LEWIS–BURKE ASSOCIATES LLC

TUFTS UPDATE – FEBRUARY 26, 2019
PREPARED BY LEWIS-BURKE ASSOCIATES LLC

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Introduction

This edition of the Tufts Washington Update for late February includes congressional updates and funding opportunities. Faculty, staff, and researchers are welcome to schedule calls with the Lewis-Burke Tufts team or meet with the team when they visit Washington, DC. Contact Amber Cassady, Lewis-Burke Associates LLC, at amber@lewis-burke.com with any questions or comments related to the Update's content or for more information on updates and opportunities.

Congressional Updates

Analysis of Fiscal Year 2019 Appropriations Minibus Package

On February 14, after months of negotiations and the longest government shutdown in history, Congress passed a compromise $333 billion, seven-bill fiscal year (FY) 2019 appropriations "minibus" package. This is the third and final minibus passed by Congress for FY 2019, just one day shy of the expiration of a stop-gap measure that averted another government shutdown for major research agencies such as the National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Agriculture (USDA). President Trump signed the bill into law on February 15.

The final FY 2019 minibus package accounts for 25 percent of discretionary spending and reflects the House-Senate agreement struck last December on FY 2019 funding prior to the shutdown, save for the Department of Homeland Security (DHS) border wall funding. The final funding package passed with largely bipartisan support with the House voting 300 to 138 in favor and passing the Senate by 83-16.

The conclusion of FY 2019 appropriations will now pave the way for the FY 2020 process. However, congressional consideration of the FY 2020 appropriations has already been delayed by the prolonged negotiations over FY 2019 funding and the Administration postponing the release of the President's annual budget request to Congress until mid-March. Although this is a political document expressing the Administration's "wish list" and will generally be disregarded by both sides of the aisle, the delay has impacted the Appropriations Committees' ability to schedule budget hearings with federal agency officials and evaluate the Administration's priorities. Further complicating the FY 2020 process is that under the current law, Congress only suspended the automatic sequestration cuts and raised discretionary spending levels for FY 2018 and FY 2019. Congress will need to reach another two-year budget agreement that raises discretionary spending caps to avoid a $126 billion fiscal cliff for FY 2020.

In the meantime, federal research agencies impacted by the partial government shutdown that are wrestling with prolonged effects and delays, will now have an abbreviated timeline to obligate FY 2019 funding before the end of the fiscal year in September.

National Aeronautics and Space Administration (NASA)

NASA received $21.5 billion in the FY 2019 minibus, which is $763 million or 3.7 percent above FY 2018.

The conference package supported NASA missions across the Science Mission Directorate (SMD). The minibus provides funding for all major Earth science missions including NISAR, PACE, CLARREO Pathfinder, OCO-3, and DSCOVR and continued funding for other major astrophysics and planetary missions proposed for termination by the Administration such as Europa Lander and WFIRST.

Funding to continue keystone and new initiatives is also provided. This includes support for the Mars Exploration Program's 2020 rover helicopter demonstration, an all-time high topline for the Heliophysics Division, and $10 million for the House-driven "technosignatures" activities. The minibus re-iterates bicameral support for the Administration's Lunar Discovery and Exploration program and provides $218

million, as requested, for those activities in SMD. This program supports the Administration's broader agenda to leverage commercial capabilities in support of a pivot to human exploration of the lunar environment. SMD will use this funding to provide scientific support for this campaign.

The minibus rejects the Administration's proposed elimination of the Space Technology Mission Directorate (STMD) and instead provided a $167 million of 14.2 percent increase above FY 2018. The FY 2019 package provided $180 million for RESTORE-L, $20 million for STMD's Flight Opportunities program, and additional funding and emphasis is directed to additive manufacturing, solar electric propulsion, nanomaterials, advanced communications, and nuclear thermal propulsion.

Within NASA's Aeronautics Research Mission Directorate, Congress provided $35 million for hypersonics research in line with the House proposal. Specifically, this funding would "support extramural fundamental research to solve remaining challenges such as propulsion, advanced materials, thermal management, and entry, descent, and landing." Congress envisions NASA leveraging university expertise to address these challenges.

National Science Foundation (NSF)

NSF is funded at $8.075 billion in the minibus, an increase of $308 million or 4.0 percent over the FY 2018 enacted level. This amount is equal to the Senate proposed amount, $106 million below the House proposal, and $600 million over the President's request.

