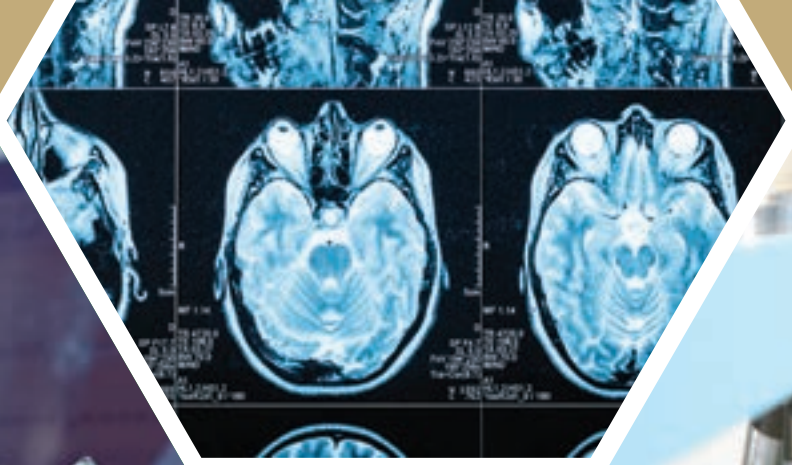
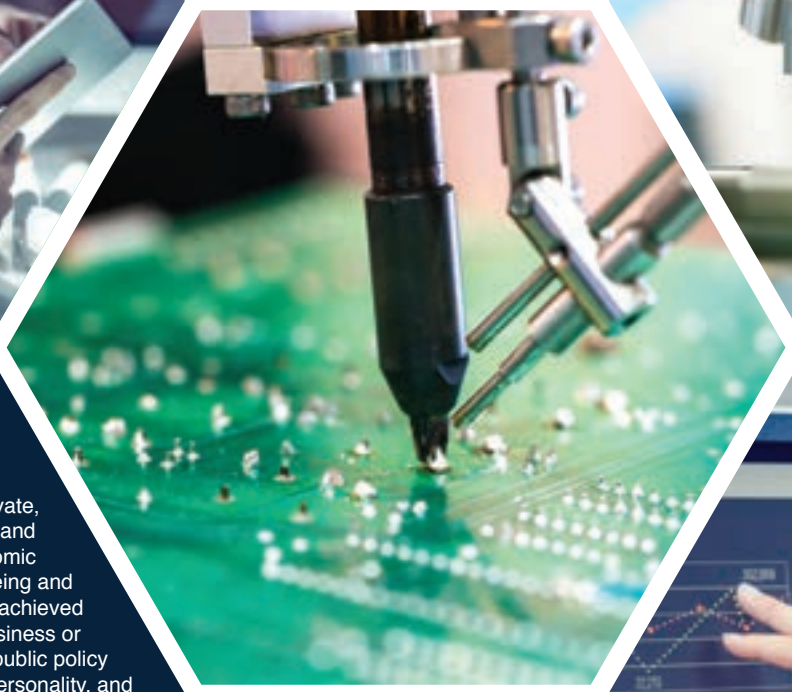
THE FLORIDA COUNCIL OF 100

BEST PRACTICES IN BUSINESS-ACADEMIC R&D COLLABORATION

Report No. 2018-01





About the Florida Council of 100

Formed in 1961 at the request of Governor Farris Bryant, the Florida Council of 100 is a private, nonprofit, nonpartisan organization of business and civic leaders, which exists to promote the economic growth of Florida and improve the economic well-being and quality of life of its citizenry. Council members have achieved a high degree of success and recognition in their business or profession; have demonstrated involvement in Florida public policy issues; and possess the personal qualities of character, personality, and leadership ability. The Council of 100 works closely with the Governor and the state agencies, the Legislature, the judicial branch, federal leaders and officials, and other private organizations, to effect positive change in the state and achieve quality of life improvements for the citizens of Florida. Through our reports, position statements, policy letters, issue advocacy, and public relations, we keep state leaders and policy makers apprised of key topics relevant to today's Florida and make recommendations for enhancing state policies and programs in ways beneficial to all Floridians.

INTRODUCTION

Along with teaching and public service, research is one of the triad of key responsibilities of higher education in Florida. Through the R&D they generate, Florida's universities play a vital role in our state's economy, building national and international reputations for coordination, collaboration, and innovation. They supply a "highly educated workforce for high-skill, high-wage jobs and companies; employ researchers who tackle some of the most significant [basic and applied research] challenges facing Florida, the nation, and the world; produce intellectual property that can be commercialized through licenses and patents; establish partnerships with industries; promote the creation of startup and spin-off companies; and attract new employers to Florida."

Because the Florida Council of 100 firmly believes R&D activities are vital to the state's economy, in 2016 the Council's Higher Education Committee adopted the following project vision and definitions:

VISION

The Florida Council of 100 will benchmark existing and planned research in the State of Florida to include successes, failures, best practices, public and private partnerships, internal collaboration, and funding. The resulting data will be used to magnify successes and new programs in the system that result in increased successful research and development, technology transfer, commercialization, positive economic impact, and maximization of cross system collaboration.

KEY DEFINITIONS

Research: Systematic investigative process employed to increase or revise current knowledge by discovering new facts. It is divided into two general categories: (1) Basic research is inquiry aimed at increasing scientific knowledge, and (2) Applied research is effort aimed at using basic research for solving problems or developing new processes, products, or techniques. [BusinessDictionary.com]

Research and Development (R&D): Systematic activity combining both basic and applied research, and aimed at discovering solutions to problems or creating new goods and knowledge. R&D may result in ownership of intellectual property such as patents. [BusinessDictionary.com]

Technology Transfer: Assignment of technological intellectual property, developed and generated in one place, to another through legal means such as technology licensing or franchising. Process of converting scientific and technological advances into marketable goods or services. [BusinessDictionary.com]

Commercialization: Commercialization is the process by which a new product or service is introduced into the general market. The process of commercialization is broken into phases, from the initial introduction of the product through its mass production and adoption. It takes into account the production, distribution, marketing, sales and customer support required to achieve commercial success. [Investopedia]

Over the past year, the Higher Education Committee has researched higher education R&D issues, including surveying key institutions and visiting major players to glean barriers to effective business university collaboration and opportunities for improvement. Although this report focuses primarily on the top-5 R&D-producing state universities, we have also included the University of Miami, a private institution, due to the magnitude of its research.

