Frequently Asked Questions:

State Research Universities and the New Mexico Technology Enhancement Fund

Prepared for the Legislative Finance Committee by New Mexico's State Research Universities

Wednesday, June 28, 2023

1. What is the Technology Enhancement Fund?

The Technology Enhancement Fund ("TEF") was a fund created in statute in 2003 by the State of New Mexico, but it remained dormant with a zero balance until the 2022 state legislative session when it received $45 million (non-recurring) via HB 2 (2022).

21-1-27.2. Technology enhancement fund created; allocations; application review panels.

A. The "technology enhancement fund" is created in the state treasury. The fund shall consist of appropriations, income from investment of the fund, gifts, grants, donations and bequests. Money in the fund shall not revert at the end of any fiscal year. The fund shall be administered by the commission on higher education [higher education department]. Money in the fund shall be used to provide matching funds to state research universities to support innovative applied research that advances knowledge and creates new products and production processes in the fields of agriculture, biotechnology, biomedicine energy, materials science, microelectronics, water resources, aerospace, telecommunications, manufacturing science and similar research areas. Money from the fund shall be expended on warrants of the secretary of finance and administration upon vouchers signed by the executive director of the commission on higher education [higher education department] or the executive director's authorized representative.

B. Grants from the fund are available to state research universities that are conducting collaborative research with corporate and nonprofit organizations. A state research university may apply for a grant from the fund in accordance with rules promulgated by the commission on higher education [higher education department]. Allocations from the fund shall be based on a competitive process with applications reviewed by a panel of scientific and business experts established by the commission [department]. The review panel shall judge proposals based on excellence in research design and possible innovation in cross-disciplinary, multi-campus and higher education-industry research collaboration. The review panel may determine new research areas.

C. To apply for a grant, a state research university must have equal or greater matching funds for the proposal from sources other than the state.

History: Laws 2003, ch. 367, § 1.

ANNOTATIONS

Bracketed material. — The bracketed material was inserted by the compiler and is not part of the law.

For designation of the commission on higher education as the higher education department, *see* 9-25-4.1 NMSA 1978.

Effective dates. — Laws 2003, ch. 367 contained no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, was effective on June 20, 2003, 90 days after adjournment of the legislature.

2. What implementation rules support the Technology Enhancement Fund (TEF)?

HED published proposed rules after the 2022 state legislative session, and after a public comment period and in consultation with community stakeholders, final rules were adopted October 25, 2022.

N.M. Code R. § 5.3.14.8

Current through Register Vol. 34, No. 11, June 13, 2023

Section 5.3.14.8 - TECHNOLOGY ENHANCEMENT FUND

A. The technology enhancement fund is created in the state treasury. The fund shall consist of appropriations, income from investment of the fund, gifts, grants, donations and bequests.

B. The technology enhancement fund shall be administered by the department. Money shall be disbursed only on warrant of the secretary of finance and administration upon receipt of voucher signed by the secretary of higher education or the secretary's authorized representative.
C. Money in the fund shall be used to provide matching funds to state research universities to support innovative foundational and applied research and equipment that advances knowledge and creates new products and production processes in the fields of agriculture, biotechnology, biomedicine, energy, materials science, microelectronics, water resources, aerospace, telecommunications, manufacturing science and similar research areas.
D. Grants from the fund are available to eligible institutions that are conducting collaborative research with corporate organizations, nonprofit organizations, other eligible institutions, or other public entities as determined by the department. An eligible institution may apply for a grant from the fund pursuant to an application schedule issued by the department.
E. Allocations from the fund shall be based on a competitive process with applications reviewed by the committee.
F. Following an award determination, an eligible institution shall not receive a distribution until that institution provides documentation to the department that it has received or will receive institutional share funding equal or greater than the state contribution. Distributions from the technology enhancement fund are made at least quarterly. Allocations not matched or not currently obligated to a proposal in review during any quarter of the cycle are made available during the following quarter for supplemental or second round matching by the corporate organization, nonprofit organization, other eligible institution, or other public entity as determined by the department pursuant to Subsection D of 5.3.14.8 NMAC.

