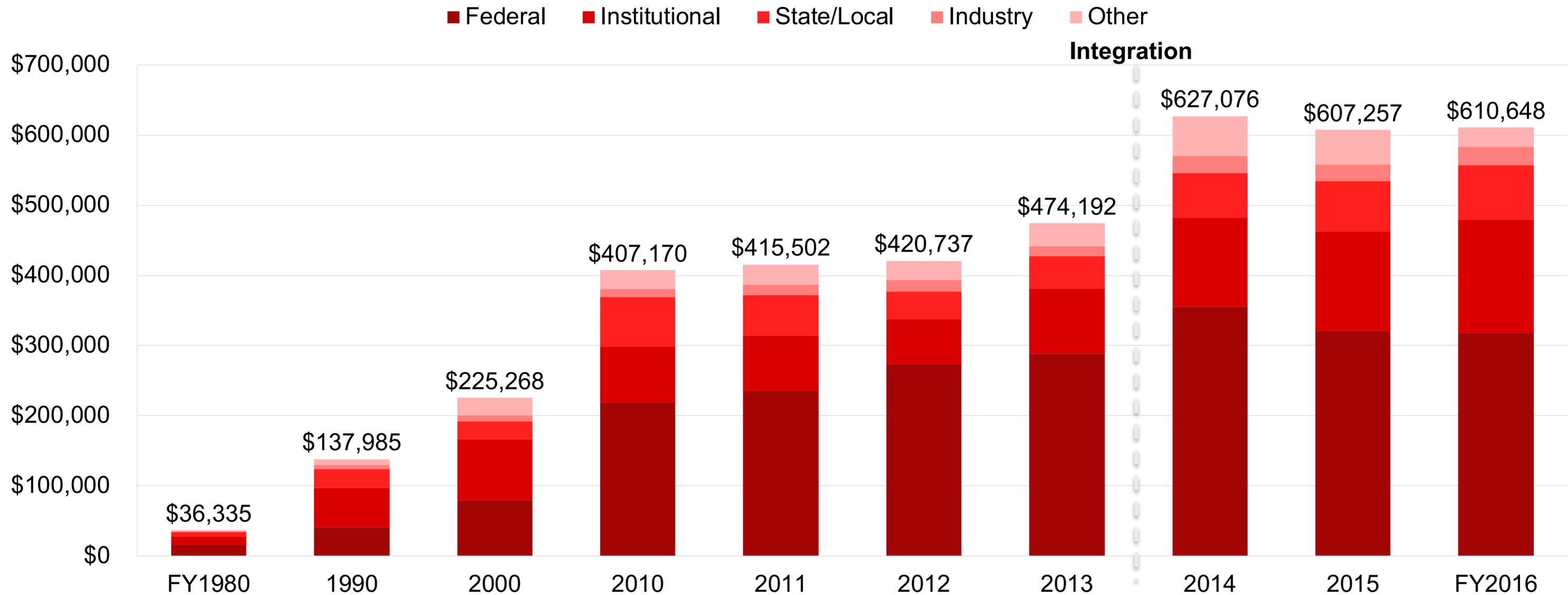


Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey  
 Note: Figures before 2010 reflect university wide reporting.

# S&E Research Expenditures Over Time – By Source

## Rutgers–New Brunswick

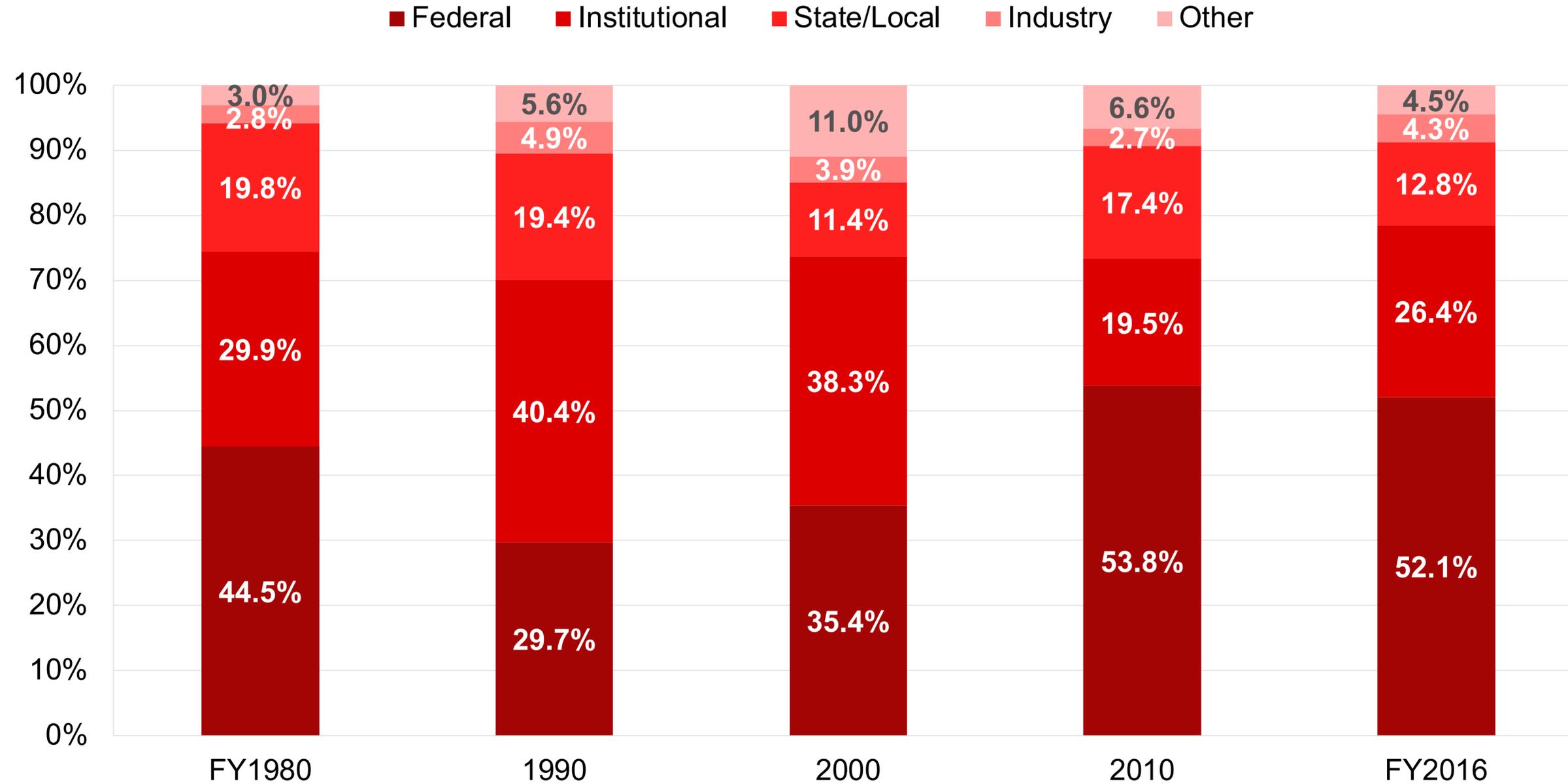
(\$=Thousands)



Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey  
 Note: Figures before 2010 reflect university wide reporting.

# Share of S&E Research Expenditures Over Time – By Source

## Rutgers–New Brunswick

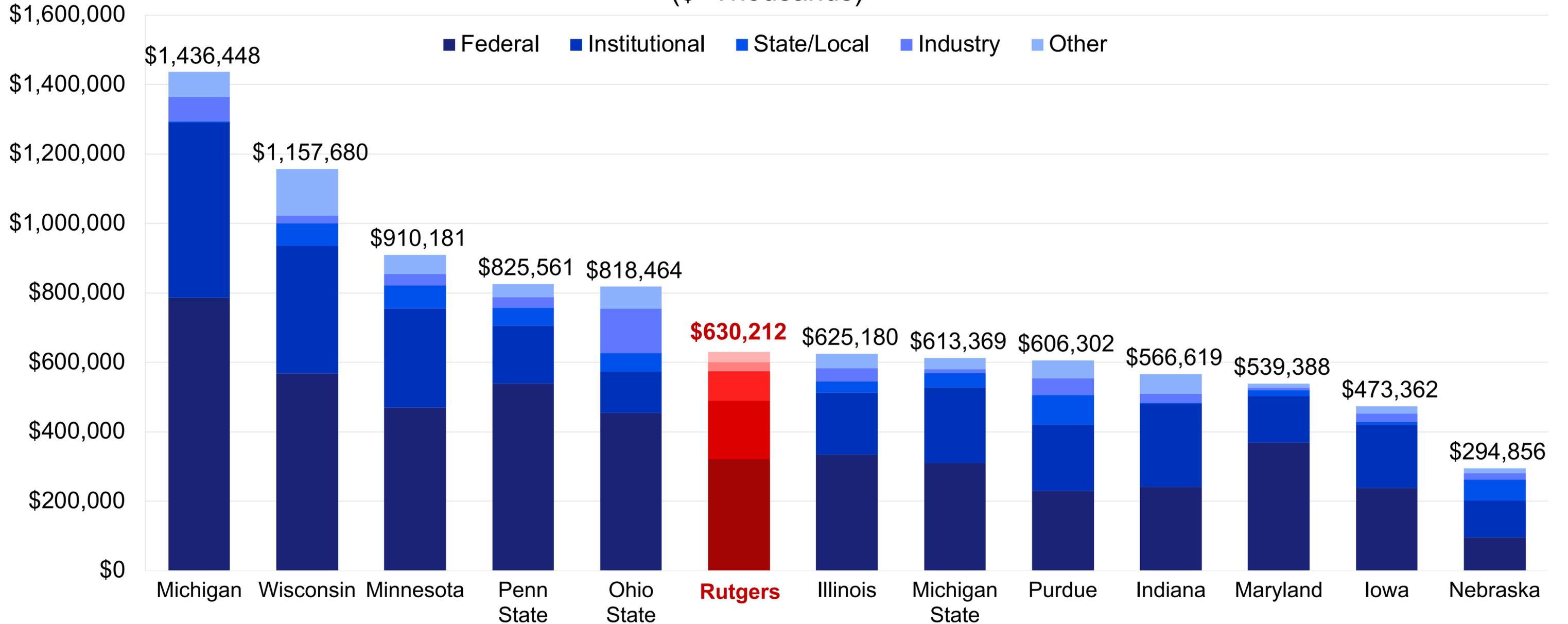


Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey  
 Note: Figures before 2010 reflect university wide reporting.

# All Research Expenditures – By Source

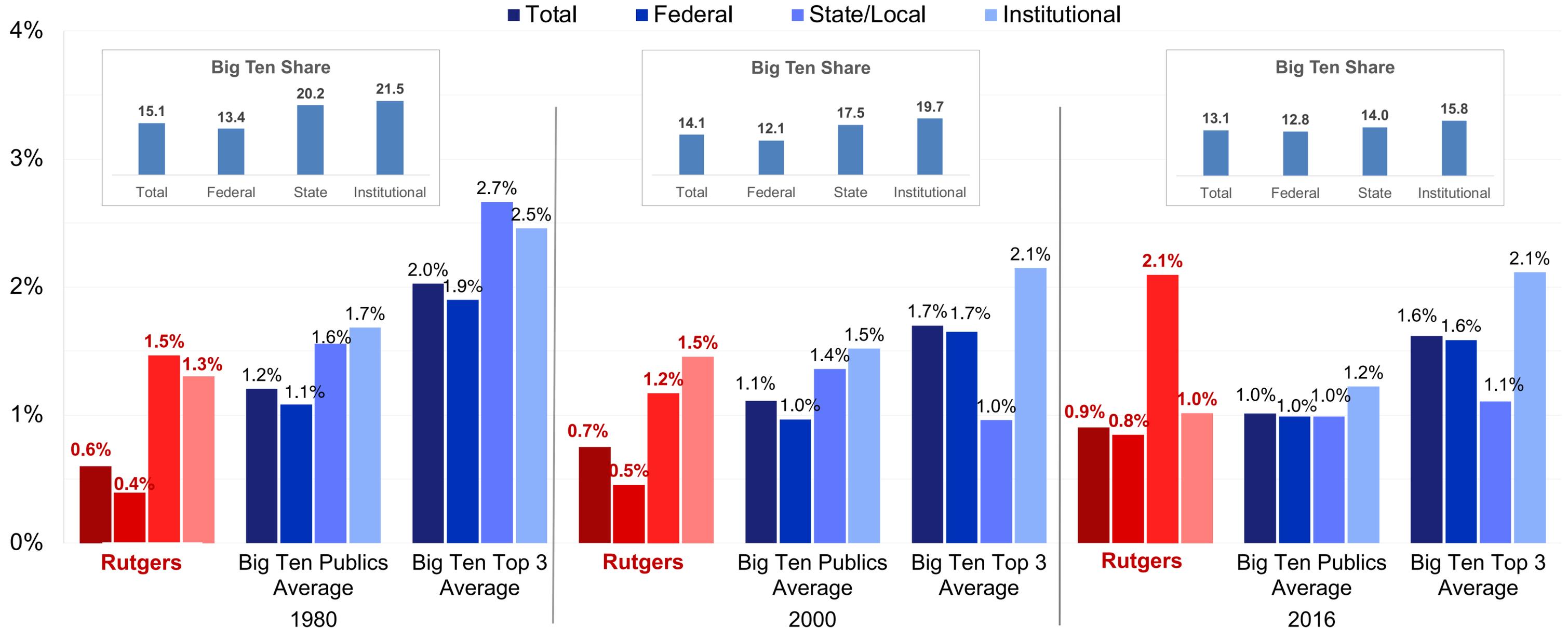
## Big Ten Publics – FY2016

(\$=Thousands)



Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey  
 Note: Reflects all reported expenditures, not just S&E. Indiana includes Bloomington & IUPUI. "Other" includes non-profit sources.