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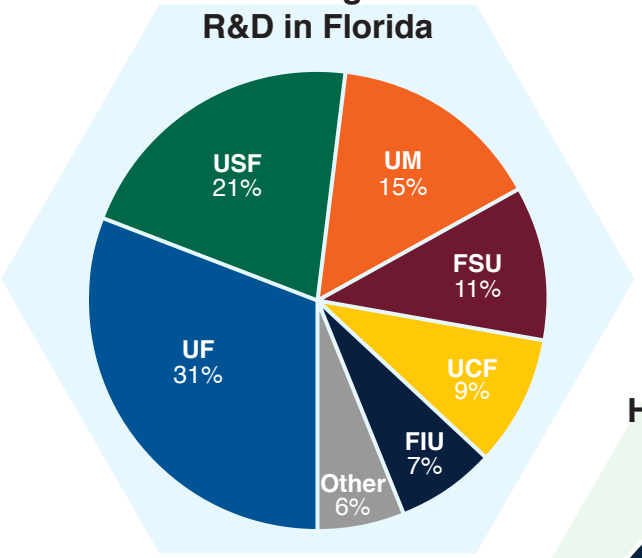
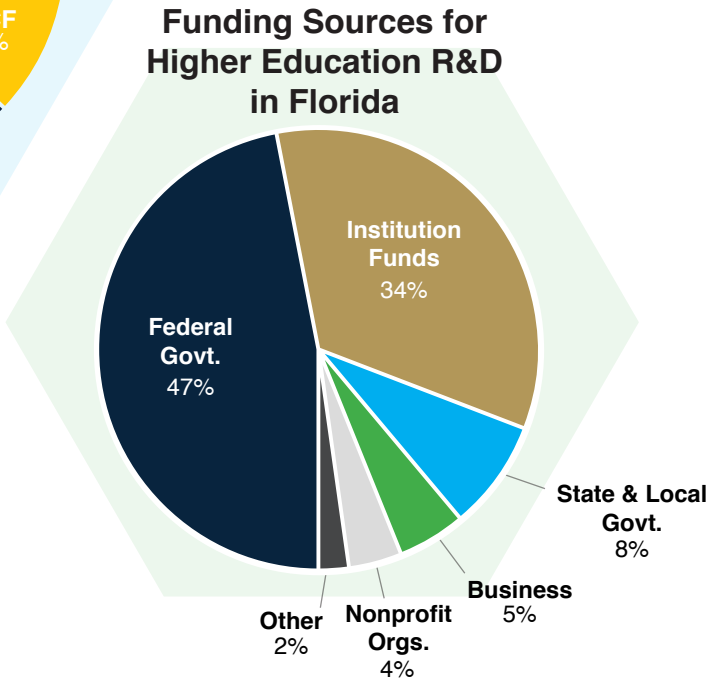
Higher Education R&D in Florida

Universities in Florida perform **$2.4 billion of R&D annually**. While much of it can eventually be used by the private sector, very little of it (less than 5%) actually comes directly from the private sector (ranking our state 23rd in the nation for this measure).

Percent of Total Higher Education R&D in Florida



Funding Sources for Higher Education R&D in Florida



Source of Funds

- **Federal government:** Any agency of the U.S. government
- **State and local government:** Any state, county, municipality, or other local government entity in the U.S., including state health agencies
- **Institutional funds:** Includes institutionally financed research (all R&D funded by the institution from accounts that are used only for research), cost sharing (committed) with other entities, and unrecovered indirect costs. [Note: Section 1004.22, Florida Statutes, requires that monies received by public universities for overhead or indirect costs, and other monies not required for the payment of direct costs, be applied to the cost of operating a university's division of sponsored research. Any surplus monies must be used to support other research or sponsored training programs in any area of the university. See Appendix A for more details about indirect costs.]
- **Business:** Domestic or foreign for-profit organizations
- **Nonprofit organizations:** Domestic or foreign nonprofit foundations and organizations, except universities and colleges
- **All other sources:** Sources not reported in other categories, e.g., funds from foreign governments, foreign or U.S. universities, and gifts designated by the donors for research

Corporate and University R&D Benefits

Not only do university-industry partnerships increase the speed and frequency with which new discoveries move from the laboratory to the market, but as technology expert Dr. Louis G. Tornatsky noted as early as 2000, “University-industry technology transfer can be a stimulant, precursor, or complement to building a high-skills, high-wage state economy.”

In fact, Florida academic R&D of $2.4 billion annually generates an estimated 55,000 jobs and $7.6 billion of economic activity, as well as countless billions of dollars of social benefits over time such as improved health of Floridians. Moreover, it is estimated that this university R&D leads to another $2.5 billion of follow-on private-sector R&D — three-quarters of the papers cited by U.S. industrial patents are from public science, and one-fifth of private-sector innovations are based, at least in part, on public sector research.

Such vital R&D interplay between universities and the business community can occur in many different ways (the **“5 C’s”**). They include **codification** (e.g., publications, patents, prototypes); **contacts** (e.g., meetings and conferences, informal interaction, science parks, industrial liaison, offices, funded networks, customer links); **crew** (e.g., sponsored university posts, internships, part-time teaching, personnel exchanges); **contracts** (e.g., licenses, contract research, consulting, universities using private equipment, product testing, business support); and **cooperation** (e.g., spin-off firms, joint ventures).

And the benefits flow in both directions. For example:

Corporate Benefits

- Accessing expertise not available in corporate laboratories
- Assisting in the renewal and expansion of a company’s technological inventory
- Gaining access to students as potential employees
- Using the university as a means of facilitating the expansion of external contacts for the industrial laboratory
- Expanding pre-competitive research with universities and with other companies
- Leveraging internal research capabilities

University Benefits

- Obtaining financial support for a university’s educational and research missions
- Supporting basic and applied research
- Broadening the experience of students and faculty
- Identifying significant, interesting, and relevant problems
- Enhancing regional economic development
- Increasing employment opportunities for students

Key Finding

When universities think about R&D, the research component is typically considered more important than the development element. The following word cloud is based on university surveys in which institutions were asked to describe “Research & Development.” The more a word was used in the descriptions, the bigger it is displayed in the word cloud.