N.M. Code R. § 5.3.14.8
Adopted by New Mexico Register, Volume XXXIII, Issue 20, October 25, 2022, eff. 10/25/2022

3. **What state funds have been appropriated to the Technology Enhancement Fund (TEF) and related TEF implementation efforts to date?**

HB 2 (**2022**), Section 11, transferred $45 million to the TEF from the General Fund:

"To provide matching funds to state research universities to support innovative applied research that advances knowledge and creates new products and production processes in the fields of agriculture, biotechnology, biomedicine, energy, materials science, microelectronics, water resources, aerospace, telecommunications, manufacturing science and similar research areas. The transfer is from the general fund and not the appropriation contingency fund." https://www.nmlegis.gov/Sessions/22%20Regular/final/HB0002.pdf (pg. 234)

HB 2 (**2022**), Section 5, appropriated $20 million to the Higher Education Department (HED) from the TEF:

"To provide matching funds to state research universities to support innovative applied research that advances knowledge and creates new products and production processes in the fields of agriculture, biotechnology, biomedicine energy, materials science, microelectronics, water resources, aerospace, telecommunications, manufacturing science and similar research areas. The other state funds appropriation is from the technology enhancement fund." https://www.nmlegis.gov/Sessions/22%20Regular/final/HB0002.pdf (pg. 204-205)

HB 2 (**2023**), Section 5, appropriated a total of $55 million to HED in support of TEF implementation, with $25 million of that drawn from the balance of the Technology Enhancement Fund, and $30 million of that drawn from the General Fund:

> *"To provide matching funds to state research universities to support innovative applied research that advances knowledge and creates new products and production processes in the fields of agriculture, biotechnology, biomedicine, energy, materials science, microelectronics, water resources, aerospace, telecommunications, manufacturing science and similar research areas. The other state funds appropriation is from the technology enhancement fund."* https://nmlegis.gov/Sessions/23%20Regular/final/HB0002.pdf (p. 226)

4. Which higher education institutions can access Technology Enhancement Fund (TEF) funding?

Per state statutes governing the TEF, "*Grants from the fund are available to **state research universities** that are conducting collaborative research with corporate and nonprofit organizations. A state research university may apply for a grant from the fund in accordance with rules promulgated by the commission on higher education [higher education department]*."

Nonetheless, other higher education institutions outside of "state research universities" are an important part of the TEF funding considerations and the greater research ecosystem in the state. On the front end, other institutions (e.g., Navajo Technical University) actively participate in the development of collaborative grant proposals with state research universities that are considered for funding, serving as key community partners for federal grant opportunities and related grant programs. On the back end, non-research institutions (for example, "comprehensive" 4-year institutions and community colleges) will be direct consumers of TEF-supported research findings and resultant innovations, and many graduates from these institutions also benefit from an improved research ecosystem in the state that offers additional education and job opportunities to graduates from other 2-year and 4-year institutions.

5. What actions has the Technology Enhancement Fund (TEF) review committee (as authorized by the TEF statutes and associated Higher Education Department rules) taken to date? Are there any awards that have been received to date by the higher education research institutions?

The **TEF review committee** (**TEC**) has formally met three times, on the dates of February 22, 2023, March 2, 2023, and May 2, 2023. The committee's next formal meeting to make TEF allocation recommendations is scheduled for July 11, 2023 and quarterly, thereafter. At the request of HED, and after approval by the TEC, UNM created a submission portal using their InfoReady site license. This portal allows secure multi-stage, multi-institution viewing, revision, and scoring of proposals, as well as tracking basic proposal information. In addition, application due dates and TEC committee review due dates have been scheduled for each quarter for FY 24, and a system of rotating Chairmanships has been established. At LFC's request, we have provided LFC analysts with a summary list of those research grant proposals that have been

approved by the New Mexico Higher Education Department (HED) and the TEC committee for a commitment of TEF match funds. Because these decisions by the committee are merely "commitments" of TEF funding, pending notification of awards, and federal agencies often take 6 months or longer to review grant proposal submissions, we do not have any official draw-downs of TEF funds yet to report. However, each institution has completed the first batch of award notifications for HED, and HED has executed MOUs to begin the first fund transfers.

In addition to the above, on a regular basis, higher education research institutions in New Mexico actively discuss new and ongoing federal research opportunities as a collaborative endeavor, seeking out new internal and external partnerships to strengthen our individual and collective research enterprise.

6. What areas of research are eligible for support from the Technology Enhancement Fund (TEF)?

The underlying TEF statutes stipulate that money in the fund shall be used "*to support innovative applied research that advances knowledge and creates new products and production processes in the fields of agriculture, biotechnology, biomedicine, energy, materials science, microelectronics, water resources, aerospace, telecommunications, manufacturing science and similar research areas*." The TEF statutes allow the scope of research eligible for TEF dollars to be broadly defined, supporting "similar research areas" (§ 21-1-27.2, part A, NMSA 1978) or even "new research areas" (§ 21-1-27.2, part B, NMSA 1978) as determined by the HED-appointed review panel.