# Share of All S&E Research Expenditures for Rutgers and Big Ten FY1980, FY2000, and FY2016 (% Share)

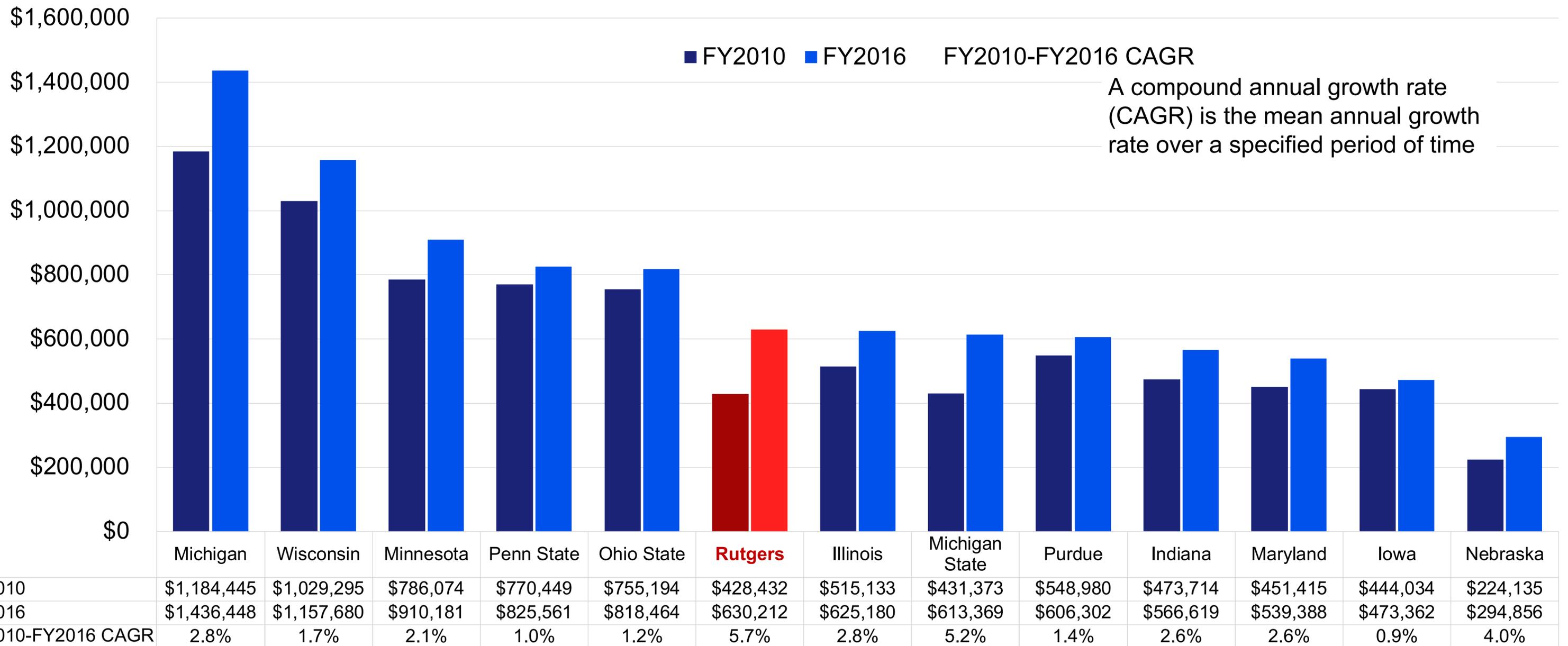


Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey

Note: Rutgers figures before 2010 reflect university wide reporting. Indiana includes Bloomington & IUPUI for 2016 and is university wide before 2010.

# Compounded Annual Growth Rate of Total Research Expenditures

## Big Ten Publics, FY2010, and FY2016 (\$=Thousands)



Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey  
 Note: Reflects all reported expenditures, not just S&E. Indiana includes Bloomington & IUPUI.

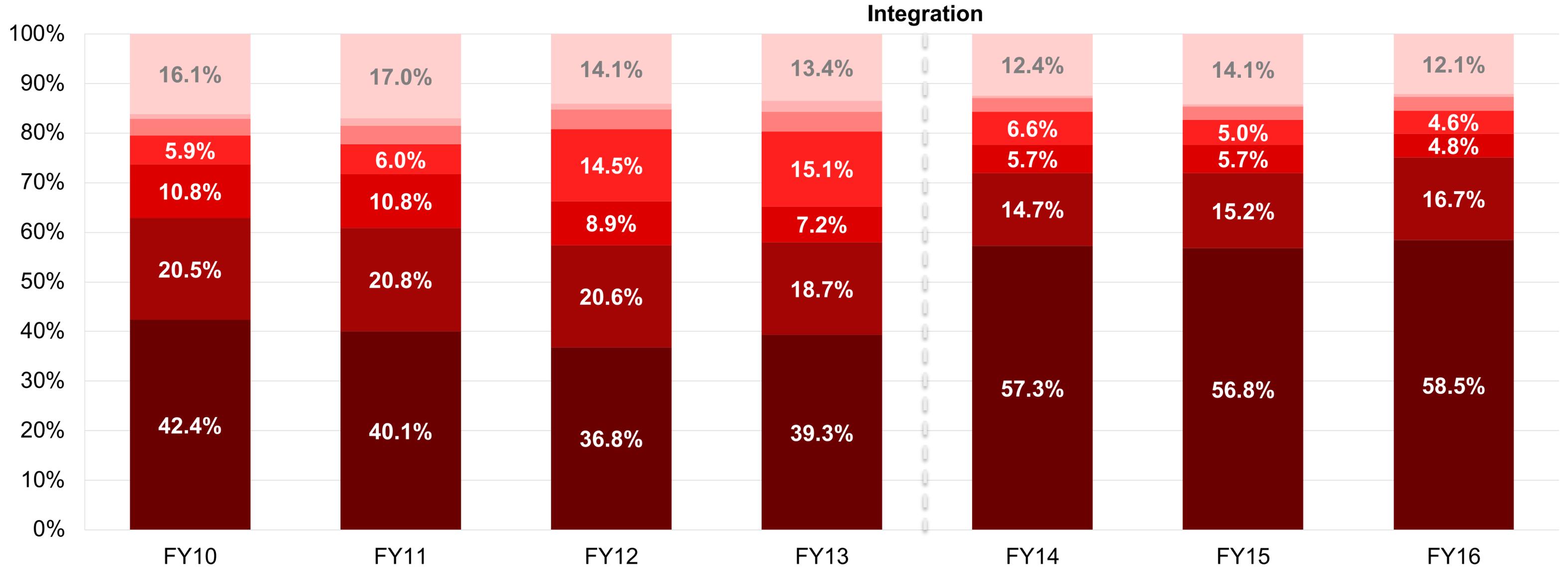
# Discussion

# Research Focus and Faculty Productivity

# Federal-Funded Research Expenditures – By Agency

## Rutgers–New Brunswick – FY2010-FY2016

■ Health/Human Services 
 ■ NSF 
 ■ Defense 
 ■ Agriculture 
 ■ Energy 
 ■ NASA 
 ■ Other

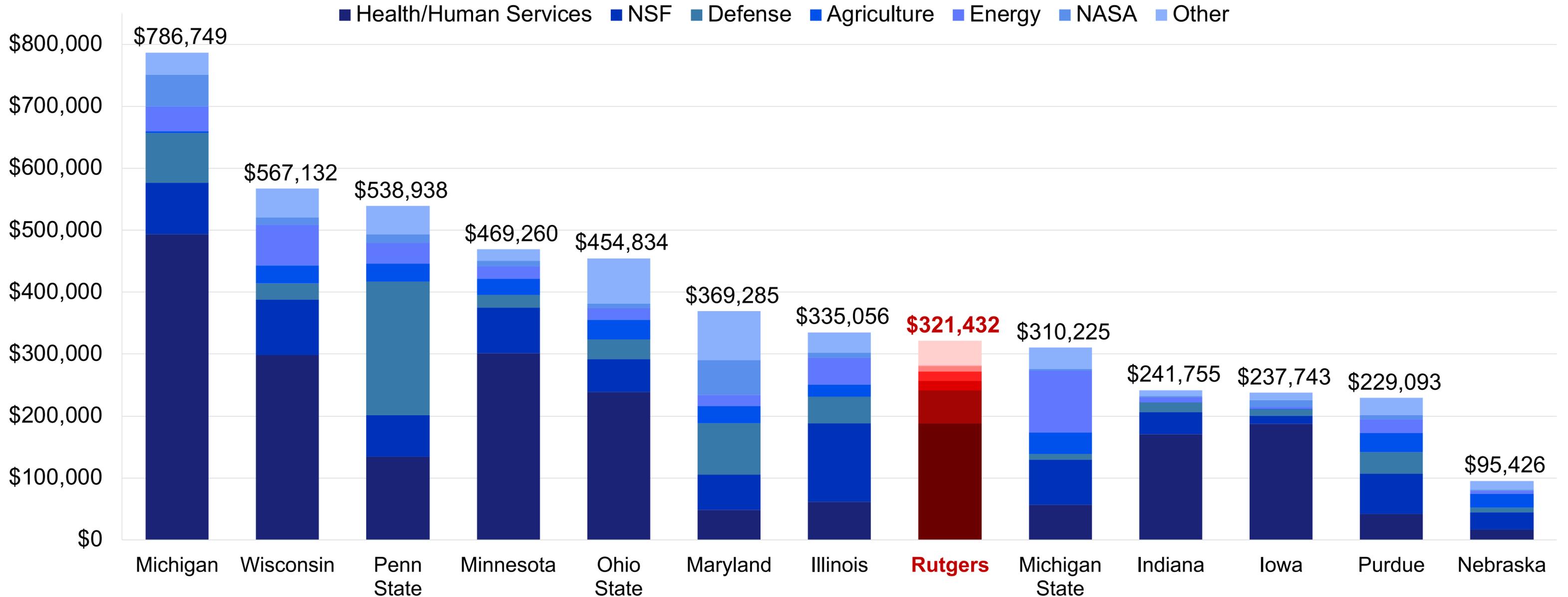


Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey  
 Note: Reflects all reported expenditures, not just S&E.

# Federal-Funded Research Expenditures – By Agency

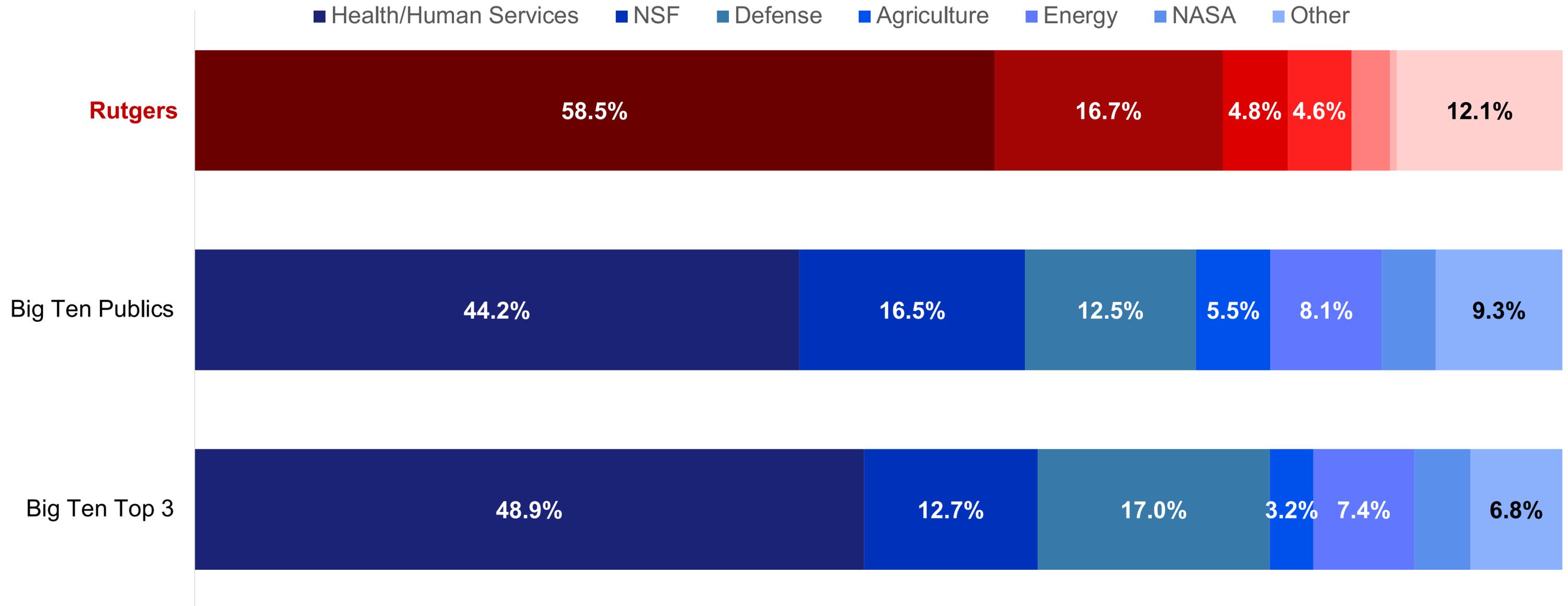
## Big Ten Publics – FY2016

(\$ = Thousands)



Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey  
 Note: Reflects all reported expenditures, not just S&E. Indiana includes Bloomington & IUPUI.