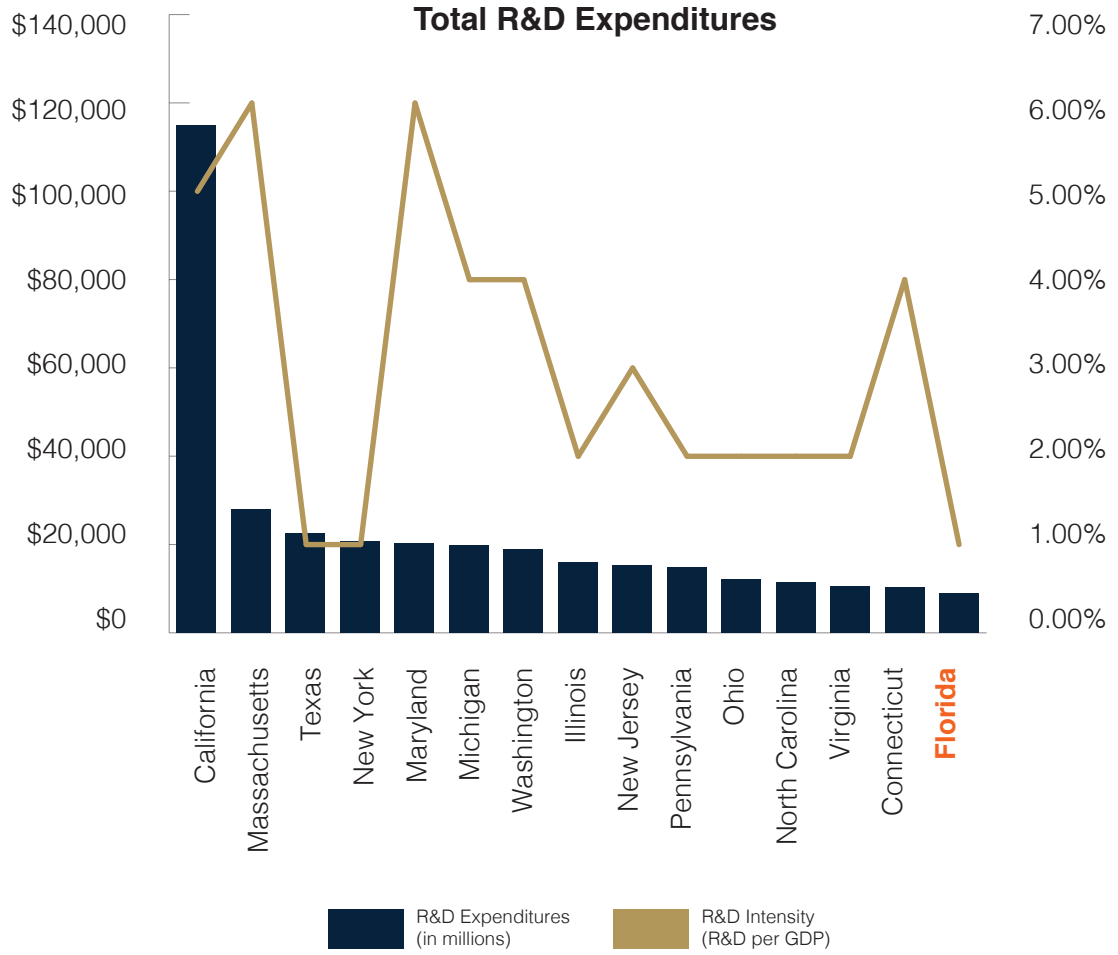
This discrepancy between research and development is born out in national commercialization data, which indicates that Florida is only generating a 2% return on its $2.4 billion in annual research spending in terms of licensing income that comes back to the universities — that’s 17th in the nation. Florida universities are aware of the issue and actively attempting to address it.

Where Florida Stands: Total R&D Expenditures

GIVEN THAT FLORIDA
IS THE
3RD LARGEST STATE
it lags many states for
total R&D performed.*

FL R&D:
$9 billion
15th

FL R&D Intensity⁺:
38th



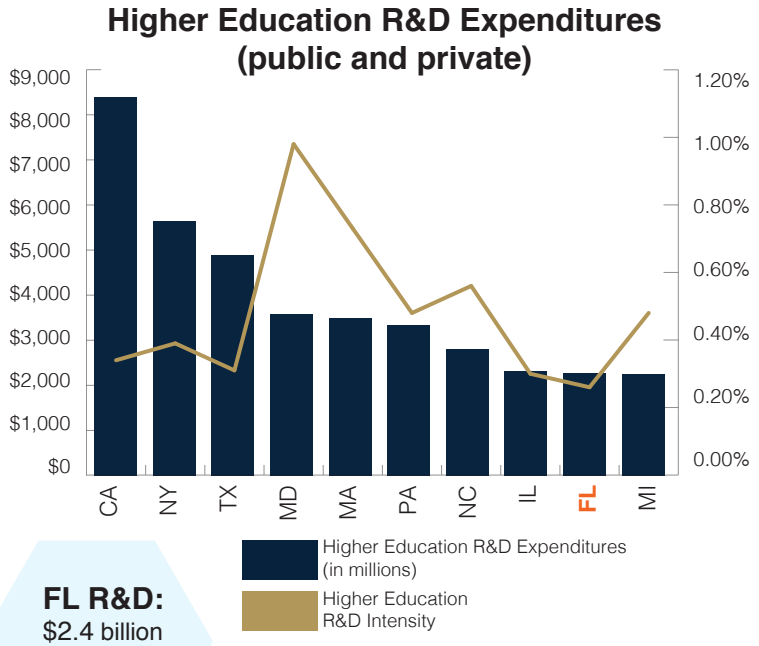
* Total R&D includes R&D performed by the following sectors: state, federal, federally funded research and development centers, business, higher education, and other nonprofit institutions.
⁺ R&D intensity is the amount of R&D performed as compared to the size of the economy.

Where Florida Stands: Higher Education R&D Expenditures

Florida is also behind in
HIGHER EDUCATION R&D

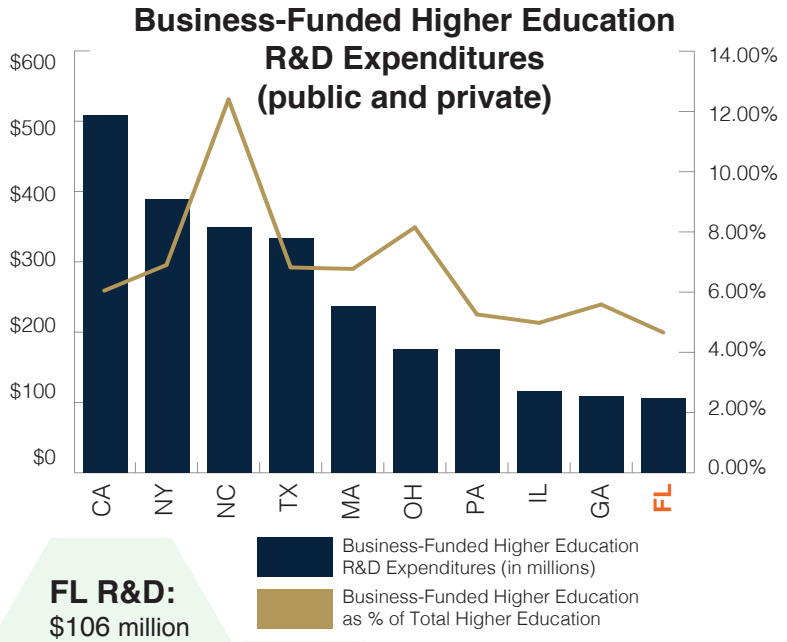
&

HIGHER EDUCATION R&D
funded by business.



