Chapter 9  Research & Technology Transfer

Goals
Excellence in research and scholarly activity is one of several central tenets of the University of Michigan’s mission. The broad scope, overall size, and emphasis on interdisciplinary approaches of the U-M’s research program contributes to its standing as one of the world’s leading research institutions. As such, the faculty attracts generous financial support from the public and private sectors.

The University expects that research discoveries by many faculty members will contribute to the development of innovative products and processes. The U-M places a high priority on supporting this kind of activity through the Office of Technology Transfer and the Business Engagement Center.

Overview
Total research expenditures by the University from all sources (external and University funds) exceeded $1.6 billion in FY 2021. Furthermore, U-M ranks second highest in the nation for total research spending among all universities, and highest in this category among public universities (based on FY2020 figures, which are the latest available). Sixty-six percent of U-M's research spending is provided by outside sources, with the largest share of research funding from the federal government.

The University’s largest fraction of grant-supported work occurs in the biomedical and clinical sciences. The U-M Medical School alone regularly attracts more than $400 million each year in research grants.

Some research is of special interest to the private sector. The Office of Technology Transfer works with faculty inventors to file patents and negotiate licensing agreements that benefit the University's industry partners and fund additional research and development work on campus. In certain instances, U-M faculty members establish companies to develop their inventions, thanks in part to an emerging campus culture of innovation and entrepreneurship.

In addition, U-M wishes to promote partnerships that involve academia, government and industry. Toward this goal, the University designates funds to interdisciplinary teams whose work has potential for broad societal impact.

U-M graduates also demonstrate success in starting companies. For instance, TechCrunch, an online publisher of news about the technology industry, reported in May 2018 that 76 University of Michigan alumni have launched startup companies that received $1M or more in funding over the previous year. Only UC-Berkeley and UCLA had more of its alumni obtaining similar levels of startup funds.

For More Information
U-M Office of Research (research.umich.edu)
Office of Technology Transfer (techtransfer.umich.edu)
Business Engagement Center (bec.umich.edu)

Charts in Chapter 9
9.1.4 Sponsored Research Expenditures by Type, FY2021.
9.2 Sponsored Research Workforce by Full-Time Equivalents, Fall 2020.
9.4.2 Revenues from Royalties and Equity Sales, FY2011-FY2021.
9.5 Counts of U-M Faculty, Staff and Students Involved in Federally Sponsored Research Who Later Took Positions at other Institutions or Companies, by state for 2002-2015.

1 “Which public US universities graduate the most funded founders?” TechCrunch, May 25, 2019.
The inflation-adjusted decline in total U-M research expenditures since FY2019 is largely attributed to the reduction in research activity on campus due to the pandemic. Even so, U-M continues to spend more on research each year than any other public university in the United States.


![Graph showing total research expenditures adjusted for inflation from 1980 to 2021.](image)

**SOURCE:** U-M Volume of Research (UMOR); American Association for the Advancement of Science Historical Trends in Federal R&D

The research expenditures displayed in this chart and the table for 9.3 include those for the Ann Arbor, Dearborn, and Flint campuses. All other figures show data only for the Ann Arbor campus.

Note: Starting in FY2007, research support originating from the U-M faculty medical group practice was included as research expenditures. Previously this was reported with clinical activity.

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\(^2\) Based on 20201 U.S. Consumer Price Index as estimated by the U-M Research Seminar on Quantitative Economics (RSQE).
As the federal budget allocated to non-defense R&D spending stalled in the later part of this decade, the U-M has made an effort to grow research support from internal and non-federal sources.

9.1.2 Research Expenditures by Major Funding Source, Adjusted for Inflation\(^3\), FY2011-FY2021.

Source: U-M Financial Operations

\(^3\) Based on 2021 U.S. Consumer Price Index.
Direct research expenditures on the U-M campus is greater today compared to 10 years ago even though the level of expenditures varies from year to year.