# Share of Federal Research Expenditures By Government Agency – FY2016



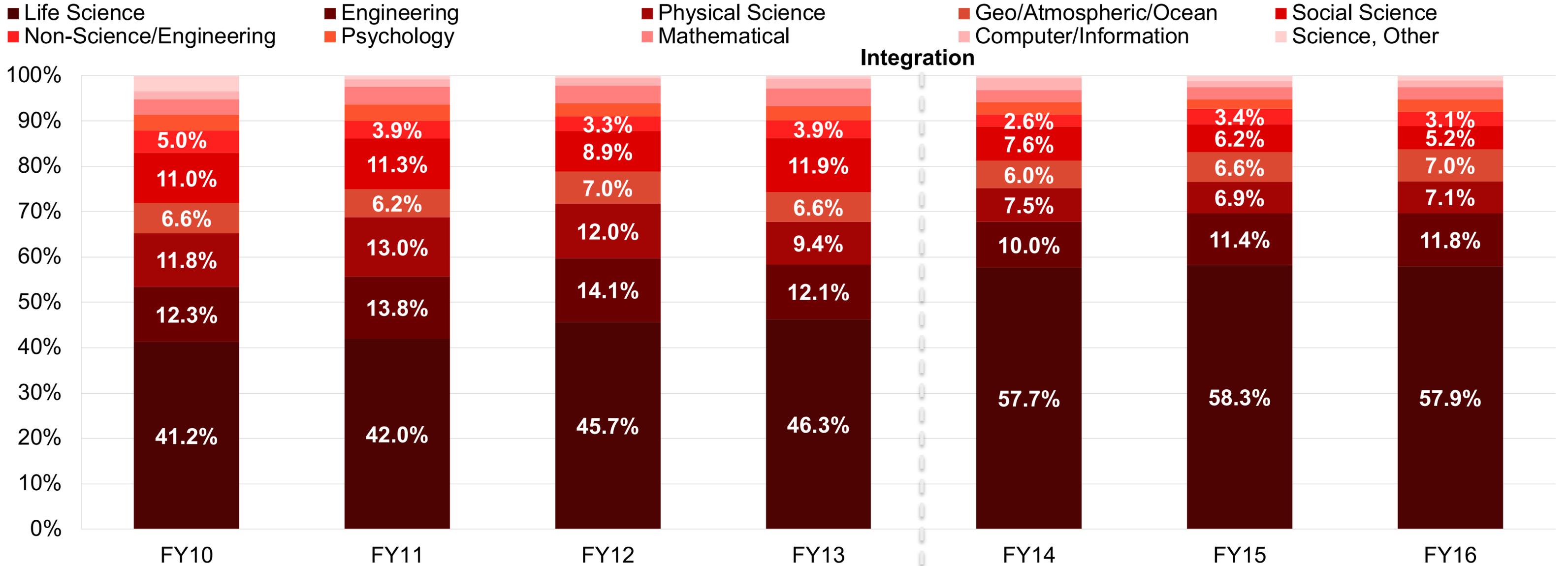
Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey

Note: Reflects all reported expenditures, not just S&E. Big Ten Publics percentages do not include Rutgers. Indiana includes Bloomington & IUPUI.

# Total Research Expenditures – By Broad Discipline

## Rutgers-New Brunswick – FY2010-FY2016

(% Shares)

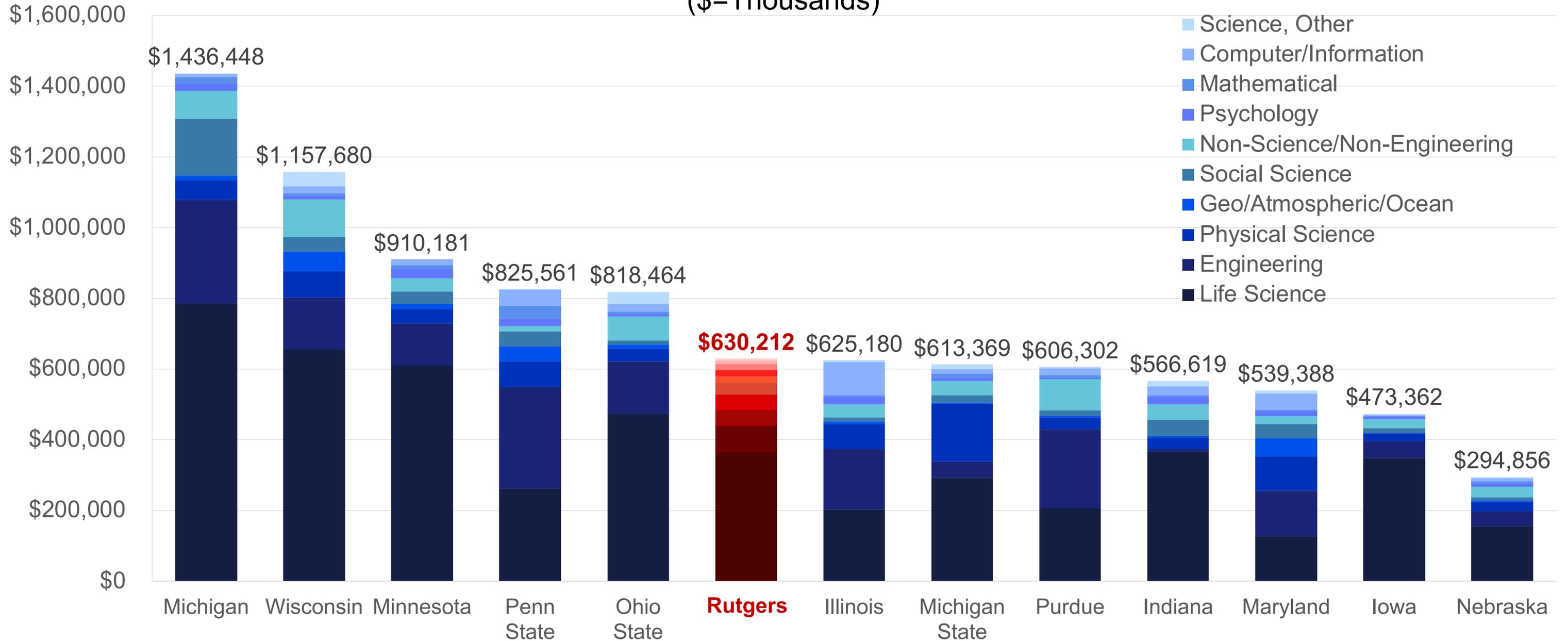


Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey  
 Note: Reflects all reported expenditures, not just S&E.

# Total Research Expenditures – By Broad Discipline

## Big Ten Publics – FY2016

(\$=Thousands)



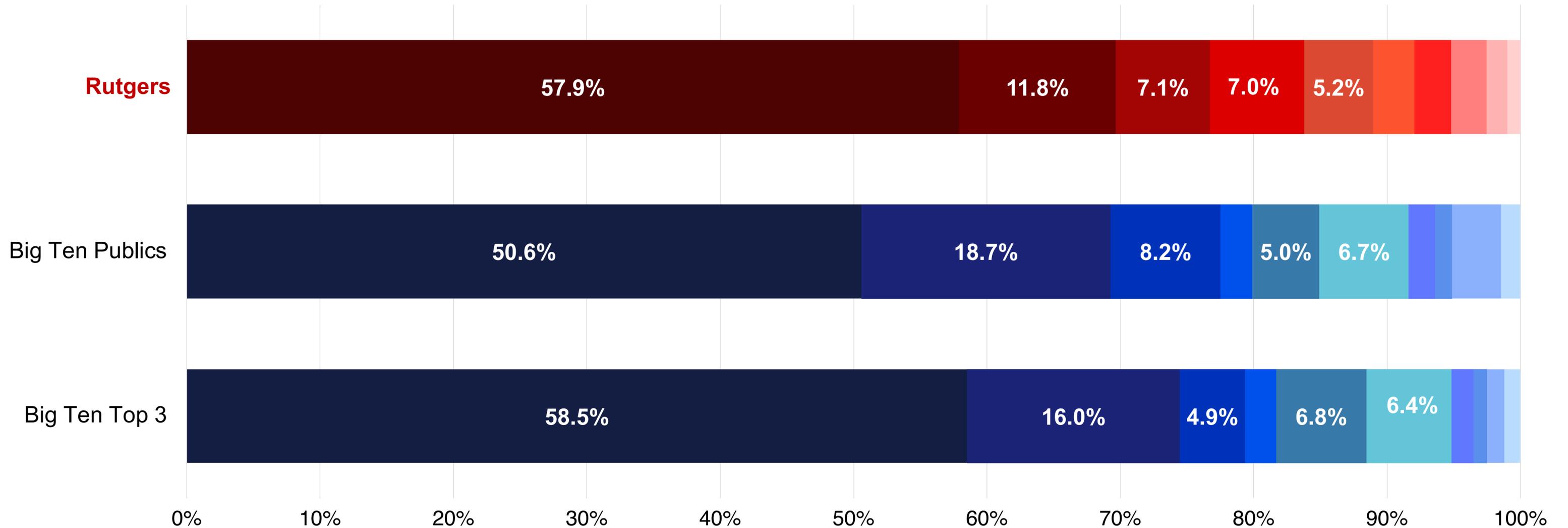
Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey  
 Note: Reflects all reported expenditures, not just S&E. Indiana includes Bloomington & IUPUI.

# Total Research Expenditures – By Broad Discipline

## Rutgers and Big Ten Publics – FY2016

(% Shares)

- Life Science
- Engineering
- Physical Science
- Geo/Atmospheric/Ocean
- Social Science
- Non-Science/Engineering
- Psychology
- Mathematical
- Computer/Information
- Science, Other



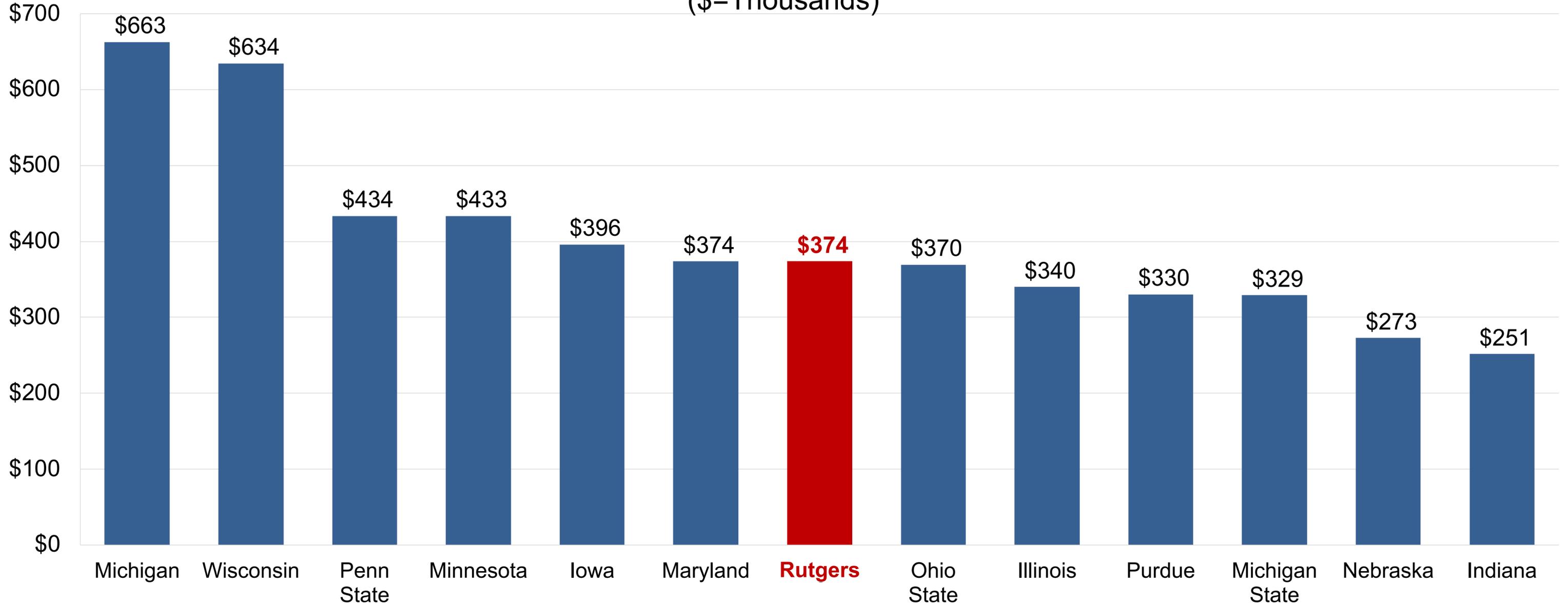
Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey

Note: Reflects all reported expenditures, not just S&E. Does not include ARRA expenditures. Big Ten Publics percentages do not include Rutgers.

# Research Expenditures per Faculty

## Big Ten Publics – FY2016

(\$=Thousands)



Source: NSF R&D Expenditures at Universities and Colleges / Higher Education R&D Survey

Note: Reflects all reported expenditures, not just S&E. Indiana includes Bloomington & IUPUI. Fall 2015 faculty counts from IPEDS. These include full-time institutional employees — excluding medical schools — with faculty status who are on the tenure track or are tenured. Faculty count from IPEDS includes Instructional staff, primarily instruction, instruction/research/public service, research staff, and management staff. For institutions with medical schools, medical school faculty are included in faculty counts. Medical faculty counts are from the Association of American Medical Colleges.