FL R&D:
$2.4 billion
9th

FL R&D Intensity:
42nd



FL R&D:
$106 million
10th

FL % of Higher Ed:
23rd

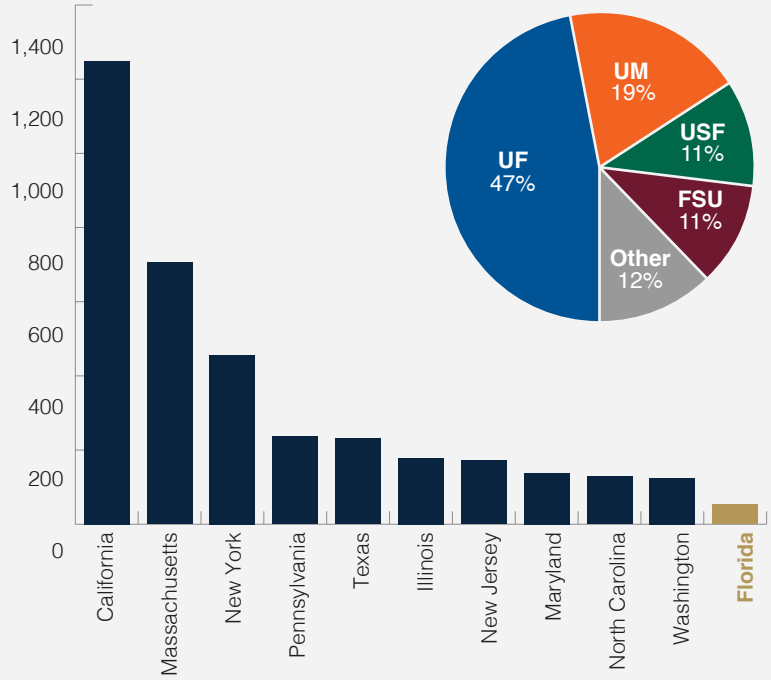
Florida's State University System lags only California, Texas, and Michigan for *public* university research expenditures — and is catching up.

Where Florida Stands: Higher Education Star Power

Besides having a medical school, a key way universities attract research dollars is by having **high-quality faculty** with **star power.** *Florida, however, lags in some key metrics.*

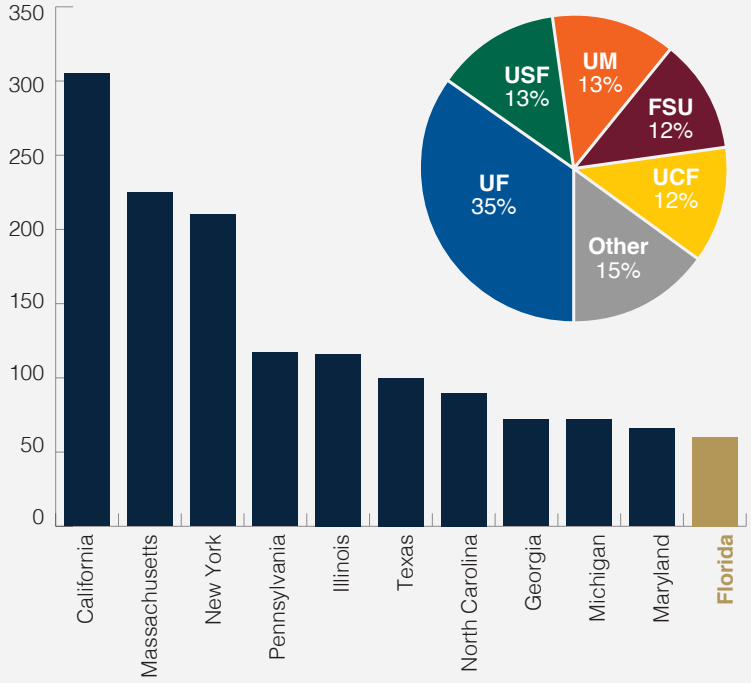
National Academy Members

53
FL Members
19th



Faculty Awards

60
FL Awards
13th



Where Florida Stands: Higher Education Technology Transfer

TECHNOLOGY **TRANSFER**

is the process of transferring scientific findings between organizations for further development and commercialization. Three Florida universities are in the top-25 of the tech transfer rankings.

Milken Institute University Technology Transfer & Commercialization Index

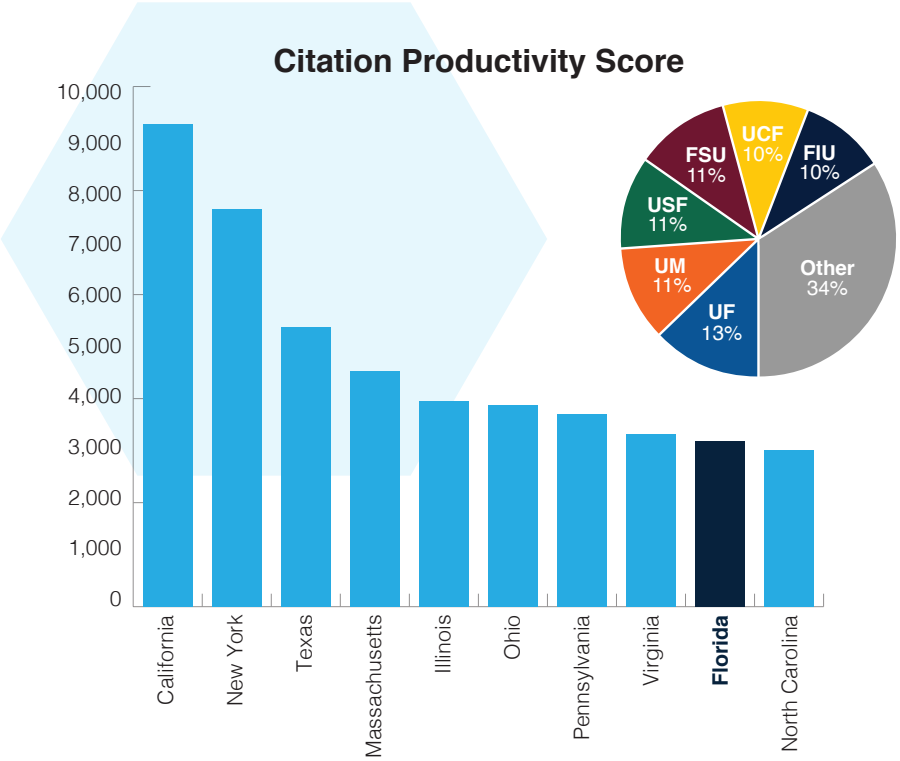
Rank	Institution	Patent Issued Score	Licensing Issued Score	Licensing Income Score	Start-Up Score	Index Score
1	University of Utah	88.27	89.38	94.04	93.90	100.00
2	Columbia University	85.86	84.54	97.08	88.50	97.93
3	**University of Florida***	**88.60**	**95.37**	**91.60**	**87.84**	**97.81**
4	Brigham Young University	85.59	85.83	86.76	94.95	96.63
5	Stanford University	96.28	85.43	94.57	81.94	96.33
6	University of Pennsylvania	83.30	86.52	91.62	87.66	95.45
7	University of Washington/Wash. Res. Fdn.	79.56	100.00	93.73	79.30	94.66
8	Massachusetts Institute of Technology (MIT)	96.76	77.92	92.91	82.00	94.58
9	California Institute of Technology	100.00	76.07	91.53	81.14	93.96
10	Carnegie Mellon University	75.57	92.29	88.50	87.05	93.72
11	New York University	84.48	78.27	98.60	77.76	93.20
12	Purdue Research Fdn.	85.58	86.56	85.45	86.87	93.19
13	University of Texas System	87.02	82.90	89.75	81.91	92.58
14	University of Minnesota	76.71	91.99	90.75	80.80	92.34
15	University of California, Los Angeles	93.32	77.37	68.43	100.00	91.48
16	University of Michigan	86.03	84.96	89.98	75.03	90.23
17	Cornell University	84.49	91.52	86.42	74.32	89.44
18	University of Illinois Chicago Urbana	84.66	78.16	89.83	75.87	89.17
19	**University of South Florida**	**89.25**	**83.45**	**81.23**	**79.65**	**88.95**
20	University of California, San Diego	89.14	83.65	65.76	93.53	88.36
21	Arizona State University	79.29	79.87	82.32	82.67	88.31
22	**University of Central Florida**	**91.93**	**69.34**	**79.69**	**83.75**	**88.06**
23	Northwestern University	84.88	69.32	88.85	77.44	87.99
24	Cleveland Clinic	85.51	76.51	90.86	71.88	87.92
25	University of Pittsburgh	78.31	91.48	87.84	71.37	87.84

