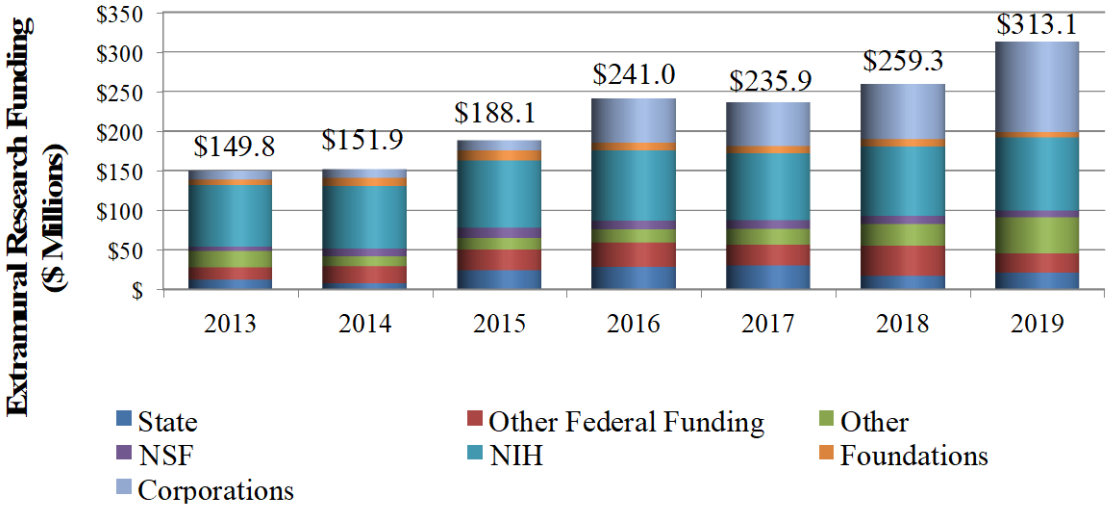
SUBMITTED BY: **STEPHEN M. LANIER, PH.D.**
VICE PRESIDENT FOR RESEARCH

DIVISION OF RESEARCH REPORT

External Research Funding



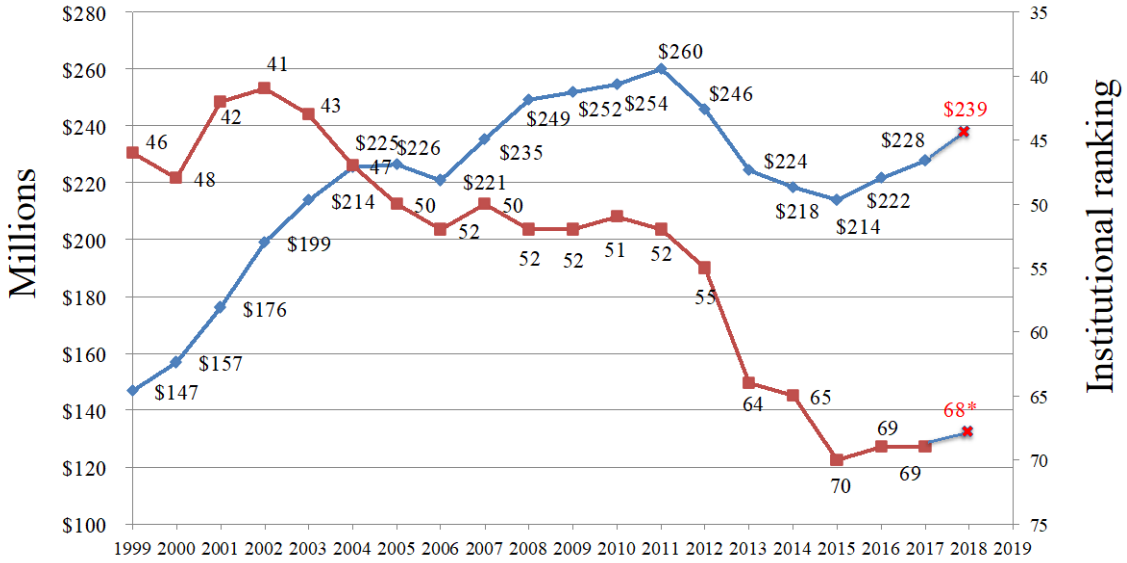
Sponsor Type	2013	2014	2015	2016	2017	2018	2019
Corporations	$10,945,325	$11,055,679	$12,384,515	$55,932,671	$54,748,102	$69,543,757	$114,301,629
Foundations	$7,529,182	$10,263,209	$12,646,443	$9,222,187	$9,113,596	$8,825,604	$7,216,099
NIH	$77,684,181	$78,603,871	$85,336,002	$89,000,331	$84,904,068	$87,991,234	$91,935,510
NSF	$5,404,977	$9,827,735	$12,992,732	$10,673,480	$10,376,183	$10,600,396	$8,359,599
Other	$20,229,869	$12,520,963	$14,823,738	$17,010,776	$19,811,924	$27,080,937	$45,627,964
Other Federal	$15,843,184	$21,879,113	$25,351,610	$30,265,253	$26,833,344	$38,077,078	$24,829,939
State	$12,174,377	$7,769,870	$24,542,587	$28,935,050	$30,149,726	$17,137,433	$20,850,557
Grand Total	$149,811,095	$151,920,440	$188,077,626	$241,039,748	$235,936,943	$259,256,439	$313,121,298