## Summary

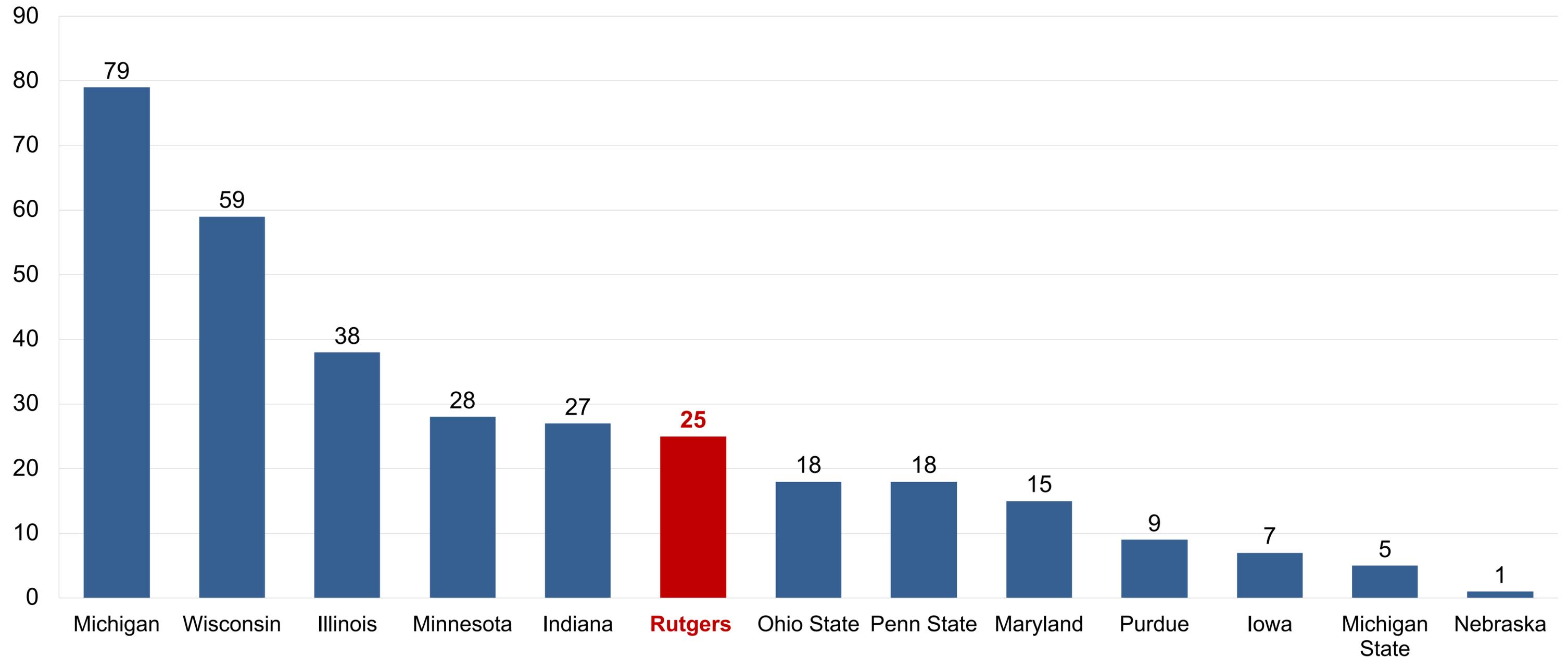
- Rutgers is **around the median** in federal-funded research expenditures among the Big Ten Publics. Michigan, Wisconsin, and Penn State lead the Big Ten Publics, each with over a half-billion dollars in FY16.
- **Health/Human Services** research funding at Rutgers increased significantly in FY14 as a result of the merger. Life Science research expenditures at Rutgers increased significantly as a result.
- Compared to its Big Ten peers, Rutgers receives a **relatively small share** of its federal funding from the Department of Defense, Department of Energy, and NASA, and a relatively large share from Health/Human Services.
- Compared to its Big Ten peers, Rutgers expenditure in **Engineering and Non-Science/Engineering** is **relatively small**, whereas in **Life Science** and **Geo/Atmospheric/Ocean Sciences** it is **relatively large**.

# Discussion

# Research Recognition and Capacity

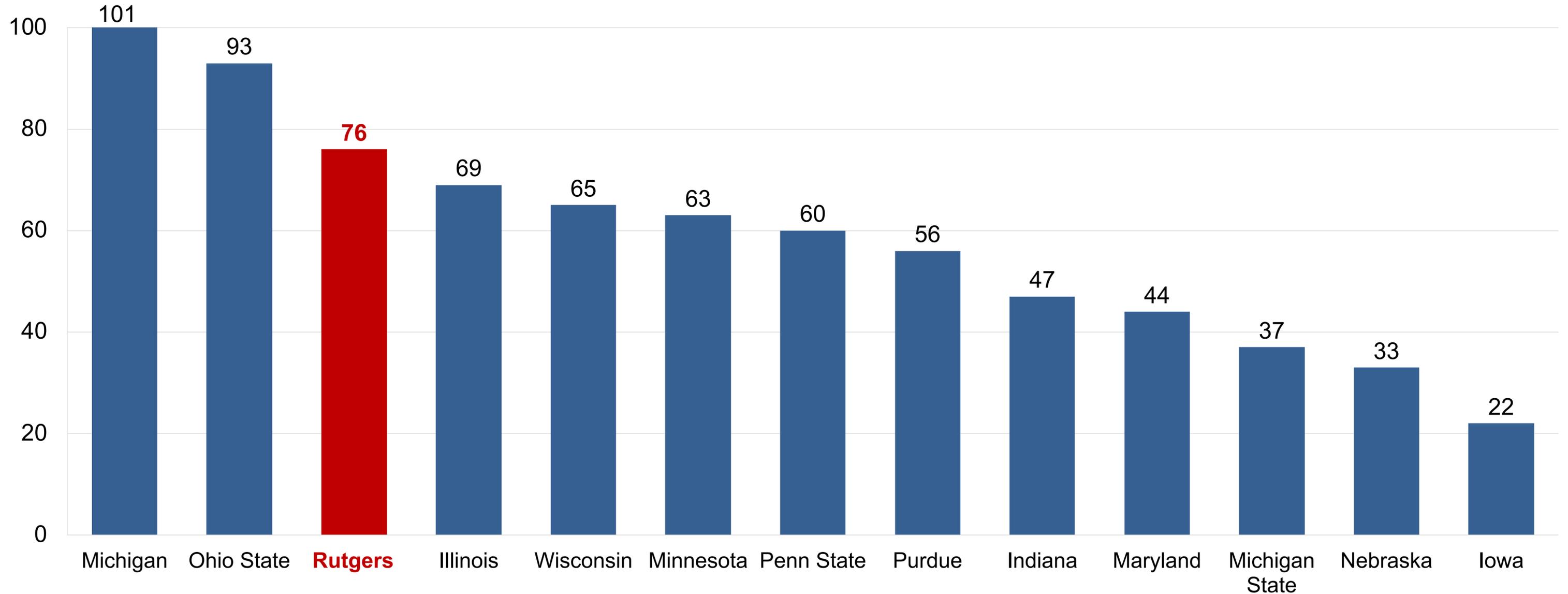
# Number of Members in the American Academy of Arts & Sciences

## Big Ten Publics – January 2018



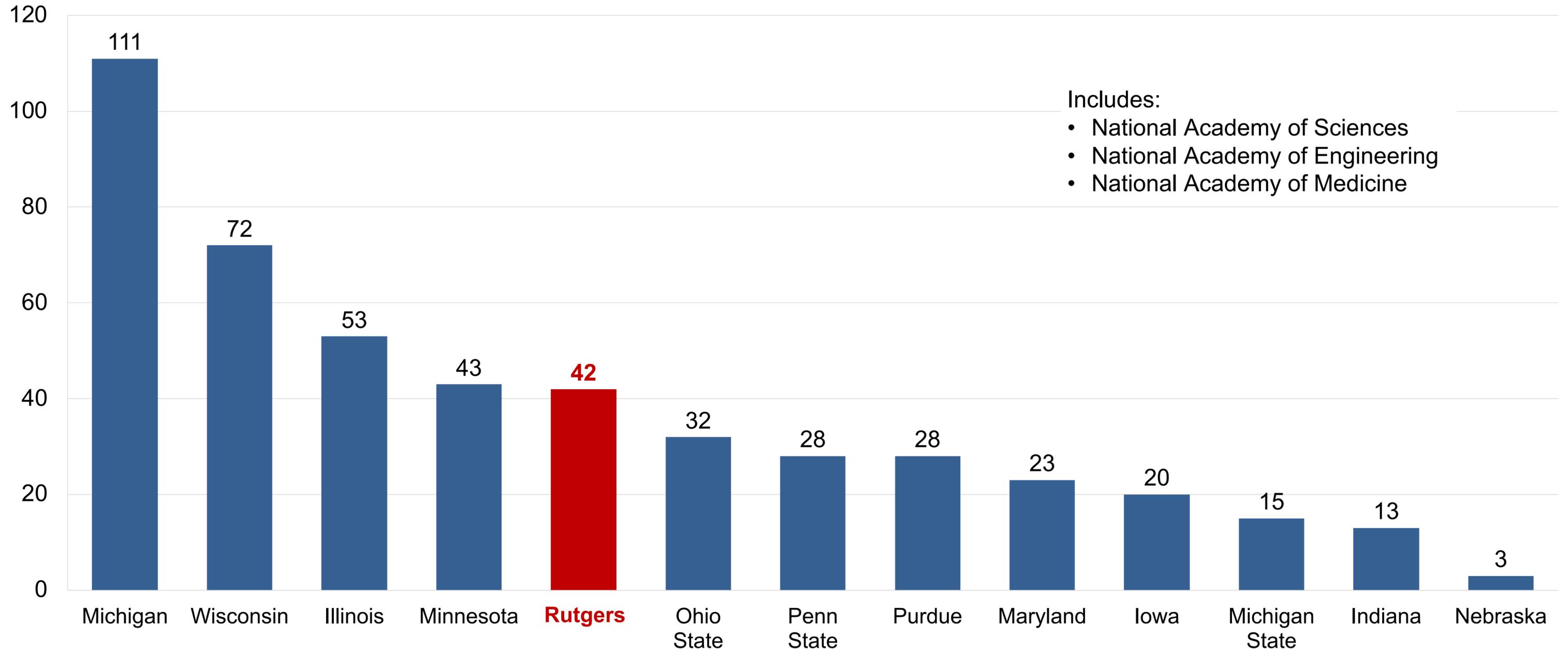
# Number of Members in the American Association for the Advancement of Science

## Big Ten Publics – January 2018



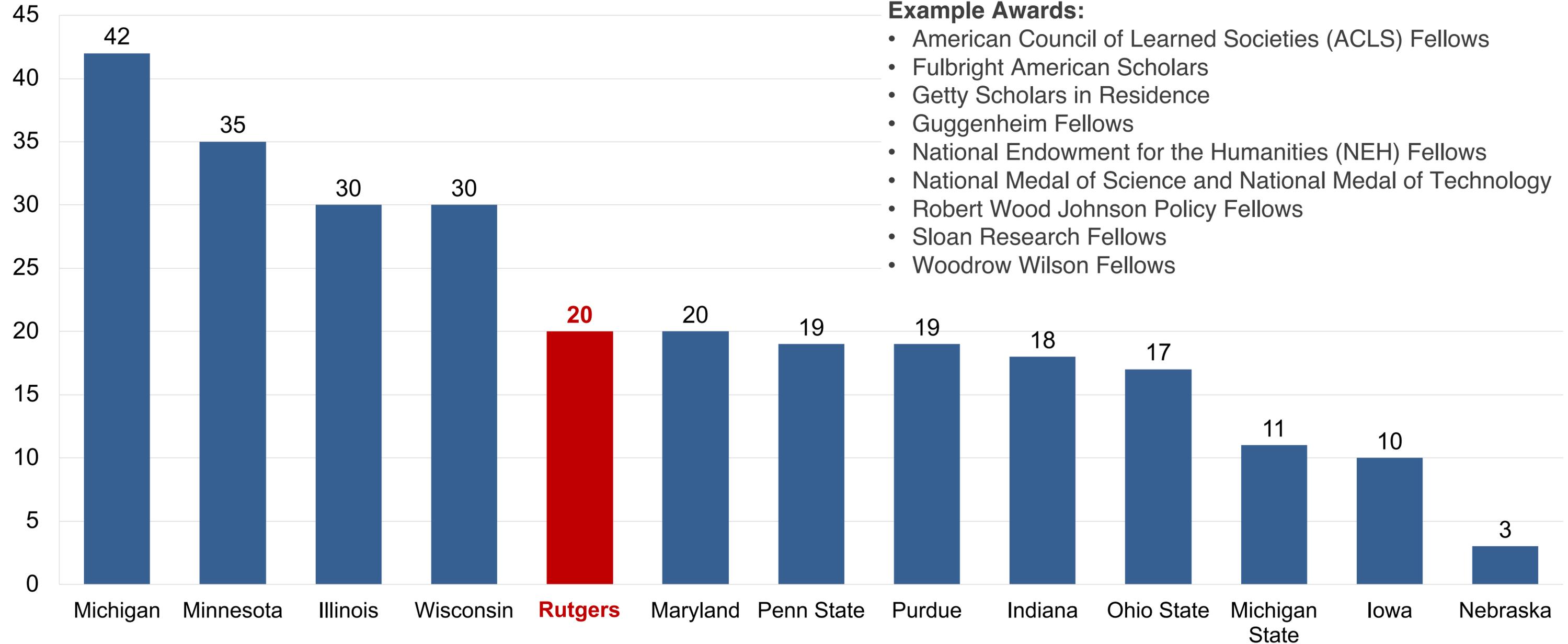
# Number of Members in the National Academies

## Big Ten Publics – January 2018



# Other Prestigious Faculty Awards

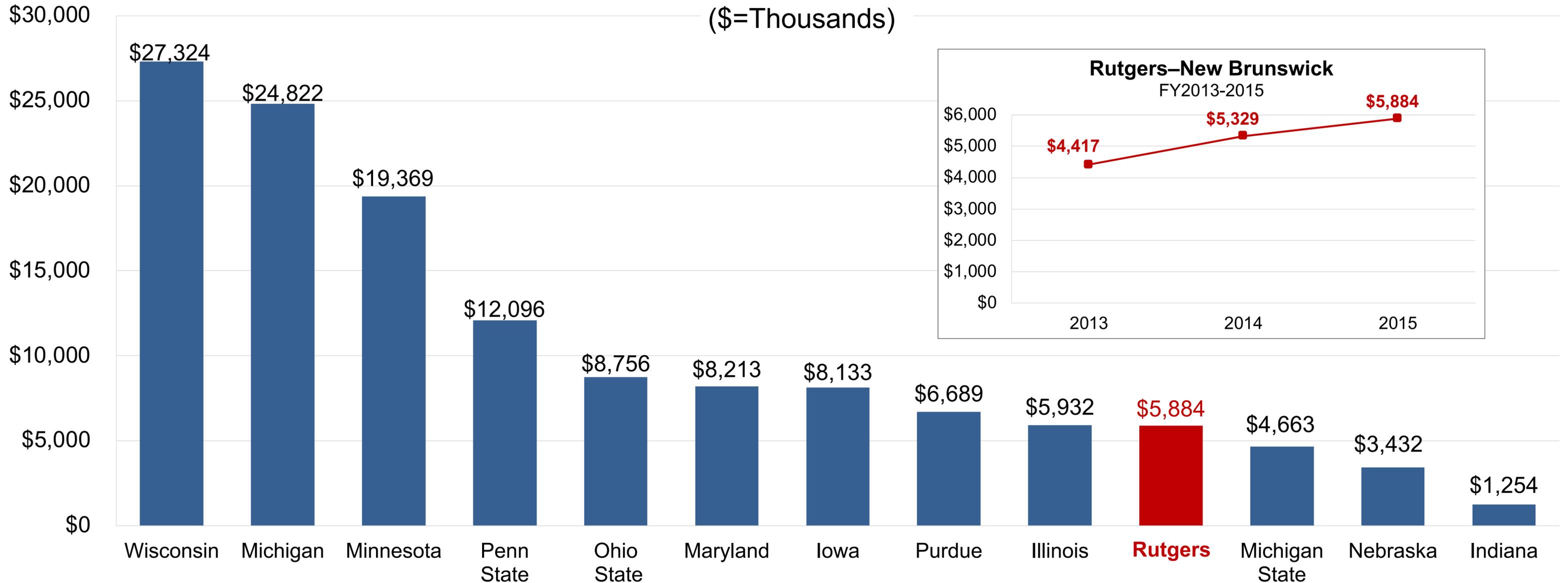
## Big Ten Publics – 2015



**Example Awards:**

- American Council of Learned Societies (ACLS) Fellows
- Fulbright American Scholars
- Getty Scholars in Residence
- Guggenheim Fellows
- National Endowment for the Humanities (NEH) Fellows
- National Medal of Science and National Medal of Technology
- Robert Wood Johnson Policy Fellows
- Sloan Research Fellows
- Woodrow Wilson Fellows