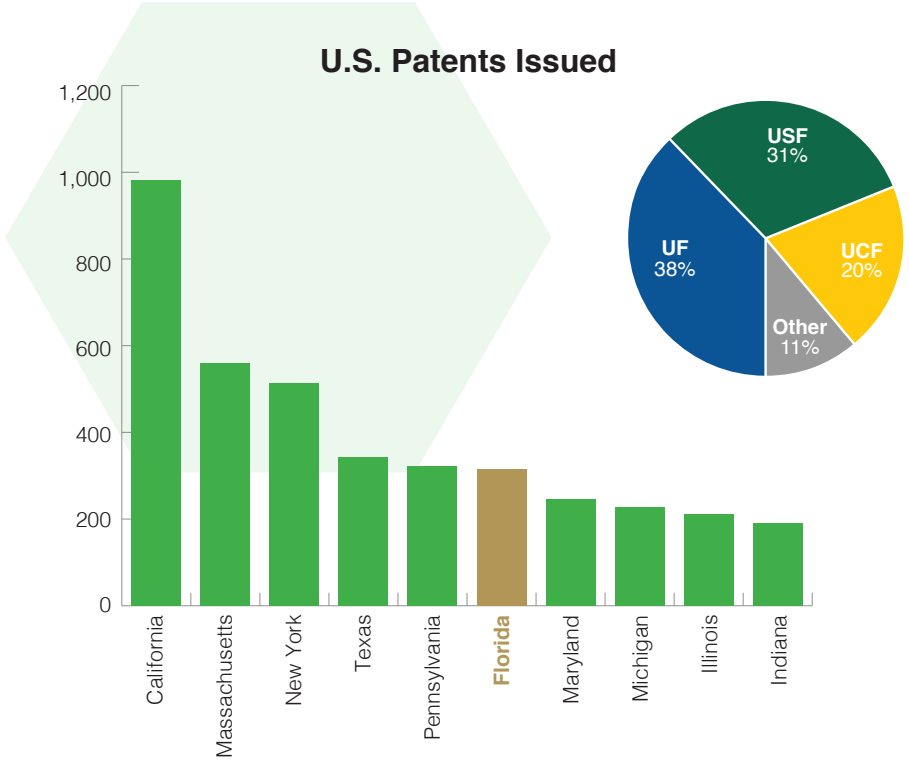
Other Ranked Florida Universities:
FSU (88), Miami (109), UWF (214), FIU (215), UNF (217)

* The University of Florida's licensing income score would be much lower if older inventions, such as Gatorade and Sentricon, were not included.

Where Florida Stands: Higher Education Citations & Patents

Florida lags in two indicators of tech transfer value
— **research citations** (indicate usefulness of a research project to others)
and patent issuance —
with citations being powerful indicators of future patent activity in some instances.