The TEF implementation rules (NMAC 5.3.14.8, part C) further stipulate that "*money in the fund shall be used to provide matching funds to state research universities to support innovative foundational and applied research and equipment that advances knowledge and creates new products and production processes in the fields of agriculture, biotechnology, biomedicine, energy, materials science, microelectronics, water resources, aerospace, telecommunications, manufacturing science and similar research areas.*"

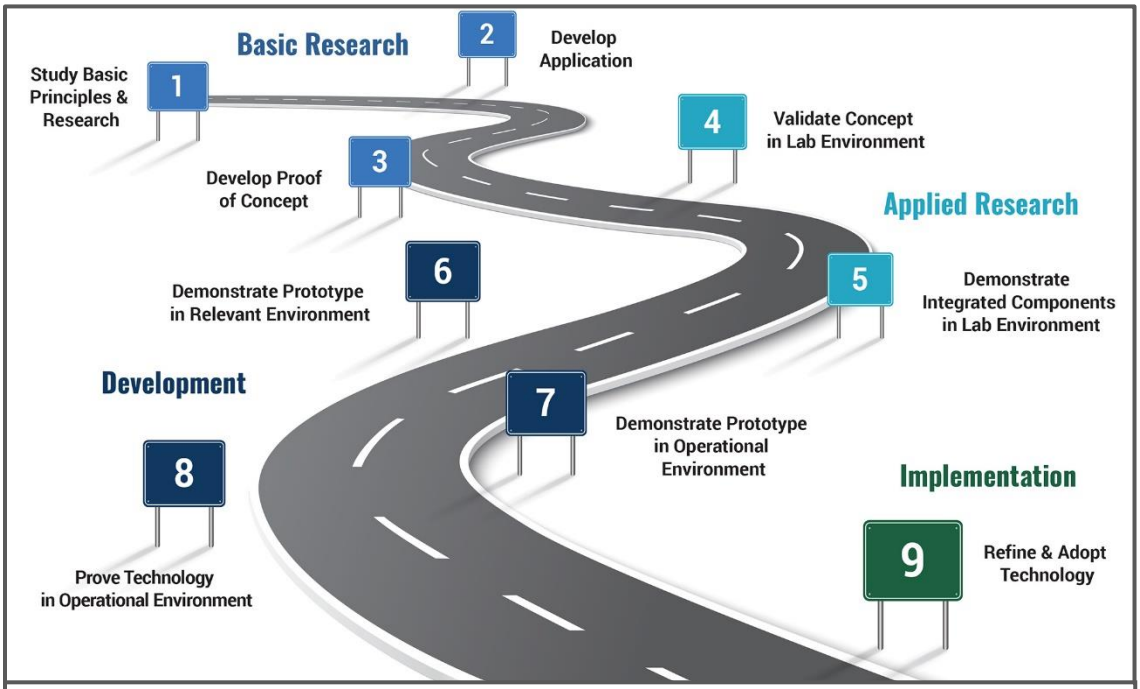
7. What is the relationship between "basic/foundational research, "applied research" and "technology development"? How are these concepts interconnected?

Basic or foundational research cultivates and refines critical, foundational scientific knowledge that is necessary for further development (e.g., applied, tested, and implemented) along a potential pathway toward new technologies. Without basic/foundational research, the underpinnings of applied research do not exist. Moreover, the key to innovation lies in "out-of-the-box" thinking that is often sparked by curiosity regarding the fundamental questions that arise from seeking to understand how our world works.

Not all basic research results in technological developments or new marketable products, nor is it necessarily designed to do so. The same is true for applied research, with the primary

difference being that applied research has a tighter definition of the starting point and the end goal. Moreover, foundational research can also help address unanswered questions about why certain technological processes and products behave in helpful (or non-helpful) ways.

When either basic or applied research creates or identifies a technology that has a potential market, subsequent funding can be sought to further develop the technology to demonstrate utility, often including new participants with development experience. If that is successful, further development funding is needed to demonstrate scalability and prove that a viable market exists. These latter stages have progressively less to do with research and more to do with business development and commercialization.