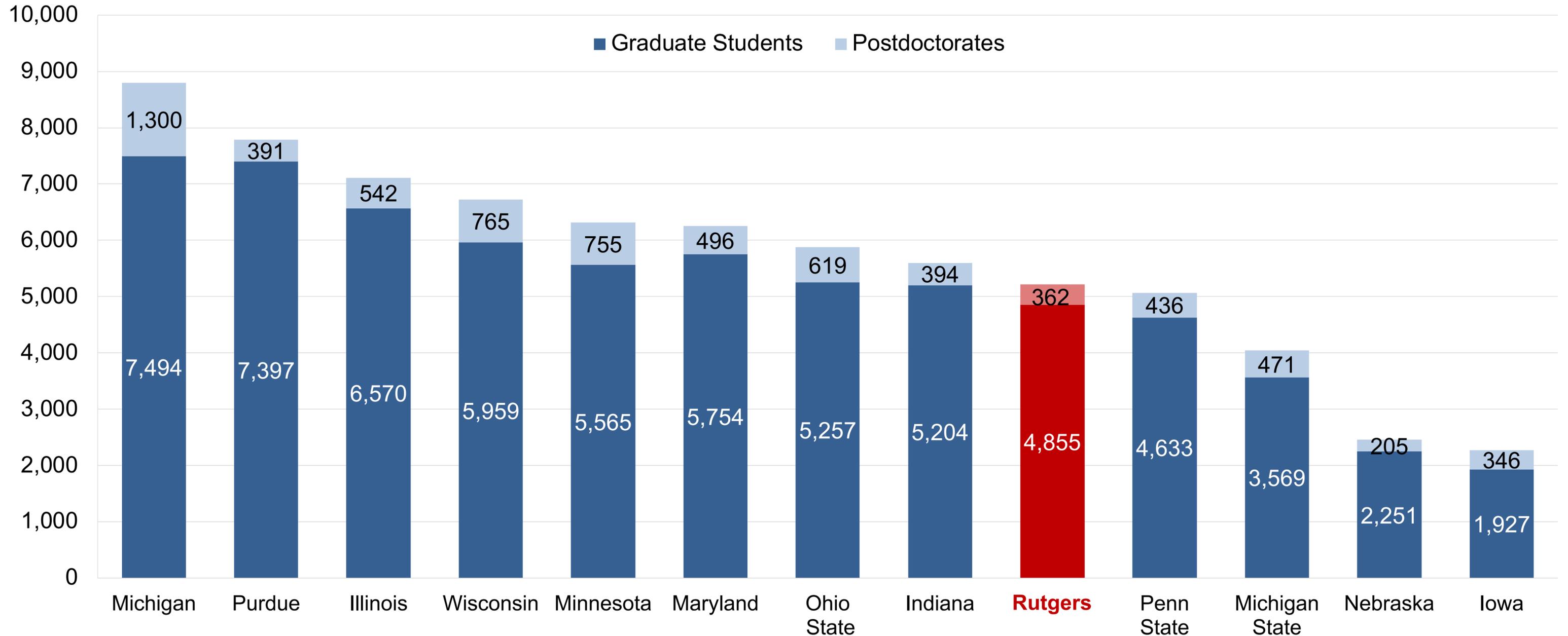
# Federal Awards for Science and Engineering Fellowships, Traineeships, and Training Grants Big Ten Publics – FY2015



Source: NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions  
 Note: Indiana reflects Bloomington. For NSF survey, the target population was all federal agencies that obligated money in FY 2015 to academic or nonprofit institutions or consortia for S&E R&D or the construction or maintenance of R&D facilities.

# Graduate Students and Postdoctorates in Science and Engineering

## Big Ten Publics – AY2015

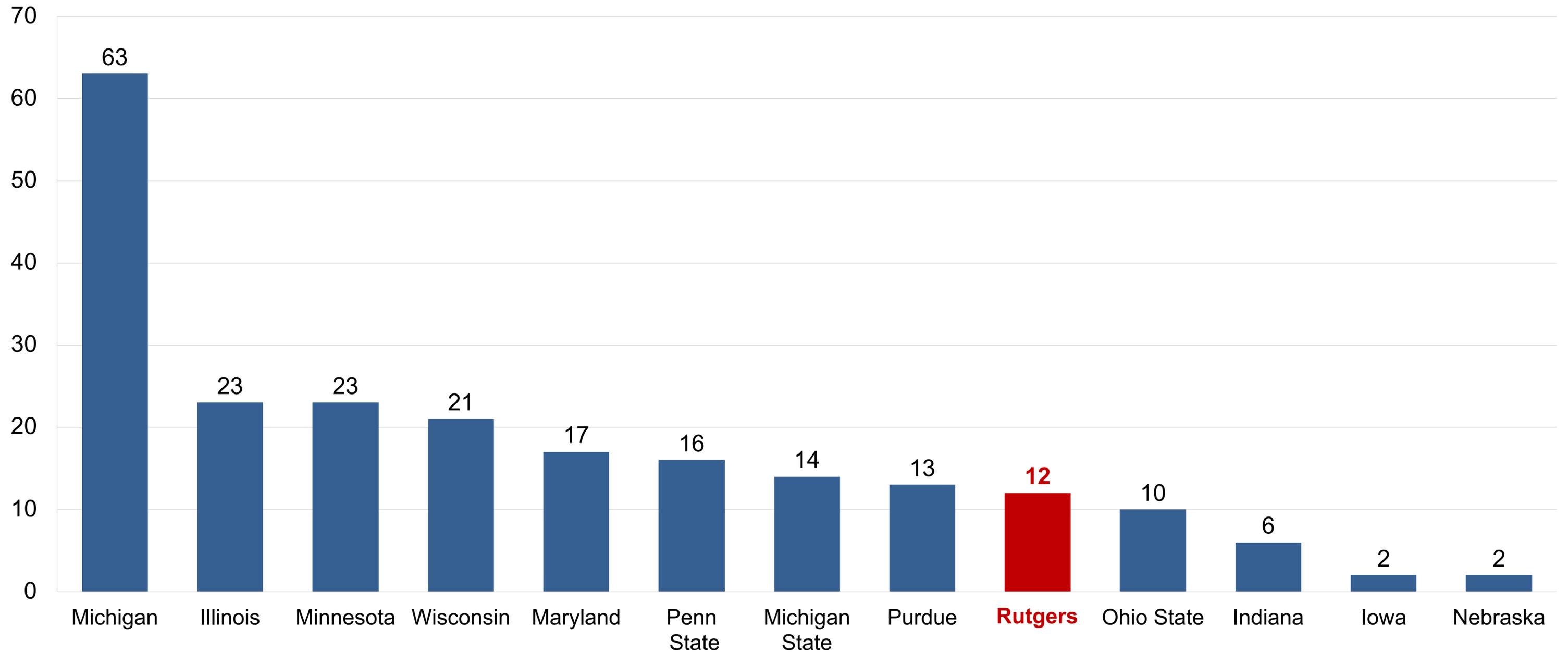


Source: NSF-NIH Survey of Graduate Students & Postdoctorates in Science and Engineering

Note: Indiana is system wide figure; campus level figures were unavailable. NSF reported Rutgers figure reflects university wide totals.

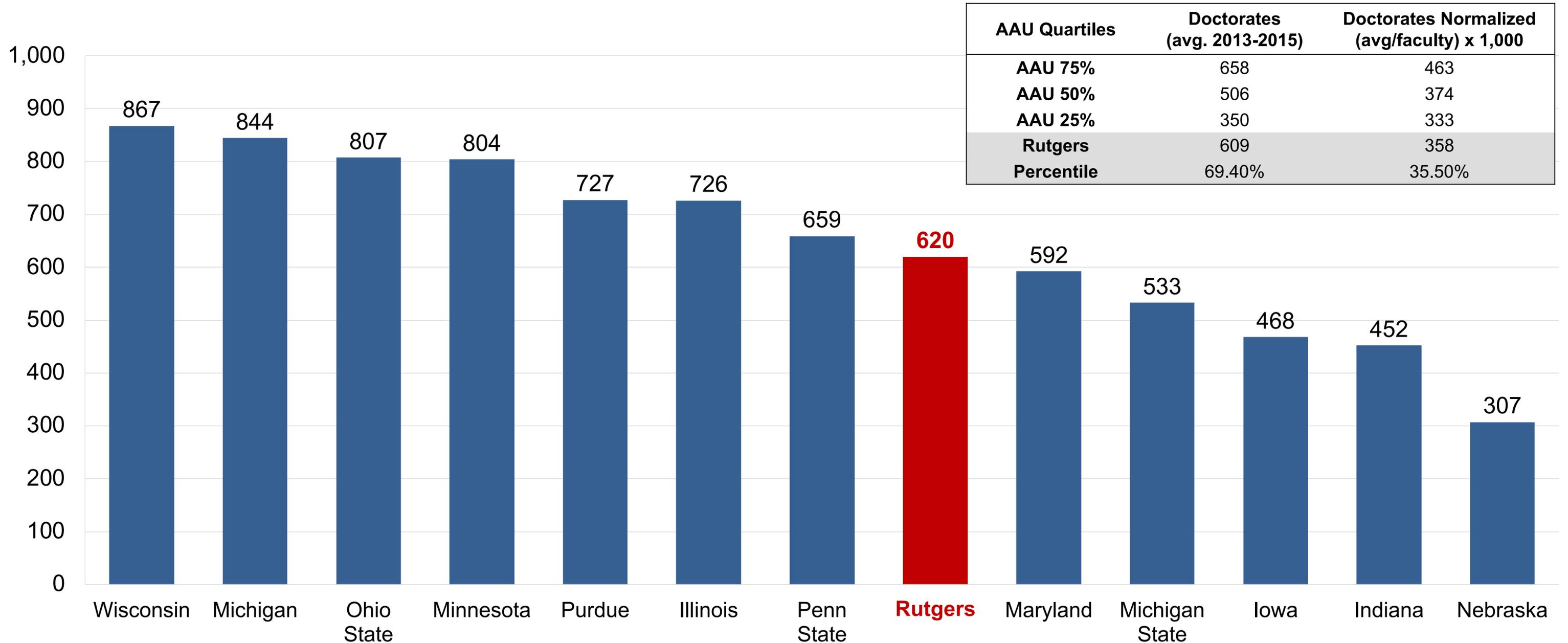
# Number of NSF Graduate Research Fellowships

## Big Ten Publics – 2017



# Number of PhD Degrees Awarded

## Big Ten Publics – AY 2015-2016



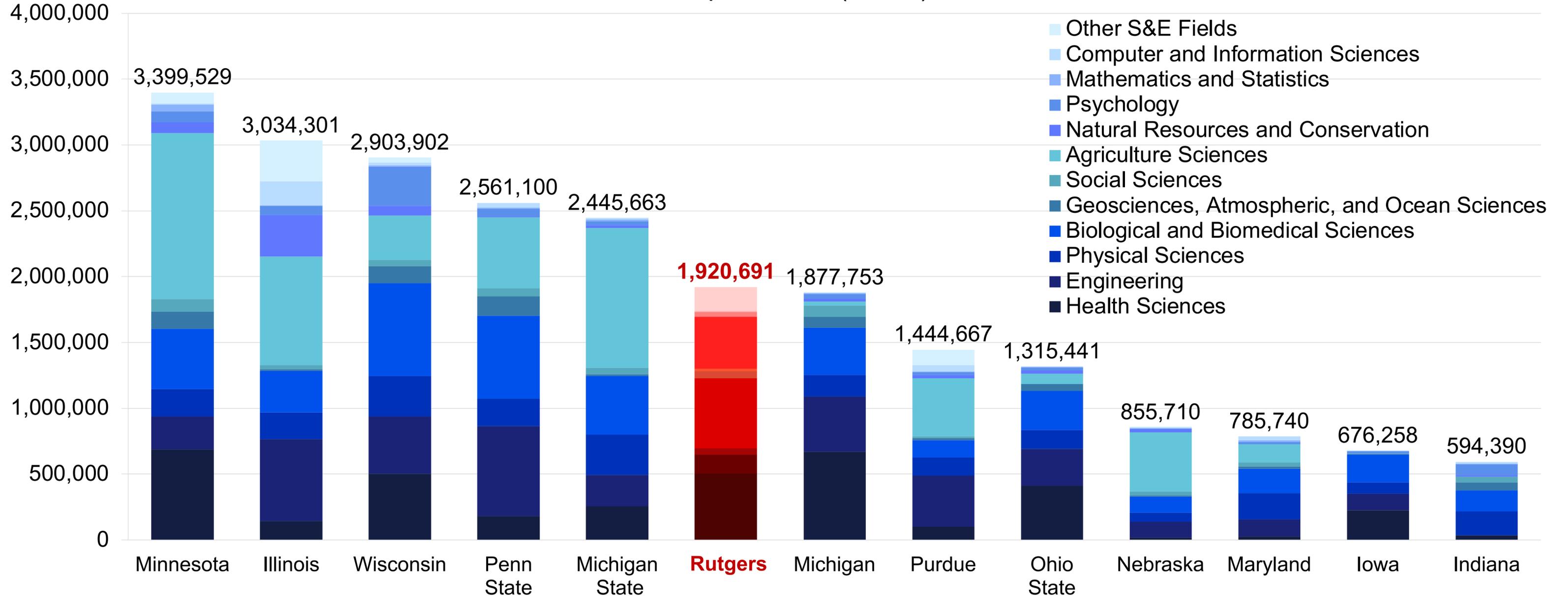
Source: IPEDS Completions Survey

Note: Doctoral degrees may include Ph.D., Ed.D., D.M.A., D.B.A., D.Sc., D.A., or D.M, and others, as designated by the awarding institution.