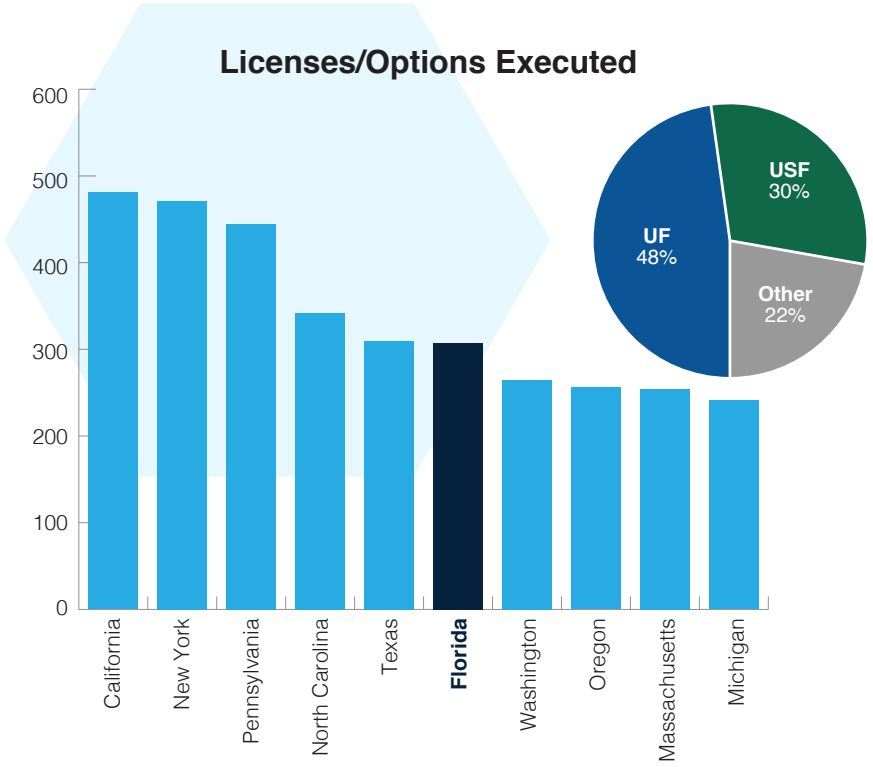


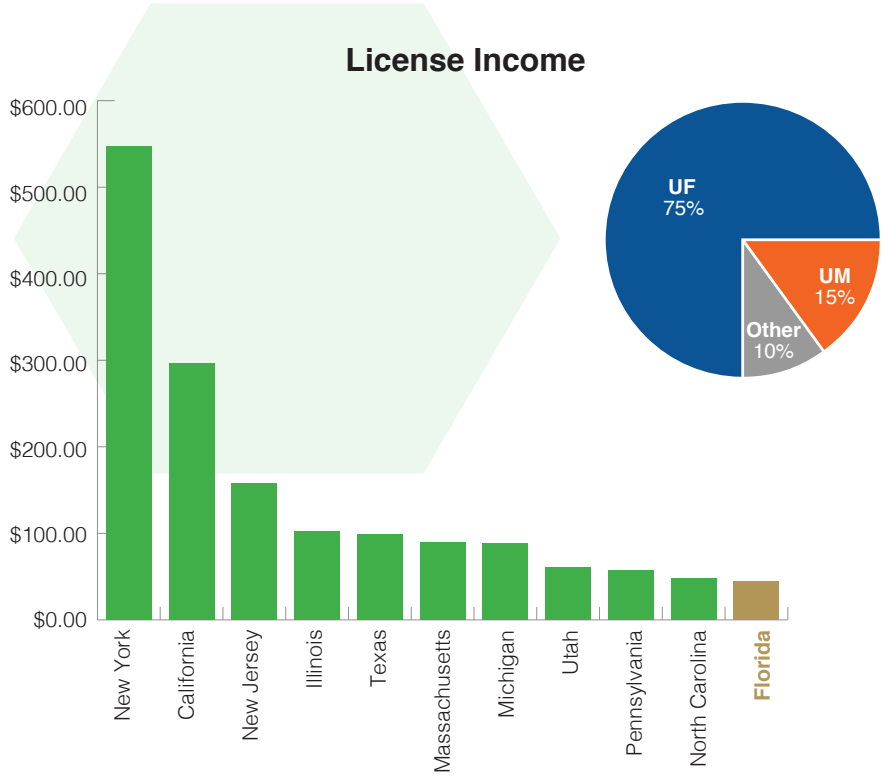
3,186
FL Points
9th

314
FL Patents
6th

Where Florida Stands: Higher Education Licenses/Options & License Income

For income, some universities license their research, often patented, to companies to commercialize. Though Florida currently lags in license income, state universities have hit a few “homeruns” with products like **Gatorade, Taxol, and Sentricon**.





307

FL Licenses/Options

6th

$44 million

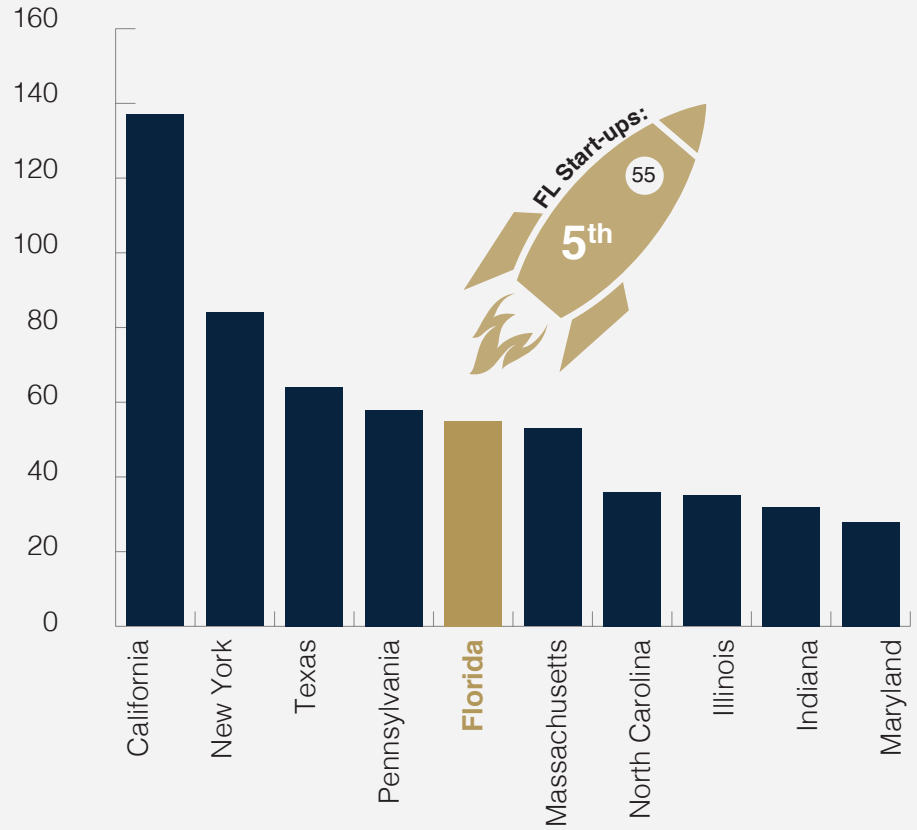
FL Income

11th

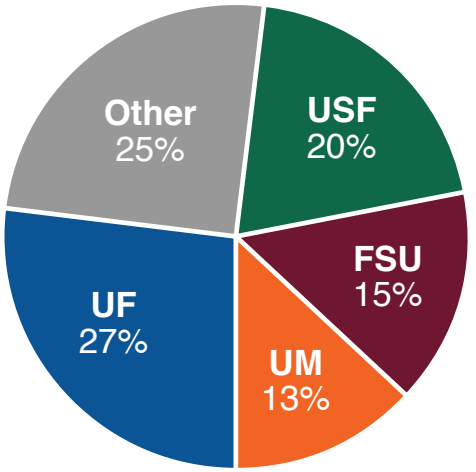
Where Florida Stands: Higher Education Start-ups

Another way a university can commercialize its research is to **create a start-up company, itself.** *Florida does better here.*

Start-ups Formed



Percent of Florida University Start-ups Formed



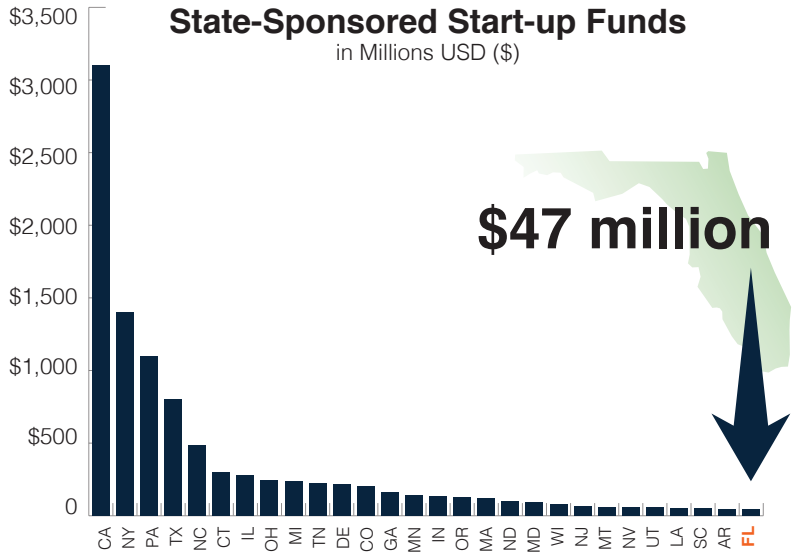
*Note: Data is not available regarding the long-term health of these initial start-ups.