In accordance with standard practices award data for FY 2016 and beyond reflects a change in the methodology used to report clinical trial awards/contracts and includes clinical trial awards/contracts involving WSU Karmanos Cancer Institute and the School of Medicine that were not previously processed through the WSU Office of Sponsored Programs.

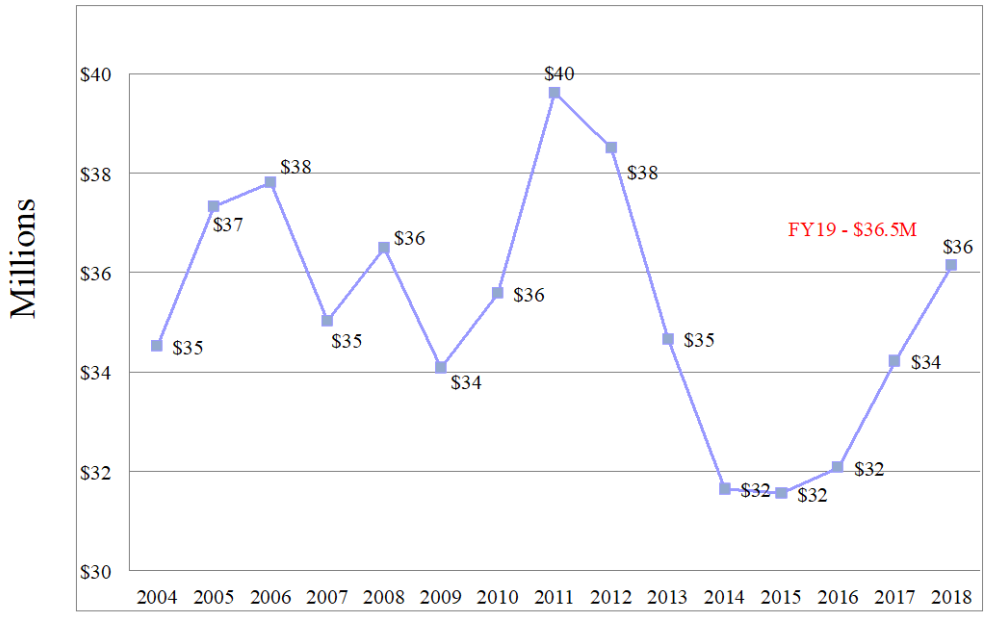
Federal Funding (% increase since 2013)