# Research Space - By Field

## Big Ten Publics – FY2015

Square Feet (NASF)



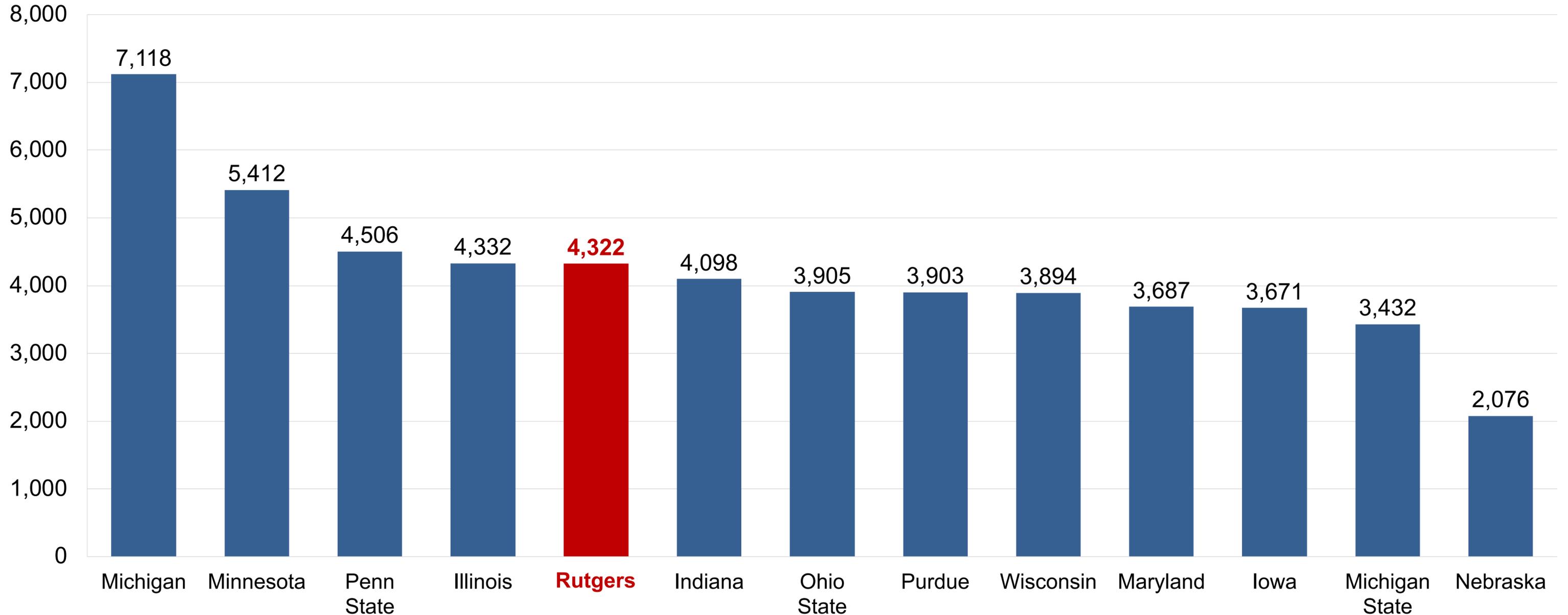
Source: NSF Survey of Science and Engineering Research Facilities  
 Note: Reflects all reported expenditures, not just S&E. Rutgers figures reflect FY2017. Indiana reflects Bloomington.

# Discussion

# Research Support (ORED)

# Average Number of All Grant Proposals Submitted Over Four Years

## Big Ten Publics FY2014 - FY2017



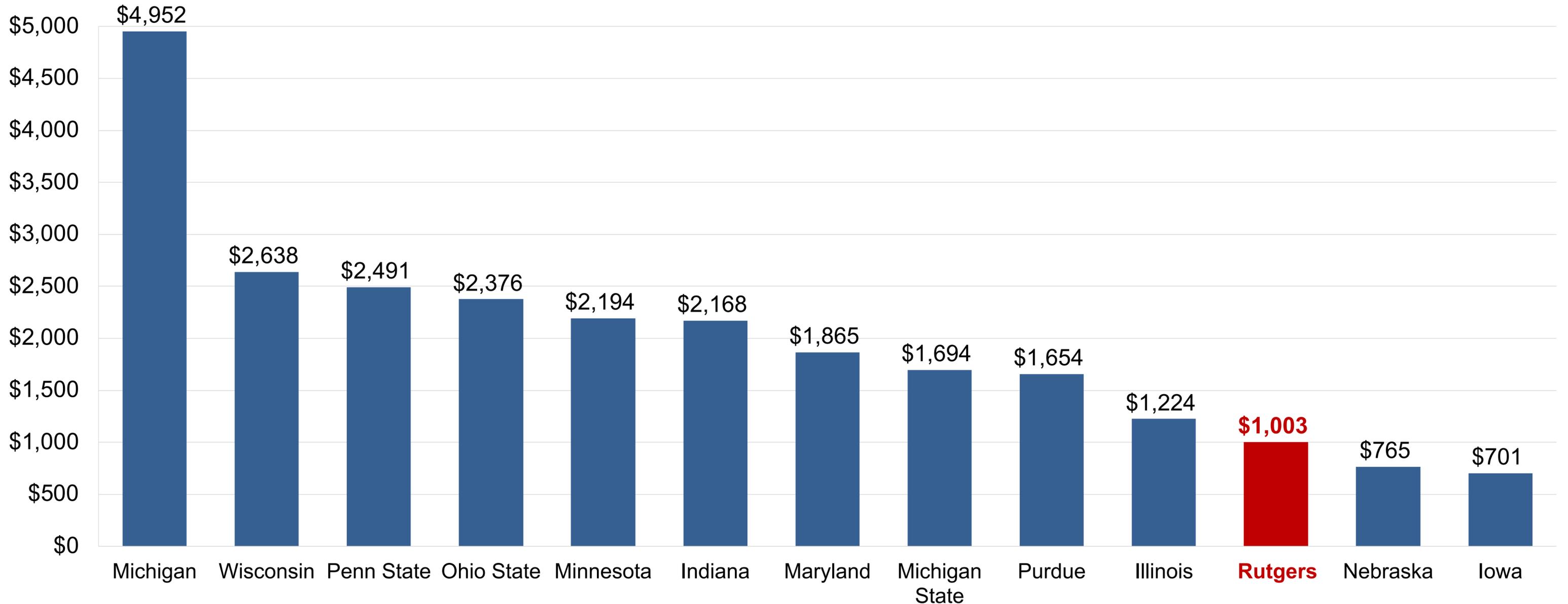
Source: Big Ten Academic Alliance Research Database.

Note: Note: Due to missing data points, Ohio State's average number of proposals does not include 2015 and 2017.

# Average Amount of All Grant Proposals Submitted Over Four Years

## Big Ten Publics – FY2014 - FY2017

(\$=Millions)

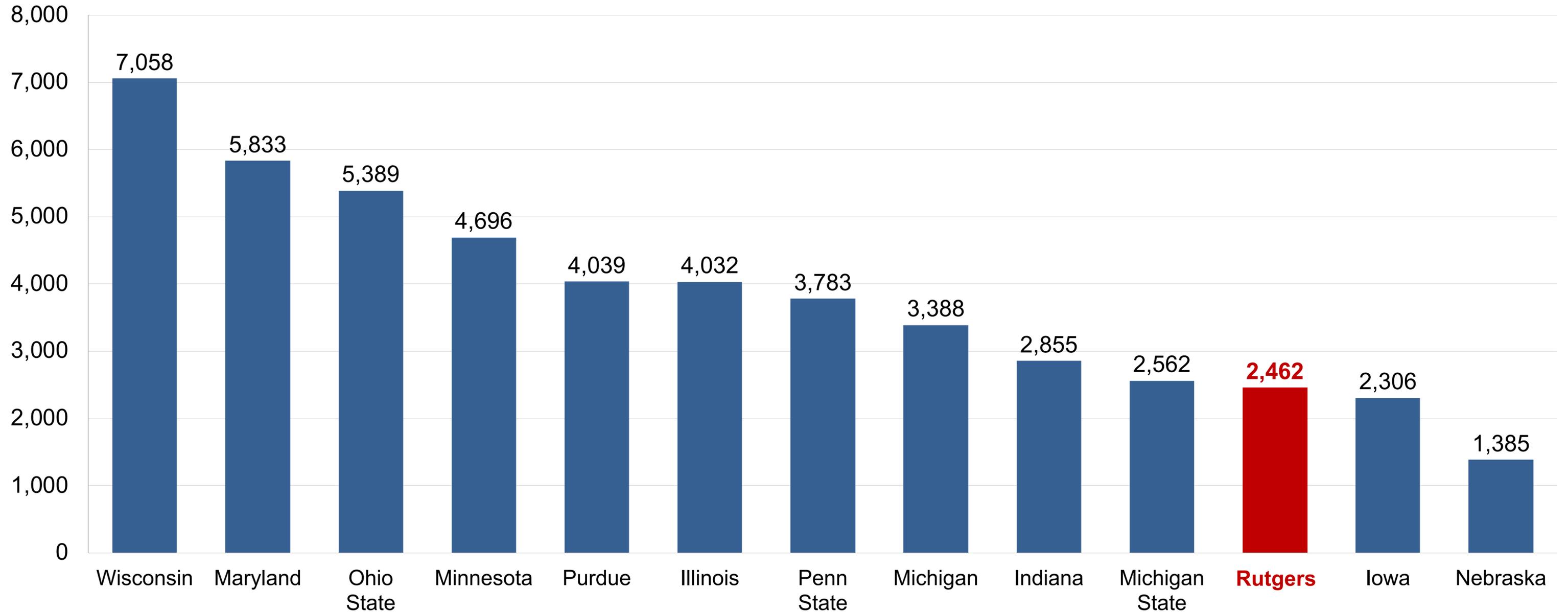


Source: Big Ten Academic Alliance Research Database.

Note: Due to missing data points, Ohio State's average amount does not include 2015.

# Average Number of All Grants Awarded Over Four Years

## Big Ten Publics FY2014 - FY2017



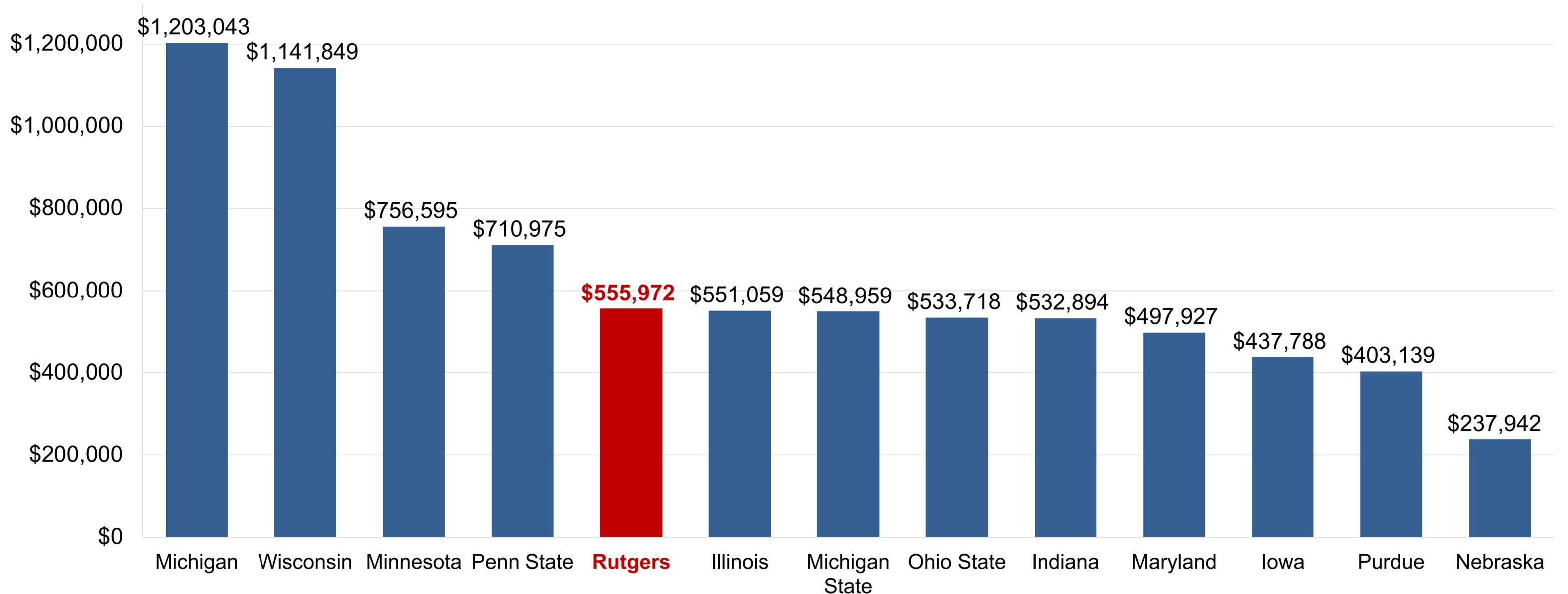
Source: Big Ten Academic Alliance Research Database.

Note: Due to missing data points, Ohio State's average number of awards does not include 2017.