Where Florida Stands: Statewide Start-up Funding

HOWEVER

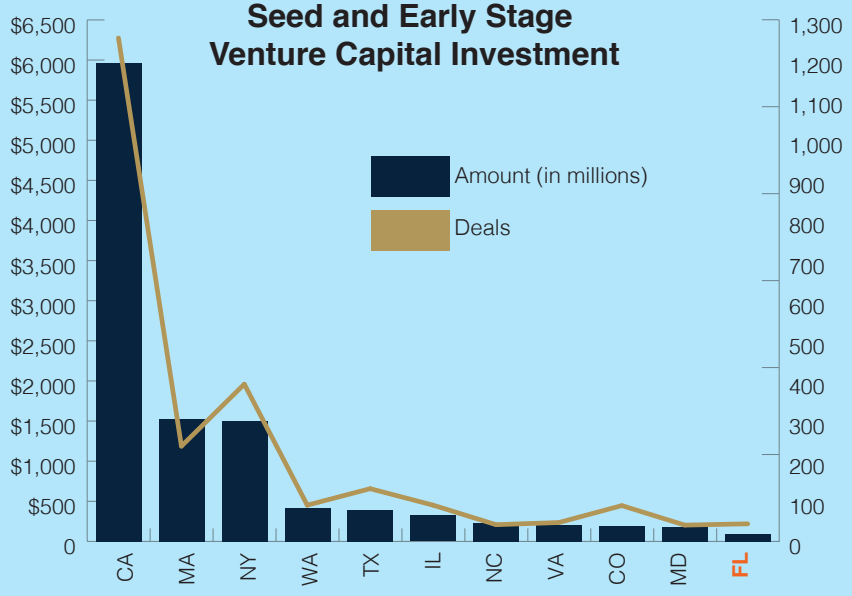
in Florida, funding for such start-ups is often hard to come by.

For example:



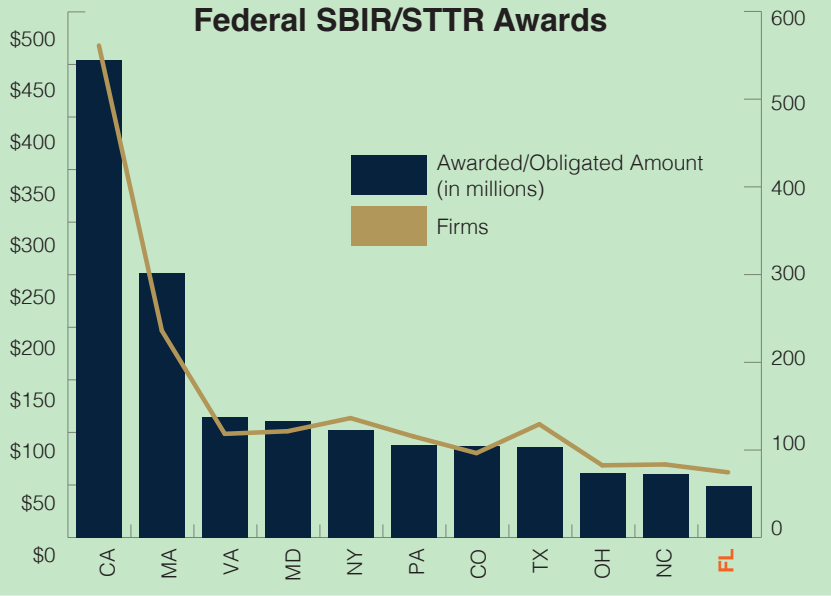
FL Deals:
38
11th

FL Amount:
$97 million
17th



FL Firms:
73
13th

FL Amount:
$49 million
14th



Recommendations

Overall, it is vital that we strengthen the foundation of Florida's innovation economy.

This includes items such as:

Recruit and Empower a World Class Faculty and Staff

Hire and retain (compensating as is required) rock star faculty researchers as anchors of university basic and applied R&D operations and arm them with dynamite staff and state-of-the-art equipment

Modernize university tenure practices to greater reward R&D and commercialization efforts. Researchers can often educate students better in the lab than the classroom, and they should be both freed and encouraged to do so

Recruit high-powered students and cultivate them as researchers

Eliminate barriers to researcher participation in success of R&D, e.g., modernize conflict of interest rules

Build a Robust Basic and Applied R&D Machine

Focus on Outcomes. R&D is like a funnel — the more R&D monies you pour in, the more patents, licenses, and start-ups you get out. Florida is 1st among the large states for licensing and start-up creation efficiency (R&D$: licenses, start-ups), but only 26th in nation for the patents-to-licenses ratio. That means we're spending too many resources generating outputs (i.e., patents) instead of potentially dollar-generating innovation outcomes like licenses and start-ups

Focus universities, or groups of universities, on R&D fields in which they have, or can have, a comparative advantage. When possible, these fields should support key Florida industries or emerging industries in which the state has, or can have, a competitive advantage nationally or internationally

Foster inter-university collaboration and cooperation through entities such as the State University System Board of Governors and the Florida Research Consortium. BOG-led federal grant-seeking initiatives have already proven the value of working together to attract large, new capital

Facilitate innovation by establishing a comprehensive concierge service for university compliance and other administrative matters

Capitalize on existing public and private R&D fixed capital through maintenance and renovation

Continue enhancing R&D measurement, including reporting institutional funds by component to the state, to ensure a dollar invested leads to a return

Shift direct and indirect overhead expenditures to primary R&D line operations

Recommendations

Enhance the Commercialized Mission

Create a one-stop online business portal for Florida universities' publicly available research, patents, technologies, and other intellectual property and technical resources, and then strongly market it

Greatly increase seed and early stage capital available to university-business partnerships, whether from state appropriations, the state pension fund, the Florida Institute for the Commercialization of Public Research, the Florida Opportunity Fund, private investors, etc. Leverage, leverage, leverage Florida dollars with external funding

Bring in the experts! Recruit more business leaders, managers, and experienced entrepreneurs and advisors to help the public sector commercialize its research

Bet on winners by focusing new and existing SBIR/STTR matching programs on Phase 2 and 3 projects, in addition to promoting Phase 1 proof-of-concept endeavors. The federal Small Business Innovation Research and Small Business Technology Transfer programs encourage businesses to engage in federal R&D with commercialization potential

Go for the game changers. Build the business cases and allocate the matching dollars to attract major projects, such as Engineering Research Centers, Industry/University Cooperative Research Centers, cluster-based research parks, university-business consortia, innovation districts, national research labs, etc.

Recreate the state as an entire research park of the future. It should be virtual and collaborative

Standardize administrative forms and processes to the maximum extent possible. Universities and businesses should hash-out common terms, contracts, and agreements (e.g., intellectual property matters) so that future/similar relationships don't waste time by starting at ground zero. Collaborating universities should do the same

Consider targeting R&D funding for strategic investment in sectors the state wants to build or issues it wants to address

Strategically focus R&D efforts on turbocharging our state economy by ensuring a formal connection between economic development leaders and universities

Hold formal R&D networking conferences among firms, researchers, and students

Summary of Recommendations

Our recommendations center on three connective themes: (1) the State University System (SUS) as a whole must continue to recruit and empower a successful research team, namely a world-class faculty and staff; (2) Florida must build a robust research & development (R&D) machine; and (3) Florida must enhance the commercialized mission of R&D. Core to these issues remains: how does Florida become number one in R&D by all measures in the world, and what must we do now to equip the system to compete globally? The challenge is to reinvent Florida's R&D model before it becomes obsolete either by being superseded or redundant.