SOURCE: U-M Financial Data

Direct expenditures cover salaries and benefits of researchers, whether faculty, staff or students, as well as equipment and supplies, research-related travel and other expenses tied to specific projects. Overhead expenditures are presented in chart 9.1.5.

4 Based on 2021 U.S. Consumer Price Index.
About 46 percent of the total annual sponsored research expenditures on the Ann Arbor campus goes to salaries and benefits for faculty, staff, and graduate students.

9.1.4 Sponsored Research Expenditures by Type, FY2021.

The FY2021 total externally funded research expenditures for the Ann Arbor campus was $1.057 billion, a decrease of $8.7 million from the previous year. Salaries and benefits is the largest cost component.

Indirect costs (IDC) are the costs of University operations that are not assigned to a particular project, such as the costs for general research administration, utilities use in research space, and other services that contribute broadly to the operation of the University’s research enterprise.

For FY2021, 27 percent of the total research expenditures went to pay for indirect costs; however, the actual indirect cost recovery rate varies for each project based on the type of research activity and the sponsor. The indirect cost recovery rate for research funded by the Federal government or industry is 56 percent for on-campus research and 26 percent for off-campus research.

The indirect cost recovery rates charged to non-federal sponsors, such as foundations, State of Michigan agencies, and private companies, vary according to the sponsor's policies or through negotiations with the sponsor. In such situations, the recovery rate may not cover the actual expenses incurred by the U-M to support some of these projects.
Federal sponsored projects provide a huge majority of indirect cost recovery funds used to cover a portion of overhead costs of conducting research.


Overhead spending covers items such as utilities, administration, and general maintenance of research facilities – known as “indirect” costs – that supports the entire research enterprise.

SOURCE: U-M Financial Data

Based on 2021 U.S. Consumer Price Index.
A fall 2021 snapshot of personnel paid under sponsored projects shows that grants and contracts fund the full-time equivalent of 4,896 faculty members, post-docs, staff and students.

**9.2 Sponsored Research Workforce by Full-Time Equivalents (FTEs), Fall 2021.**

![Pie chart showing distribution of FTEs by category: Admin. & Research Staff 2310 (47%), Post-doctoral Fellows 734 (15%), Research Faculty 456 (9%), Faculty 578 (12%), Students 818 (17%).]

SOURCE: U-M Human Resources Data

Many tenured and tenure-track faculty members play key roles in sponsored research activity. Research faculty members, post-doctoral fellows, graduate (and some undergraduate) students and a subset of the staff also contribute in major ways to the research enterprise.

The Fall 2021 total represents an increase of 1,386 FTEs (39.5 percent) supported on sponsored projects compared to Fall 2020. The large increase represents a return to the growth trend the U-M was experiencing prior to the coronavirus pandemic.

This FTE total does not include faculty, staff, and student involvement in research and scholarship whose activities are paid for by the General Fund.
U-M spends more on research than any other U.S. public university and second most among all universities.


<table>
<thead>
<tr>
<th>Institution</th>
<th>FY2016</th>
<th>FY2017</th>
<th>FY2018</th>
<th>FY2019</th>
<th>FY2020</th>
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<td>$2,562M</td>
<td>$2,661M</td>
<td>$2,917M</td>
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<tr>
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<td>$1,158M</td>
<td>$1,204M</td>
<td>$1,204M</td>
</tr>
</tbody>
</table>

SOURCE: National Science Foundation, Higher Education Research and Development Survey

The U-M has been the nation’s leading public university in total research spending for the past five years. Total expenditures include research spending from government sources, non-government sources, and the institution’s own budget.

The list above is ordered by total research expenditures for FY2020. Data for public universities are shaded in yellow; private university data are shaded in blue.

6 Johns Hopkins University expenditures include those by the Applied Physics Laboratory. In FY2020, APL R&D expenditures totaled $1.909M, 61% of JHU’s total for the year.