Technology readiness levels define the path from innovation research to deployment

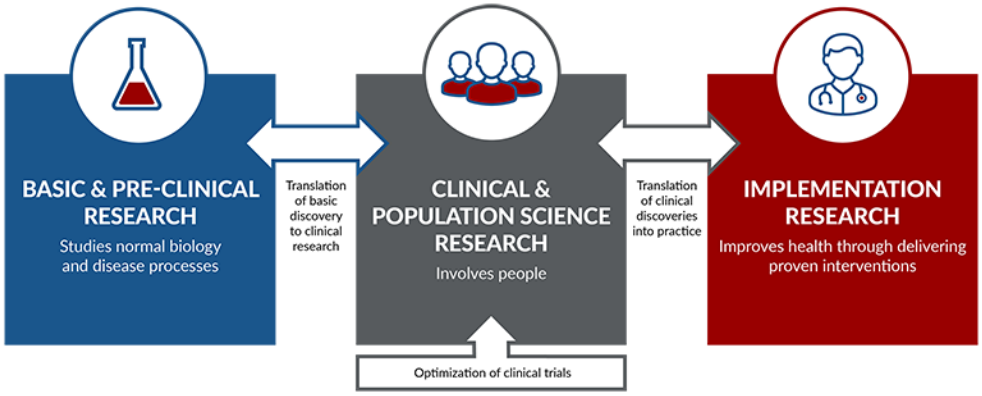
Source: U.S. Department of Transportation, Federal Highway Administration, as adapted from a NASA model used to describe the 9 steps an innovation undergoes from concept to deployable resource

https://www.fhwa.dot.gov/innovation/innovator/issue77/page_04.html

8. **How do pathways related to research and technological development contribute to improvements in the health of New Mexicans?**

Health-related research is an important example of how (and why) not all research impacts should be designed to result in "new products and production processes" (to borrow language from the TEF statutes). In this area of research which is often more human-focused, the impacts may be more directed towards processes that pave the way for improvements in health care, population health, and disease prevention. Even so, providing these services also sustains and

grows the regional economy, attracting personnel and investment in much the same way that growing the entire research enterprise does.



The research spectrum, as defined by the National Institutes of Health

Source: National Heart, Lung, and Blood Institute, National Institutes of Health.
https://www.nhlbi.nih.gov/science/research-spectrum

9. **Why not limit our focus of TEF resources to tech transfer and commercialization activities, capitalizing on research that is market-ready? Aren't those the types of activities that produce more tangible results and ROI to the state economy?**

In the simplest terms, just focusing on tech transfer and commercialization is akin to building an engine without considering a fuel source, refinery/factory, and supply chain. Such a narrowly focused effort will peter out before it goes anywhere. The state's intent to support a comprehensive, highly functional research ecosystem throughout the state of New Mexico (or any state) will benefit from a broad look at the inputs, pathways, and outputs of research and technological development, including strengthening the workforce, leveraging available resources, and expanding breadth and depth of research. The interdependency of these concepts has been studied at length by the nation's leading research institutions and government agencies, and may be summarized as follows:

> *"… the American research enterprise is a system that must be viewed in relation to the innovation system in which the discoveries it produces are used to develop new technologies and other innovations. Without this system-level understanding,* ***policies focused on relatively narrow objectives—such as increasing university patenting and licensing of research discoveries or reducing the funding for certain disciplines or types of research—could have undesired consequences****. With this understanding, however, the committee*

concludes that societal benefits from federal research can be enhanced by focusing attention on three crucial pillars of the research system: a ***talented and interconnected workforce****,* ***adequate and dependable resources****, and* ***world-class basic research in all major areas of science***." (p. 2)

Source: National Research Council. 2014. Furthering America's Research Enterprise. Washington, DC: The National Academies Press. https://doi.org/10.17226/18804

"*Basic research … lays the foundation for economically significant future innovations. In addition****, public investment in basic research contributes to the growth of a trained research workforce*** *by developing their talent, abilities, knowledge, skills, experience, and professional connections, and enables American researchers and would-be innovators to exploit the worldwide networks of researchers who advance the scientific enterprise and open access to a vast stock of knowledge and technological approaches offering opportunities for commercialization*." (p. 16)

Source: National Research Council. 2014. Furthering America's Research Enterprise. Washington, DC: The National Academies Press. https://doi.org/10.17226/18804

The critical linkage between the pursuit of basic science and economic development cannot be overstated. Basic science research, including both the people performing the research and the research findings themselves, are one of the great challenges for state research institutions as we seek to support our national labs and other federal research installations in the state. They need New Mexico's research community to supply them with high-quality human and intellectual capital, or else they are forced to seek such resources out-of-state.