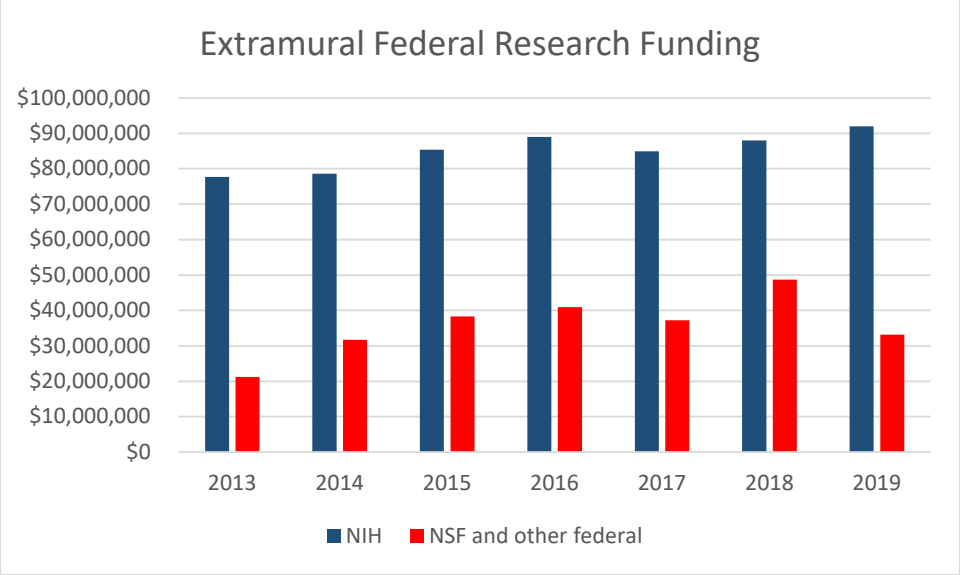
Total	=	26%
NIH	=	18%
NSF	=	55%
Other Federal	=	57%

Research Expenditures and Ranking
National Science Foundation
(public universities - 400)



Facilities and Administration costs recovered
(Generated by research expenditures)





	2013	2014	2015	2016	2017	2018	2019
NIH	**$77,684,181**	**$78,603,871**	**$85,336,002**	**$89,000,331**	**$84,904,068**	**$87,991,234**	**$91,935,510**
NSF and other federal	**$21,248,161**	**$31,706,848**	**$38,344,342**	**$40,938,733**	**$37,209,527**	**$48,677,474**	**$33,189,538**

Wayne State University team developing new treatments for Barth syndrome

Barth syndrome (BTHS) is a rare and life-threatening, X-linked genetic disorder that primarily affects males and is passed from mother to son; women who are carriers do not show symptoms of the disorder. Fifty percent of children born to a mother who is a carrier will inherit the defective gene, and all daughters born to an affected man will be carriers. BTHS is caused by a mutation in the *tafazzin* gene that results in decreased production of cardiolipin, an essential lipid for energy metabolism.

A team from Wayne State University, led by Miriam Greenberg, Ph.D., professor of biological sciences in the College of Liberal Arts and Sciences, recently received a grant from the National Heart, Lung, and Blood Institute of the National Institutes of Health to work on potential new targets for treating Barth syndrome. The four-year, nearly $1.5 million award, "The role of cardiolipin in the TCA (tricarboxylic acid) cycle: Implications for Barth syndrome," aims to identify specific metabolites as candidate for new treatments for Barth syndrome and other cardiomyopathies.

According to Greenberg, BTHS causes numerous pathologies, including cardiomyopathy, a disorder of the heart muscle; neutropenia, a reduction in the number of white blood cells; hypotonia, reduced muscle tone; undeveloped skeletal muscles and muscle weakness; delayed growth; decreased stamina; physical disability; and methylglutaconic aciduria, an increase in an organic acid that is characteristic of abnormal mitochondrial function.

Study provides first look at sperm microbiome using RNA sequencing sensitive enough to detect bacteria

A new collaborative study published by a research team from the Wayne State University School of Medicine, the CReATe Fertility Centre and the University of Massachusetts Amherst provides the first in-depth look at the microbiome of human sperm utilizing RNA sequencing with sufficient sensitivity to identify contamination and pathogenic bacterial colonization.

"We show that non-targeted sequencing of human sperm RNA has the potential to provide a profile of micro-organisms (bacteria, viruses, archaea)," said Stephen Krawetz, Ph.D., associate director of the C.S. Mott Center for Human Growth and Development at WSU and the Charlotte B. Failing Professor of Fetal Therapy and Diagnosis in the Department of Obstetrics and Gynecology, and the Center for Molecular Medicine and Genetics. "This information was recovered from the data typically cast aside as part of routine nucleic acid sequencing. The enhanced sensitivity and specificity of the sequencing technology as compared to current approaches may prove useful as a diagnostic tool for microbial status as part of the routine assessment as we move toward personalized cYare."