# Average Amount of All Grants Awarded Over Four Years

## Big Ten Publics – FY2014 - FY2017

(\$=Thousands)



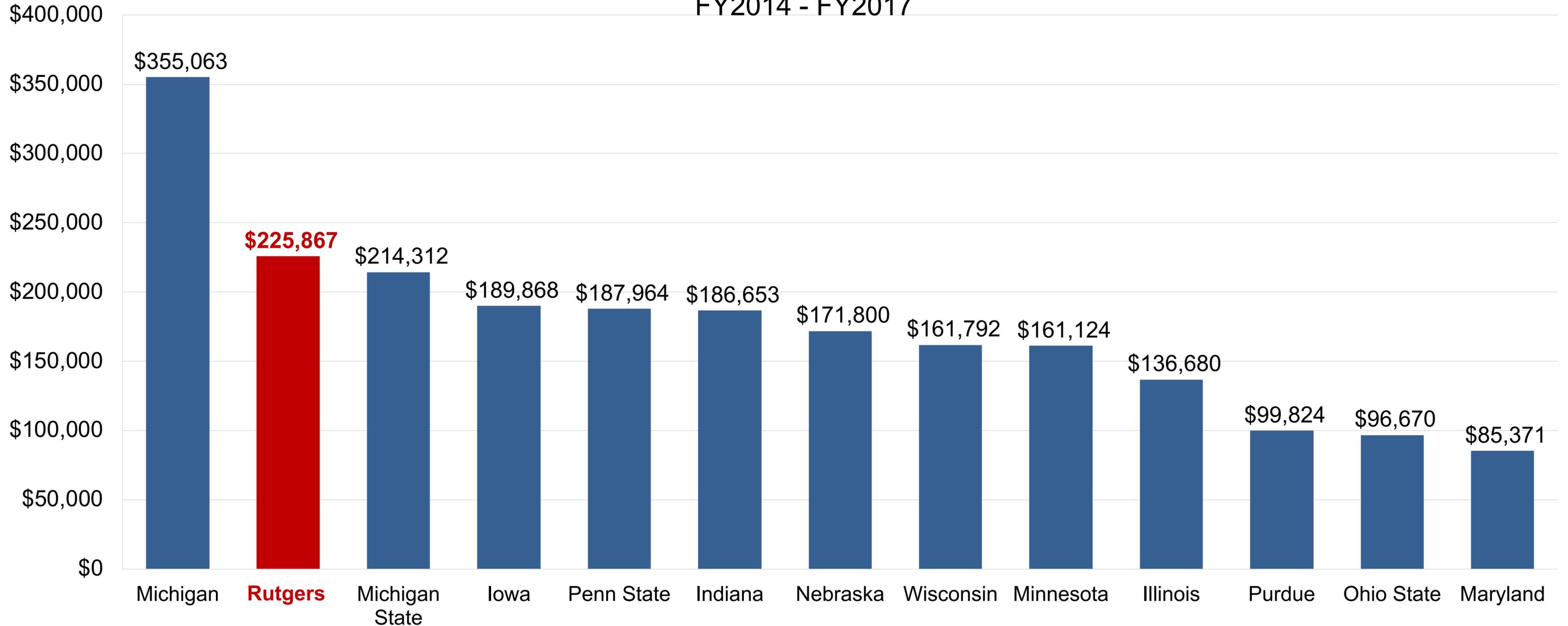
Source: Big Ten Academic Alliance Research Database.

Note: Note: Due to missing data points, Ohio State's average amount does not include 2015.

# Average Amount per Award Over Four Years

## Big Ten Publics

FY2014 - FY2017



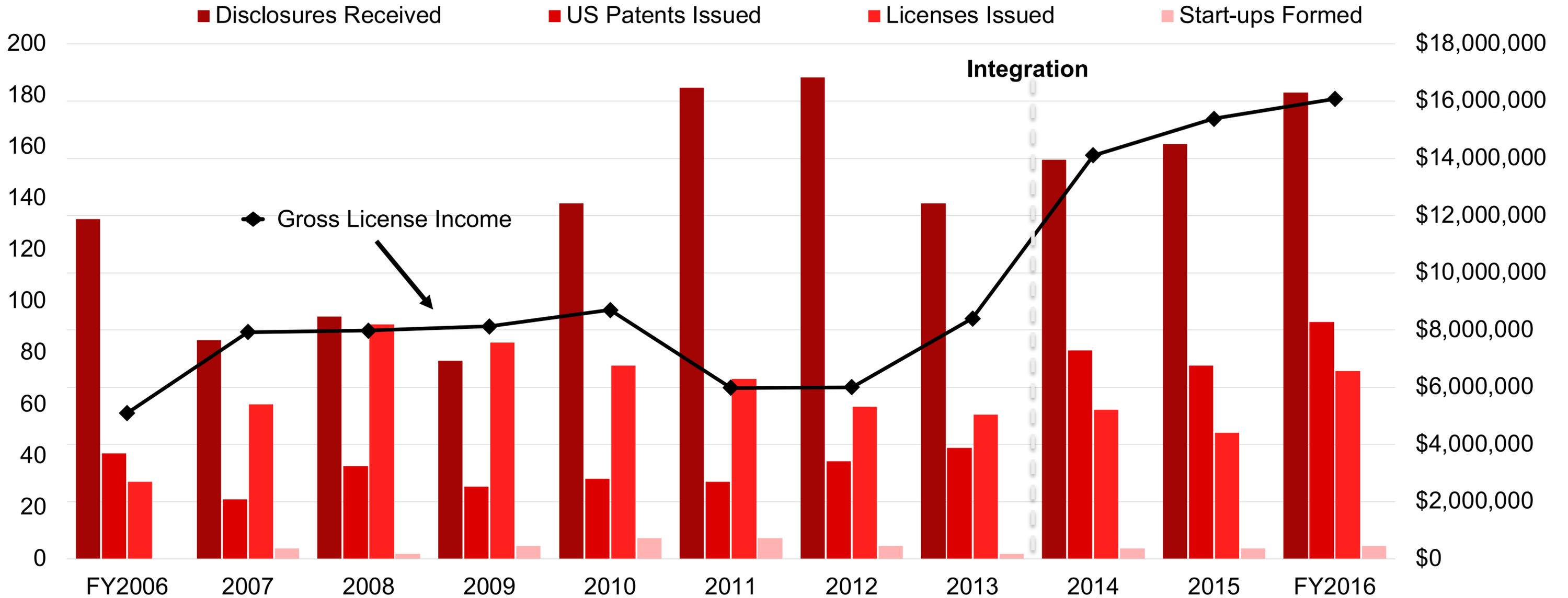
Source: Big Ten Academic Alliance Research Database.

Note: Due to missing data points, Ohio State's average award amount does not include 2017.

# Technology Transfer Metrics

## Rutgers–New Brunswick

### FY2006 - FY2017



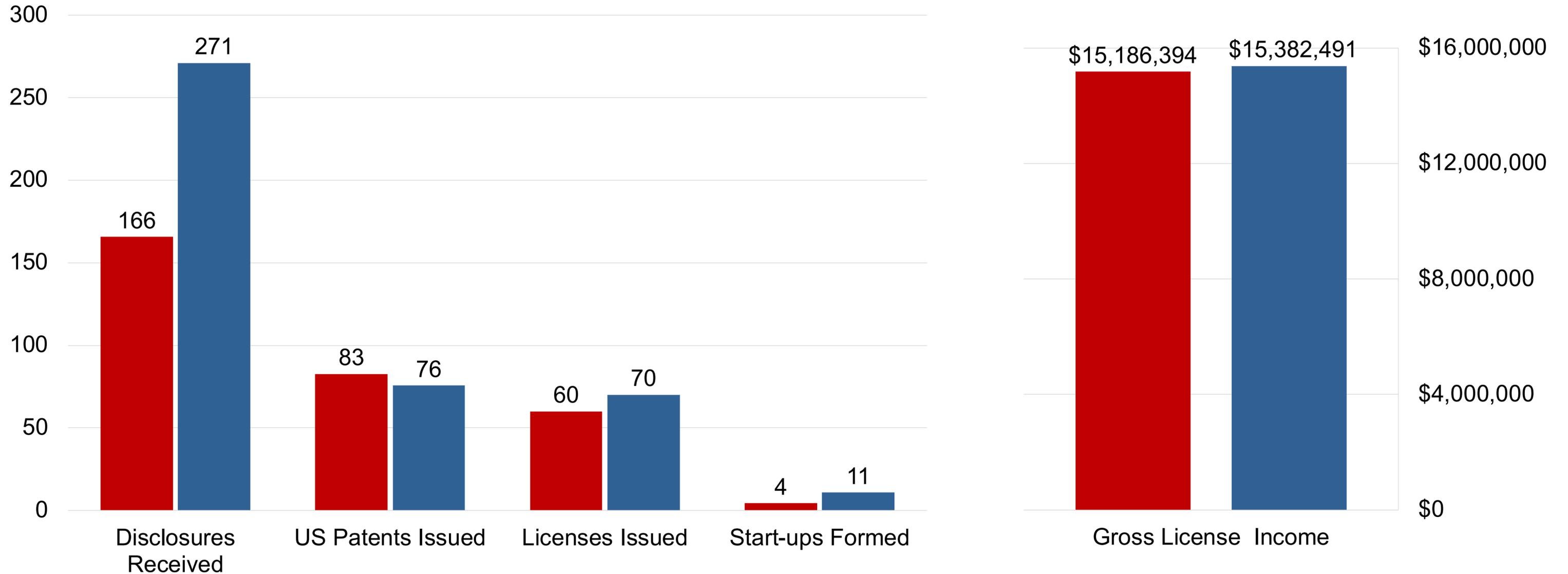
Source: Association of University Technology Managers, Statistics Access for Technology Transfer (STATT) Database.

# Tech Transfer

## Big Ten Publics – FY2014 - FY2016

3-Year Average

■ Rutgers ■ Big Ten Average

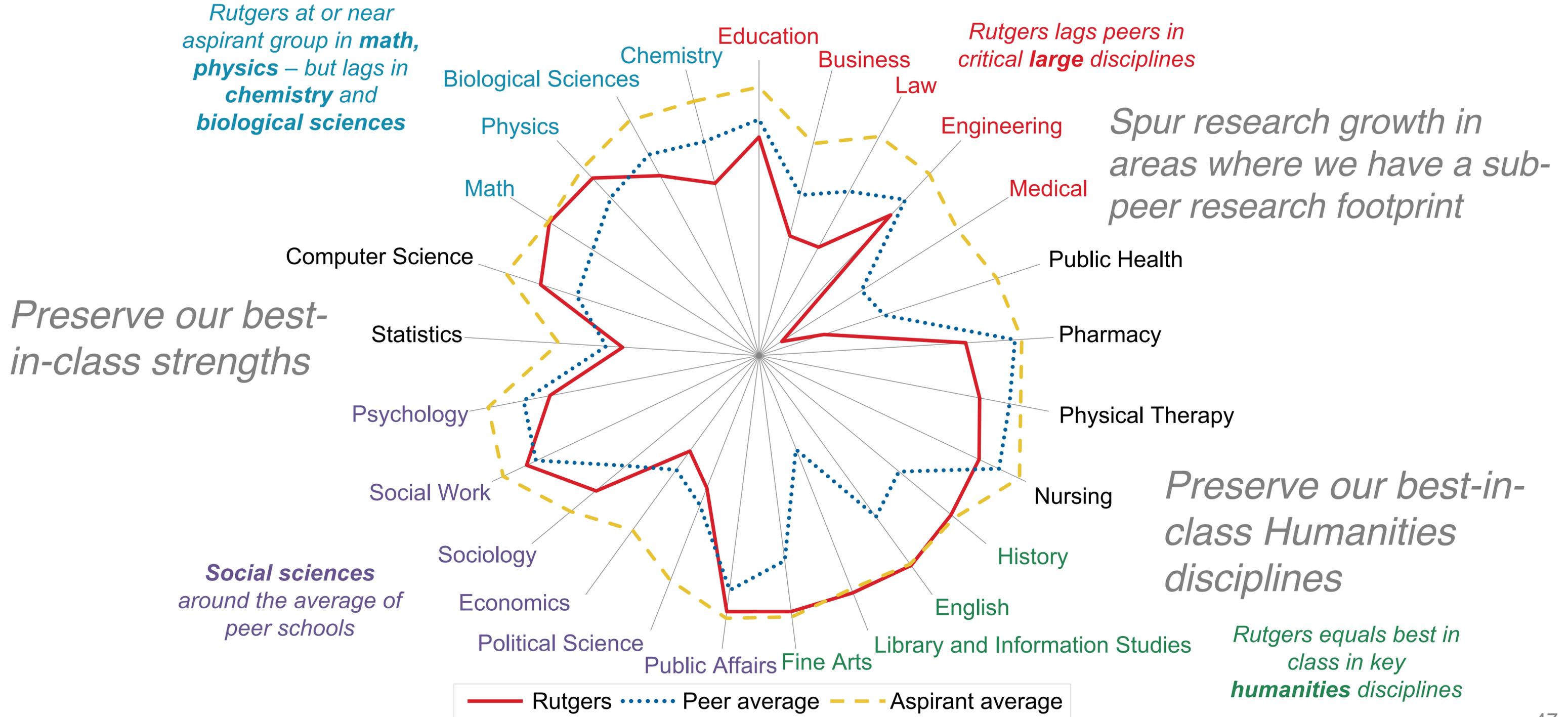


Source: Association of University Technology Managers, Statistics Access for Technology Transfer (STATT) Database.  
 Note: Big Ten average excludes University of Maryland System.

# Discussion

# Some Ideas to Spur Research Growth

# Analysis from University Strategic Plan – 2014



# Growing Rutgers' Research

- **Strategic Initiatives:**

Seek resonance with federal/state/industrial/foundation opportunities

→ **Increase # strategic grant submissions**

- **Coalescing Teams:**

Mobilize RU-NB faculty to develop a critical mass around areas of strength

→ **Enhance collaborative and competitive edge**

- **Research Capacity:**

Expand training program support for graduate students and postdocs.