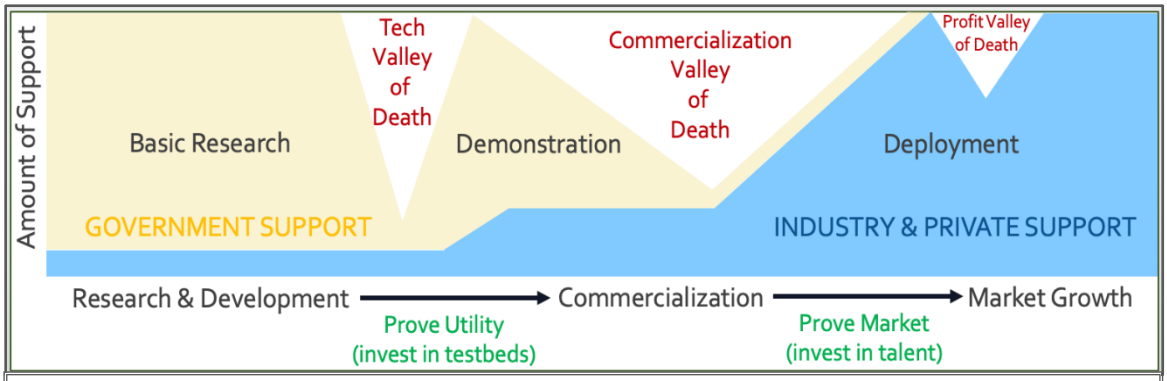
10. How do government investments in research and technology dovetail with financial support from industry and the private sector?

Along the "technology readiness levels" pathway (see below, and also FAQ item #7 above), several recurring obstacles typically exist for any research ecosystem. Namely, we often see steep challenges in moving basic research to a demonstration phase (sometimes called "testbeds"), and similar challenges moving demonstrated products and processes to commercial deployment. Also, within the "deployment" phase, other issues sometimes arise around profitability, for example, in response to changes in external/market conditions. The amount of time—and the mix of talent—it takes to translate basic research into tested concepts and products, and then to generate manufactured products for market consumption, can bear heavily on the degree to which developed research can successfully fill a known market opportunity and become profitable within that market.

One key trend highlighted in the below graphic is that, for healthy research ecosystems, government support (in beige) tends to figure prominently in the early stages of the technology readiness pathway, but private capital and other support (in blue) tends to play a bigger role in

the demonstration and deployment phases, with government support thereby becoming less critical, proportionally speaking.

In its current construction and implementation, the Technology Enhancement Fund (TEF) is well-positioned to help provide focused support to those earlier phases of the technology readiness pathway that suffer from a lack of resources as they attempt to traverse what is referred to below as the "tech valley of death" and also the "commercialization valley of death." The TEF provides research teams in New Mexico more tools and resources by which research knowledge may progress further along in the technology readiness pathway, for instance, from basic research to applied research.



The progression of basic research through the technology readiness levels pathway, noting various "valleys of death" where research ideas often fail to advance

Excerpted from: U.S. Department of Energy, Building Technologies Office
https://www.energy.gov/eere/buildings/technology-market

11. Why is the Technology Enhancement Fund (TEF) needed as a state funding mechanism if higher education institutions can also apply for federal grant funding?

In reality, the federal government supports research at all stages of the "technology readiness levels" pathway from basic research to the deployment of new technologies, with some agencies focused more on particular stages. Federally supported research awards are also extremely competitive and often require institutional support in various forms. For New Mexico to effectively compete with better-resourced states, policy levers like the TEF are needed to provide additional capacity for state institutions in New Mexico, along with our public and private partners, to improve our position as we work collaboratively to apply for federal grants that require significant up-front cash match dollars to be eligible to apply. Some of these new federal opportunities are offered by U.S. Department of Commerce and the U.S. Department of Energy, among others.

12. What are F&A (Facilities and Administrative) costs in relation to federal grants? Don't those generate additional revenues for the institutions?

F&A provided as part of (for example) federal grant opportunities are designed by the sponsoring federal government to allow grantees to recover standard overhead costs attributable to the funded project. F&A is literally a reimbursement for costs already incurred by the institutions. Thus, F&A costs that are incorporated into budgets for federal grant proposals do not create significant new surplus revenue streams for research institutions.

Rules governing federal grants further substantiate that F&A is to be viewed as a cost reimbursement.