The study, "What human sperm RNA-Seq tells us about the microbiome" (https://link.springer.com/article/10.1007%2Fs10815-019-01672-x) published in the Journal of Assisted Reproduction and Genetics), sought to determine if human sperm RNA sequencing data could provide a sensitive method of detection of micro-organisms, including bacteria, viruses and

archaea compared to current methods of targeted culturing. The researchers collected 85 semen samples, isolated the sperm RNA and subjected it to RNA sequencing.

Grace Swanson, Ph.D., a postdoctoral fellow working with Dr. Krawetz, discovered a sample with an abnormally high level of microbial sequences. After taking a closer look, the sample was found to contain a considerable amount of Streptococcus agalactiae bacteria. A leading cause of neonatal infection during pregnancy and post-delivery linked to significant mortality rates in premature births, this bacteria can also be life-threatening in adults, particularly the elderly.

The current method for testing the male reproductive tract microbiome relies on culturing samples. This, the study reported, can be limiting because the majority of pathogens cannot be cultured. The costs of RNA sequencing have dropped dramatically and continue to decrease, providing a more complete picture of the human biome.

NIH grant to improve neonatal brain injury detection using photoacoustic imaging technology

Hypoxic-Ischemic brain Injury (HII) is a severe injury caused by oxygen deprivation to the brain at or near time of birth in preterm or low birth weight newborns. It is very important to recognize HII as soon as possible because early intervention improves outcomes. Preterm neonates experiencing HII are at risk for developing hypoxic-ischemic encephalopathy, cerebral palsy, periventricular leukomalacia, and hydrocephalus.

Kamran Avanaki, Ph.D., assistant professor of biomedical engineering in Wayne State University's College of Engineering, received a two-year, $725,000 R01 grant from the National Institute of Biomedical Imaging and Bioengineering of the National Institutes of Health for the development of a novel point-of-care 3D neonatal photoacoustic tomography (3D-nPAT) to improve the detection and measurement of hypoxic-ischemic in neonates without the need for sedation, radiation or radionuclides.

"3D-nPAT is safer and less costly than current, clinically-used neuroimaging methods," said Avanaki. "It will allow for earlier treatment, which could circumvent neural complications and improve functional outcomes from cerebral palsy and cognitive impairments."

This project is a collaboration between the Wayne State University Department of Biomedical Engineering, the neonatology program in Wayne State's School of Medicine, the Department of Biomedical Engineering at the University of Michigan and the Department of Neonatology at Harvard Medical School. The team plans to fully test the 3D-nPAT technique for future potential clinical use.

Wayne State University's MTRAC Innovation Hub for Advanced Computing awards $250,000

In its first year as a program, the Michigan Translational Research and Commercialization (MTRAC) Innovation Hub for Advanced Computing at Wayne State University awarded a combined $250,000 in funding to three high-tech, early-stage research projects led by researchers at Wayne State University, Michigan State University and University of Michigan-Dearborn. These projects aim to

address future or poorly met market needs in frontier computing technologies such as deep learning, augmented reality and robotic process automation.

The MTRAC Innovation Hub for Advanced Computing call for applications attracted highly competitive and innovative technology proposals from researchers around the state. Ten proposals were submitted by Wayne State researchers, which resulted in new invention disclosures that demonstrated robust research activities and tech commercialization opportunities at Wayne State University.

The three projects funded by the hub focus on transformational innovations that have the potential to bring disruptive solutions to the market in their respective fields. The teams will receive mentorship support from the committee members and mentors-in-residence from Tech Transfer Talent Network as their projects progress toward commercialization. Funded projects include:

- Abhilash Pandya, Ph.D., (Wayne State University) is developing an integrated robotic and mixed-reality platform to provide surgeons the ability to see and predict potential bleed out during the intraoperative procedures.
- Guowei Wei, Ph.D., (Michigan State University) whose MAID2 — Mathematical AI for Drug Discovery — technology significantly reduces the time and amount of capital required to bring new drugs to the market.
- Marouane Kessentini, Ph.D., (University of Michigan-Dearborn) is commercializing software refactoring technology that automates the quality control of software development and proactively improves and optimizes the coding and debugging of applications using deep learning and continuous integration innovation.