The research expenditures displayed in this table and the chart for 9.1.1 include those for the Ann Arbor, Dearborn, and Flint campuses. All other figures show data only for the Ann Arbor campus.
Since Fiscal Year 2011, U-M faculty, staff and students have reported 4,854 inventions, have engaged in 1,995 licensing agreements, and have been issued 1,614 U.S. patents.


Invention reports are descriptions of discoveries made by U-M faculty, staff and students with the potential to be further developed into new products or processes. Patents protect intellectual property that shows some promise for future development and application. License and option agreements are legal arrangements with companies (some of which have U-M faculty involvement) that allow the firms to use University-owned technology in products or processes being developed for the market.

SOURCE: U-M Office of Technology Transfer
Over the last decade, U-M discoveries have generated $264 million in revenues. The inventors and University share these revenues, with the U-M’s portion devoted to ongoing research and development.

9.4.2 Revenues from Royalties and Equity Sales, FY2011-FY2021.

SOURCE: U-M Office of Technology Transfer

Revenues from licensing agreements support technology transfer operations as well as provide valuable resources for investment in research, education, and innovation.

Royalties are periodic payments by a licensee to the University of Michigan in order to have continued access to U-M-owned intellectual property. Equity sales include transfers of stock or cash payments by a licensee to the U-M.

Royalty revenues reached an all-time high in FY2015. Nearly $75 million of that total comes from a new royalty agreement connected to a drug that was developed at U-M to help patients with Gaucher disease.
Since Fiscal Year 2011, 185 new companies based on U-M discoveries have been launched.


While much of the new technology developed at the U-M is licensed to existing companies for use in new products and processes, some inventions become the basis of new enterprises. Often this occurs when the U-M inventors wish to have hands-on involvement in the further development of the technology.

Several U-M start-ups have reached a level of success such that larger firms have acquired them. For example, two medical device start-ups – HandyLab and Accuri Cytometers – were acquired by Becton Dickinson in 2009 and 2011, respectively. Arbor Networks, which provides internet protection tools, was purchased in 2010 by Tektronix Communications. Health Media, developer of health support programs, was acquired in 2008 by Johnson & Johnson. In October 2012, Compendia Bioscience, which has developed an oncolgy database that drug companies utilize in drug discovery work, was acquired by Life Technologies Corp. And in April 2018, Boston Scientific, a major company in the medical devices sector, bought U-M start-up Securus Medical Group and its FDA-cleared thermal monitoring technology.

In 2011, the U-M opened the Venture Accelerator at the North Campus Research Complex. The Venture Accelerator provides laboratory and office space, as well as business services, to startup companies emerging from the pipeline of new ventures at U-M Tech Transfer.

Portfolio of U-M start-ups: techtransfer.umich.edu/for-startups/portfolio-companies/
Federally funded research projects at the University of Michigan have served as feeders of highly trained personnel who later moved to jobs in all 50 states.

9.5 Counts of U-M Faculty, Staff and Students Involved in Federally Sponsored Research Who Later Took Positions at other Institutions or Companies, by state for 2002-2015.

Thousands of faculty, staff and students participate in research projects funded by the federal government every year. This graphic represents the flow of people and ideas into the economy by showing how many research-trained University of Michigan faculty, postdoctoral researchers, staff and students paid on federal research have taken jobs in other locations across the country. Most who leave U-M are concentrated in the state of Michigan. The top three geographic destinations for U-M trained researchers who leave the state of Michigan are, in order, California, New York, and Illinois.

The Institute for Research on Innovation and Science (IRIS) is a national consortium of more than 30 research universities that conduct about $22.6 billion in R&D (~31% of the national total). These schools granted nearly 15,000 doctorates in 2016, about 27% of the nation’s total. IRIS collects detailed administrative data from its members to produce an IRB-approved data repository that can support research and reporting that aids our ability to understand, explain and improve the public value of research and training. For more information about IRIS, see iris.isr.umich.edu.

7 This graphic was created in conjunction with data from the U.S. Census Bureau, DRB Decision #CBDRE-FY2018-411.