> *"OMB rules (2 CFR Part 200 - Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards) require that F&A cost reimbursements can only be based on federally funded research space and related research activities, not education or other university facilities or activities."*

The standard federal agency-approved F&A rate ranges from ~48% to greater than 70% for research universities nation-wide and depends on a rather complex assessment that evaluates research facilities and capacities of each institution. For example, the standard F&A rate at UNM is 52.5%. Higher education institutions performing offsite research have an off-campus research rate that normally drops to 26-29%, depending on the federal agency involved. The standard federal F&A rate is negotiated with federal agencies and applies only to federal awards when no other agreements are in place. Also, this rate does not apply to State, non-governmental organizations (NGOs), foundations, or other entities, unless the funds provided are federal flow-through.

Many grants also involve subcontractors. Per negotiated federal F&A rates and generally accepted business practices for research institutions, the federal government typically allows institutions to capture F&A only on the first $25,000 of such sub-contracted amounts.

In reality, however, the *effective* F&A rate drops to about 22-25% of direct costs (defined as F&A received, divided by total direct costs of securing and implementing a grant, on average). "Capture costs"—referring to the cost of all the work performed by an institution to prepare, apply for and secure specific federal grant awards—are particularly significant and may range in the hundreds of thousands of dollars or higher, depending on the nature of the federal (or other sponsored) opportunity. Capture costs are typically estimated at 2% of the value of the grant opportunity. For example, $200,000 would be budgeted to capture a $10 million grant. Thereafter, grant award administration and research compliance activities require the lion's share of those F&A dollars, leaving relatively little to reinvest in the research enterprise or to provide matching or cost-share funds.

Additionally related to F&A, the success and viability of a particular research proposal often hinges on whether the research team has access to the latest research *instrumentation/equipment*. The cost of upgrading or replacing a single piece of research instrumentation often runs in the hundreds of thousands—or even millions—of dollars. This is a

particular concern for New Mexico's research institutions. Any state support in this regard is very much appreciated. HB 2 (2023) included a total of $3 million for equipment renewal and replacement to HED for such purposes statewide. F&A is essential but insufficient for providing available dollars for new research instrumentation purchases and for maintenance on existing research instrumentation.

13. What is the difference between "facilities" vs. "equipment" vs. "instrumentation"? Why are these concepts important to research competitiveness?

A key factor for higher education research institutions in maintaining research competitiveness and eligibility to pursue new government and private sector research collaborations is the timely modernization of research facilities. "Equipment" is a broad term in the research domain whose definition typically involves criteria related to function and anticipated durability, subject to applicable policies and definitions within state or federal government agencies. "Instrumentation" is a more specific type of research equipment that provides the specific measurement of units and is often the source of innovative discoveries that push the boundaries across many disciplines.

For state research institutions, having appropriate, reasonably modernized research facilities and equipment is, simply put, a game-changer for many research opportunities.

The TEF implementation rules (NMAC 5.3.14.8, part C) further stipulate that "*money in the fund shall be used to provide matching funds to state research universities to support innovative foundational and applied research **and equipment** that advances knowledge and creates new products and production processes in the fields of agriculture, biotechnology, biomedicine, energy, materials science, microelectronics, water resources, aerospace, telecommunications, manufacturing science and similar research areas*."

14. What are neighboring states doing along the lines of supporting basic & applied science and commercialization efforts?

These data can be difficult to obtain, particularly when drilling down to the level of individual state policies that support one or more stages of the pathway that includes research, development, and commercialization. The National Science Foundation tracks state-level R&D expenditures in the following annual report: https://ncses.nsf.gov/surveys/state-government-research-development/2021, with an info brief available at: https://ncses.nsf.gov/pubs/nsf23301. Topline analysis from the most recent NSF report (2021) is excerpted below. An update to the NSF report is due out in November, 2023.

> *"State government agencies' expenditures for research and development totaled **nearly $2.5 billion** in FY 2021, an increase of 1.1% from FY 2020. While total state government agency R&D expenditures saw a slight increase between FY 2020 and FY 2021, state agency expenditures for R&D decreased in four of the five largest states. Agency spending on R&D*

*declined in **California** (-1.9%), **Florida** (-3.4%), **New York** (-8.1%), and **Pennsylvania** (-9.2%), while spending in **Texas** increased (24.6%). Combined, **these five states constitute 59.4%** of all state agency expenditures for R&D. Spending in all other states combined increased 4.1% from FY 2020."*