→ **Invigorate our research ethos and increase # PhDs**



# Vice Chancellor for Research & Innovation

## Rutgers University–New Brunswick

- Recognize high quality research/grants/initiatives
- Develop faculty mentoring mechanisms
- Ideate new research initiatives and centers across RU-NB
- Seed and assist new training programs (predoctoral, postdoctoral)
- Oversee the growth of current research centers and the next phase
- Develop strategic research partnerships with industry
- Align RU-NB research to federal and state research agency opportunities

# Nucleating the next wave of collaborative research initiatives

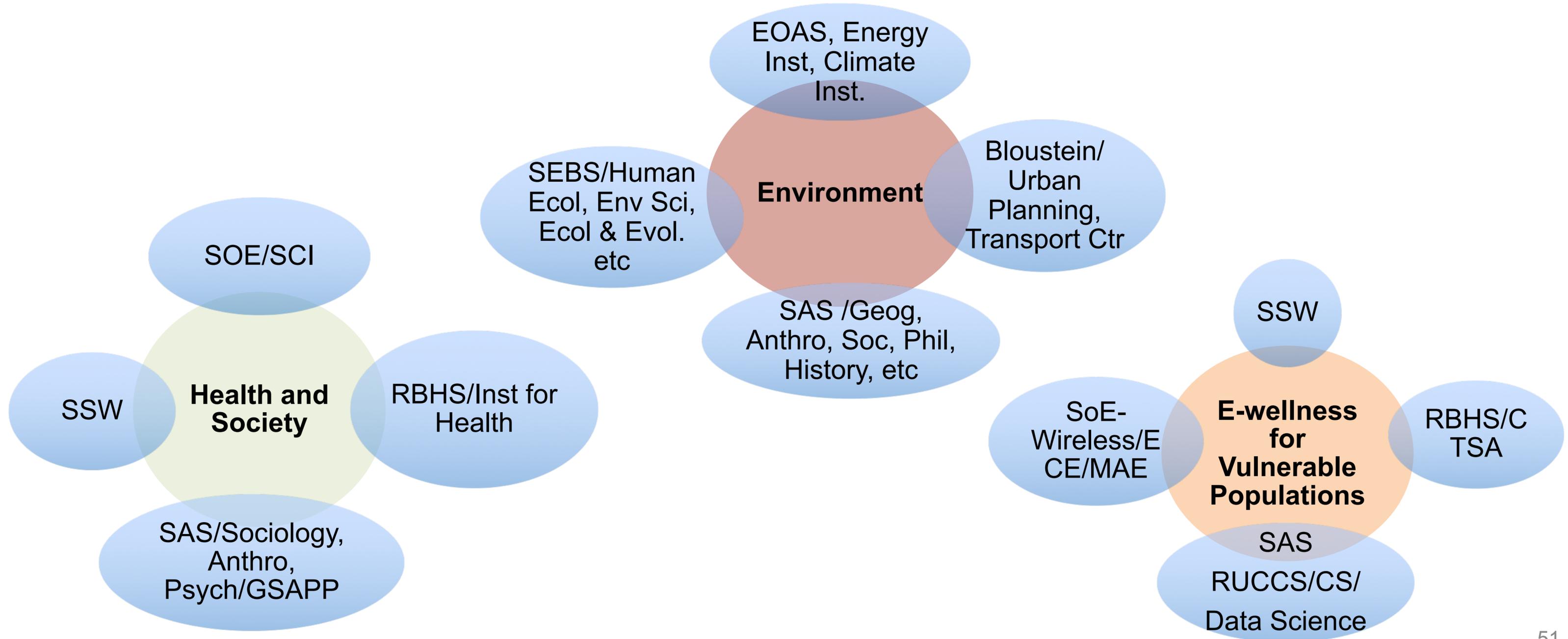
The VCRI and the leadership team will engage with RU-NB faculty to nucleate research initiatives where we can be most competitive. The goal is to be broad and inclusive while anchoring around our existing and emergent strengths.

A few examples:

- Advanced Materials Initiative
- The Microbiome Project
- Bio/Pharma Manufacturing Institute
- Energy & Sustainability Initiatives
- Security and the Human Element
- ...

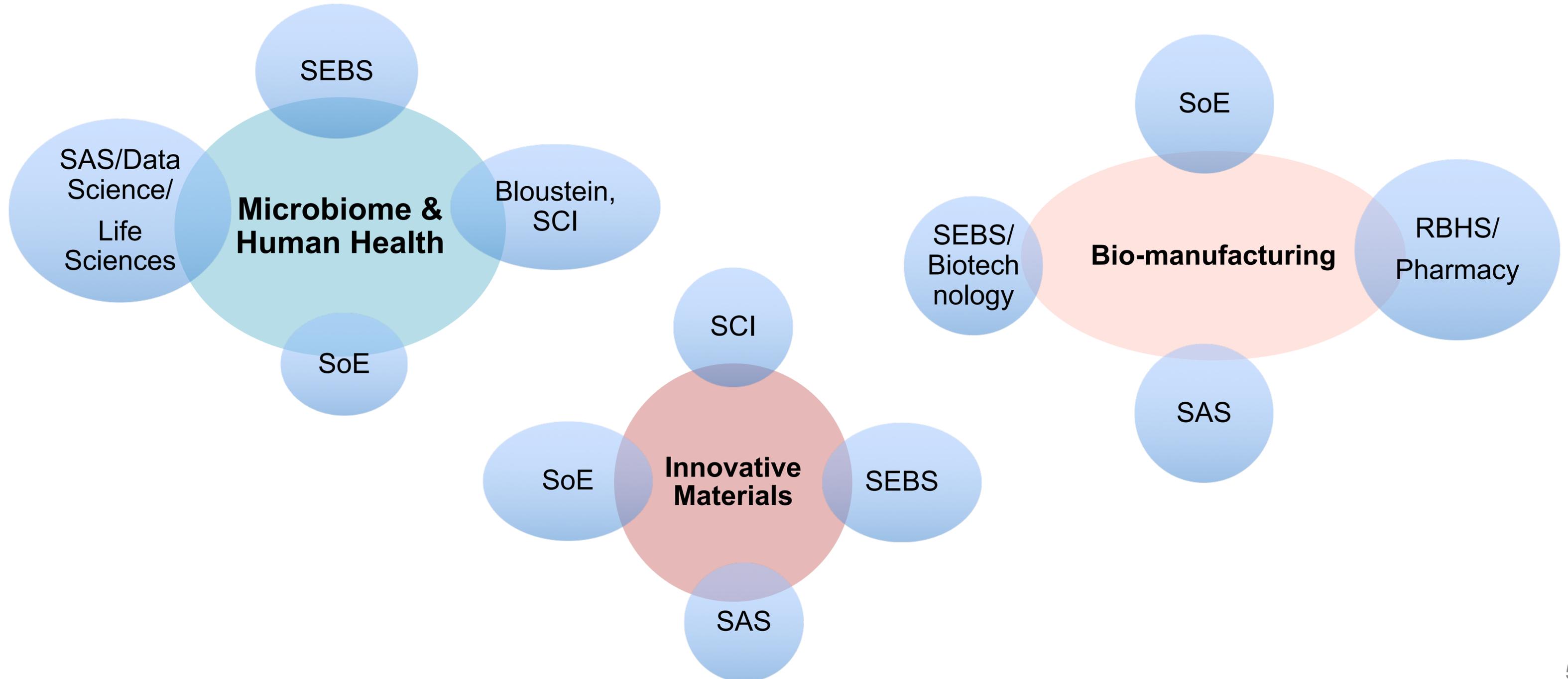
# Anchoring Team Research Around Multiple RU–NB Nodes

A sampling of possible ideation landscapes...

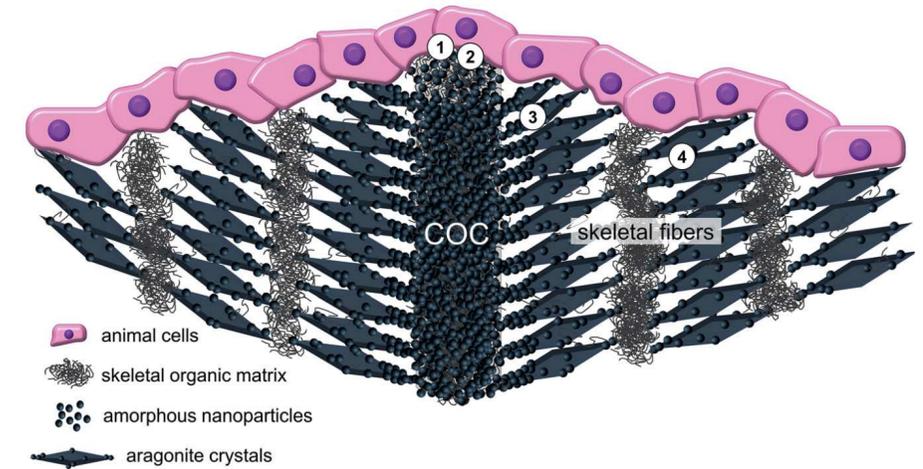
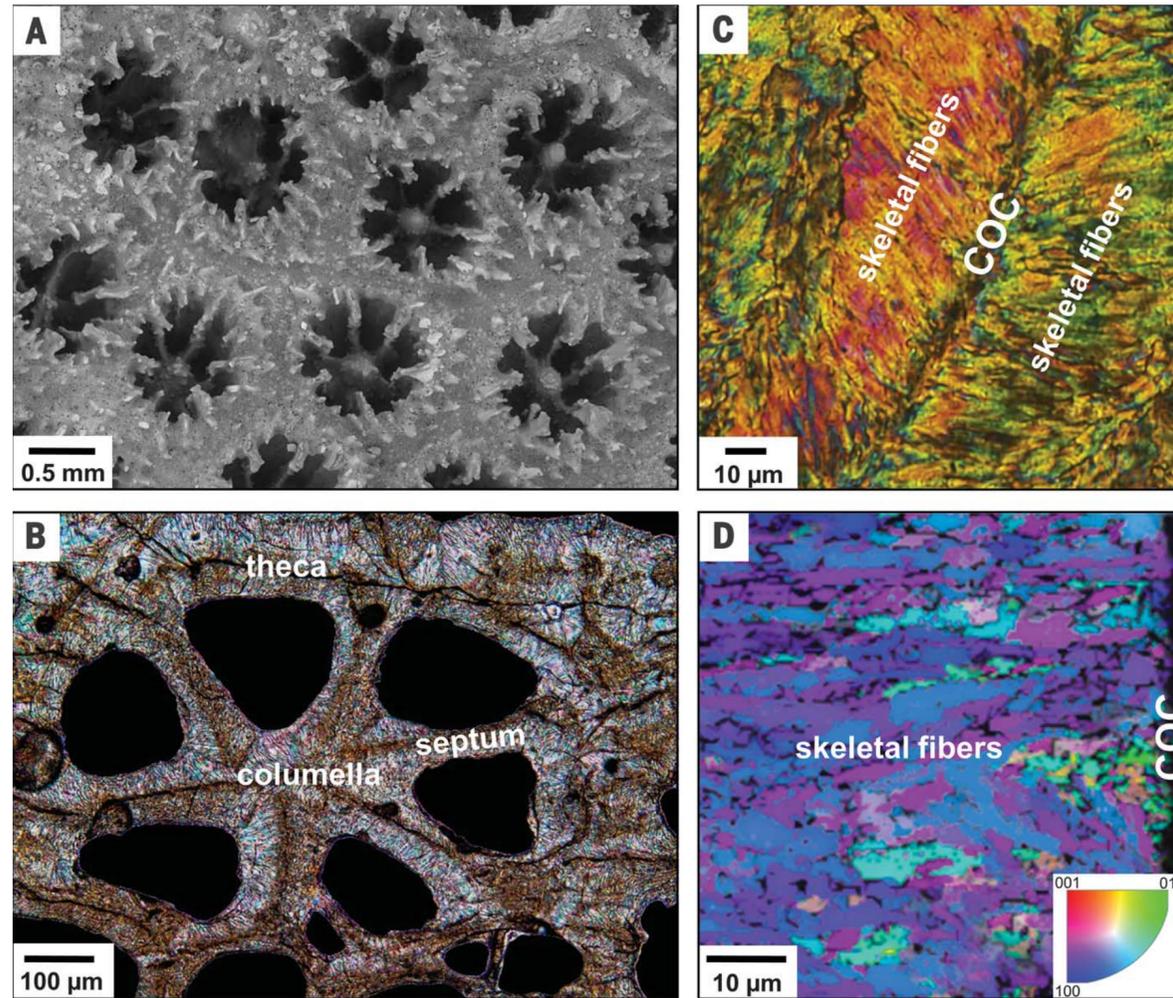


# Anchoring Team Research Around Multiple RU–NB Nodes

A sampling of possible ideation landscapes...



Obama Administration Praises Rutgers Electron Microscope as Project “Changing America” Challenge: Upgrading and Supporting our Instrumentation landscape



CORAL FORMATION

# Biological control of aragonite formation in stony corals

Stanislas Von Euw,<sup>1\*</sup> Qihong Zhang,<sup>2</sup> Viacheslav Manichev,<sup>3,4</sup> Nagarajan Murali,<sup>3</sup> Juliane Gross,<sup>5,6</sup> Leonard C. Feldman,<sup>4,7</sup> Torgny Gustafsson,<sup>4,7</sup> Carol Flach,<sup>2</sup> Richard Mendelsohn,<sup>2</sup> Paul G. Falkowski<sup>1,3,5,6,7\*</sup>

Von Euw *et al.*, *Science* **356**, 933–938 (2017) 2 June 2017

Advanced Research Infrastructure at RU-NB:  
Helium Ion Microscope

# Vice Chancellor for Research & Innovation

We welcome your ideas and engagement

## Vice Chancellor for Research & Innovation

*Rutgers University—New Brunswick*

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- Develop strategic research partnerships with industry
- Align RU-NB research to federal and state research agency opportunities



## VP for Research & Economic Development

*Rutgers University*

- Pre- and post-award grants support
- Research analytics
- IP and Commercialization
- Economic Development/outreach to industries
- Regulatory Affairs
- Animal Facilities (IACUC)
- Research Computing Services
- Innovation Park

Questions/Comments?

Ideas for Future Conversations?

*THANK YOU!*