Important to advancing this mission, the SUS should:

1. Continue to enhance the measurement of its successes and return on investment of all sources of funding using metrics that provide tangible, measurable applied results;
2. Continue to develop a better tracking system of the commercialization of our investments. Startups and public and private funding models that foster enterprise level results should be considered if they are determined to be profitable in advancing the overall mission, such as resulting in new economic engines;
3. Refocus to treat all R&D efforts as a statewide endeavor and not solely an individualized university mission. We need to better set unified expectations of the system as a whole;
4. Elevate cooperative collaborations as important measures of results; and
5. Recruit and empower a robust and successful team to perform quality research.

In short, we should always be asking the question, what is the massive transformative purpose of billions of dollars invested through the SUS R&D model?

Recent Ground-breaking SUS R&D Actions

- The Vice Presidents for Research identified the most important research areas for Florida: health, big data, advanced manufacturing, marine/coastal/estuary science, and cybersecurity.
- The SUS executed an "Institutional Review Board (IRB) Reciprocity Agreement and Memorandum of Understanding" among the 12 SUS institutions to permit the reciprocal use of IRB for research conducted by investigators at SUS institutions.
- As directed by the Board of Governors' Task Force on Research, the Vice Presidents for Research have developed a 17-metric dashboard to chart progress on SUS research.
- In order to help win grants, the SUS has held five annual two-day workshops in Washington, D.C., to meet with federal agency officials that fund research. Florida is the only state to hold such workshops.
- The Board of Governors added a new position, Director of Workforce Education and Economic Development, to ensure even better connections between business and industry and SUS R&D and high-demand programs.
- In an effort to put the SUS on the map as a national destination for research, the SUS worked to get Florida chosen as a "destination state" for two recent major national research conferences.
- The Board of Governors' focus on funding for research was rewarded with 2017 legislative approval to provide funding to support the hiring of star faculty.


NaOH
purple coloration
FeCl3
Conc. HNO3
dil HNO3
CH3COCl
Br2 (g)
PCl5
SOCl2
acidified
H2O
Au
Gold
196.96655
111
Hg
Mercury
200.59
112
In
Indium
114.818
81
Tl
Thallium
204.38
113
Sn
Tin
118.710
82
Pb
Lead
207.2
114
Ge
72.61
50

Appendix A: Direct and Indirect Costs

Direct Costs

Direct costs are those that can be specifically and easily identified with a particular project or activity and are allowable under the sponsoring organizations guidelines. Institutions report direct costs in the following categories:

- Salaries, wages, and fringe benefits for all R&D personnel; includes salaries, wages, and fringe benefits paid from an institution's funds and from external support
- Capitalized and noncapitalized software purchases
- Capitalized equipment
- Pass-throughs to other universities or organizations
- Other direct costs that do not fit into one of the above categories, e.g., travel, tuition waivers, consulting services, computer usage fees, supplies

Indirect Costs

Indirect costs are those costs that are incurred for common or joint objectives, and cannot be easily and specifically identified with a particular sponsored project, an instructional activity, or any institutional activity.

These costs are also sometimes called "facilities and administrative costs (F&A)" or "overhead." As Nature writer Dr. Heidi Ledford explains, the U.S. "began reimbursing universities for indirect costs in the 1950s, as part of a push to encourage more research. An initial cap was set at 8%, but that had risen to 20% by 1966, when the government began to allow institutions to negotiate their rates….the agreed rate holds across all federal funders, irrespective of where the negotiations took place.

"A common misconception is that indirect-cost rates are expressed as a percentage of the total grant, so a rate of 50% would mean that half of the award goes to overheads. Instead, they are expressed as a percentage of the direct costs to fund the research. So, a rate of 50% means that an institution receiving $150 million will get $100 million for the research and $50 million, or one-third of the total, for indirect costs.

"But, there are multiple caps that lower the base amount from which the indirect rate is calculated, or that limit the amount of money that a research institution can request. So very few institutions receive the full negotiated rate on the direct funding they receive."

Appendix A: Direct and Indirect Costs

Direct Costs

Salaries/Wages & Fringe Benefits: Faculty, other professionals, technicians, post doc associates, research associates, graduate and undergraduate students

Materials and Supplies: Project related research and scientific supplies. Any equipment or software that does not qualify under the equipment definition

Equipment: Equipment used for scientific, technical, and research purposes that costs greater than $5,000 and has a useful life of at least one year (see Direct Charges for Computing Devices)

Facilities: Project specific space rental for off-campus facilities from a third party. Use of specialized equipment for which there is a commonly applied charge

Travel: Transportation, lodging, subsistence, and related items incurred by employees who are in travel status on official business of the institution related to the project

Telephone: Long distance calls, phone surveys or calls to project participants

Maintenance & Repairs: Requires justification that the expenditures are required and directly related to the specific award (e.g., less expensive than buying new)

Advertising: Recruitment of research subjects or for job openings approved for a specific project

Publications: Project specific and project related. Copying included only when charges can be tracked

Memberships, subscriptions and professional activity: Membership in business, technical, and professional organizations; related to and supportive of the project. Subscriptions to business, professional, and technical periodicals; related to and supportive of project

Freight/express deliveries and Postage: Justification required that cost needed to transport project material in a timely way

Consulting: Project specific

Miscellaneous Costs: Subcontract costs, recharge center charges, and training costs

Participant Support Costs: Participant support costs were traditionally allowed only by certain federal agencies or funding announcements. Under the Uniform Guidance, these costs are allowed with prior written approval of the funding agency, provided they are programmatically justified. The budget justification should describe the purpose for the costs and the way in which they will directly benefit the proposed project's scope of work. These costs must be excluded when calculating the Modified Total Direct Costs (MTDC) to determine the overall project's F&A costs.

Indirect Costs

Salaries/Wages & Fringe Benefits: Clerical and administrative assistants, fiscal manager, secretaries, and directors

Office Supplies/Books & Journals: Pens, pencils, paper, staples, transparencies, toner cartridges, diskettes, printer paper, word processing and spreadsheet programs

Equipment: General office equipment such as copiers, printers, office computers, and fax machines

Facilities: Utilities, building use, grounds maintenance, renovations, and alterations of University property whether on- or off-campus

Travel: Costs of entertainment, and any costs directly associated with such costs (such as tickets to shows or sports events, meals, lodging, rentals, transportation, and gratuities)

Telephone: Local calls, cell phones, installation and maintenance

Maintenance & Repairs: Maintenance and repairs to general purpose equipment, buildings, and grounds

Advertising: Public relations to promote unit/department/college

Publications: General printing and copying

Memberships, subscriptions and professional activity: Membership in any civic or community organization, in any country club or social/dining club, or organization

Freight/express deliveries and Postage: Routine or internal courier

Consulting: General, management, financial

Miscellaneous Costs: Computer network charges and utilities

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