The Research and Related Activities (R&RA) account, which funds all of NSF's research directorates, is funded at $6.52 billion, an increase of 2.9 percent or $186 million over the FY 2018 level. The conference report adopts the Senate's proposal to fund Antarctic Infrastructure Modernization within the Major Research Equipment Facilities and Construction (MREFC) account rather than R&RA (as the Administration requested), which in practice frees up an additional $104 million in the R&RA account for other programs. The report reiterates both House and Senate report language related to support for existing NSF research infrastructure. Additionally, $175.69 million is provided for the Established Program to Stimulate Competitive Research (EPSCoR), which is $1 million less than the House proposed level, $5 million above the Senate proposed level, and $16 million above the President's request. The minibus directs NSF to spend at least the FY 2018 level for I-Corps.

The minibus provides $295.7 million for the Major Research Equipment and Facilities Construction Account (MREFC), $113 million above the FY 2018 level, above both the House and Senate proposed levels, and $201 million over the President's request. As mentioned above, this amount includes $103.7 million for AIMS as well as $127 million for continued construction of three Regional Class Research Vessels, $98 million above the President's request; $16 million for the Daniel K. Inouye Solar Telescope as requested; and $49 million for the Large Synoptic Survey Telescope as requested. A total of $1 million is also provided for enhanced oversight of MREFC projects.

The minibus provided $910 million for the Education and Human Resources (EHR) account, $8 million above the FY 2018 level. The explanatory statement increases funding for Hispanic Serving Institutions to $40 million, $10 million above the FY 2018 level and $35 million more than requested. The minibus also maintains funding for other broadening participation undergraduate programs, provides the

requested level of $66 million for Advanced Technological Education, and provides $64.5 million for the Robert Noyce Teacher Scholarship Program as proposed by the House.

In addition to items specified in the explanatory statement, House and Senate committee report language that is not addressed carries forward, including items related to plant genome research, Windows on the Universe, cybersecurity research, ocean exploration, marine seismic research, USArray monitoring stations, neuroscience, computer science education, math institutes, sustainable chemistry, astronomy, and supercomputing planning.

Department of Agriculture (USDA)

The bill provides $23.04 billion in topline discretionary funding for USDA, a $32 million increase from the FY 2018 enacted level.

The National Institute of Food and Agriculture (NIFA) received $1.47 billion, a 4.5 percent increase from FY 2018. This includes $415 million, a $15 million increase, for the Agriculture and Food Research Initiative (AFRI). With respect to the relocation of NIFA and the Economic Research Service (ERS) outside of DC, the conference explanatory statement expresses concerns and directs USDA to submit costs and an analysis of the research benefits of relocation in the FY 2020 budget request. The proposed transfer of ERS to the Office of the Chief Economist is "delayed indefinitely" citing the "insufficient information and justification relating to the reorganization and relocation."

Regarding the Agricultural Research Service (ARS), the bill rejects the President's request for termination, redirection or closure or research programs or facilities. The minibus provided $1.684 billion to the ARS, a $341.1 million or 25.4 percent increase. Funding increases are directed to several research topics, including human nutrition. Additionally, the conference explanatory statement directs a $2 million increase to expand research on resilient dryland farming. The bill also provides $10.6 million for transfer costs associated with relocating the National Bio and Agro-Defense Facility (NBAF) from Plum Island to its new home in Manhattan, Kansas, as well as $42 million for stand-up activities. This funding supports the transition of responsibility for NBAF from the Department of Homeland Security (DHS) to USDA.

Department of Commerce (DOC)

National Institute of Standards and Technology (NIST)

The National Institute of Standards and Technology (NIST) received $985 million in the final FY 2019 spending package. This is 17.8 percent below what they received in FY 2018. The decrease in funding is a result of a cut to NIST's research facility construction account which provides funds for intermural labs. The spending bill maintains support for multiple NIST priorities including cybersecurity and privacy, advanced manufacturing, and quantum information sciences. The bill maintains $140 million of the Hollings Manufacturing Extension Partnership and $15 million for the National Network for Manufacturing Innovation.

National Oceanic and Atmospheric Administration (NOAA)

NOAA received a topline cut of 8.2 percent compared to the FY 2018 level, but the bulk of this $484.7 million decrease is from the Procurement account. The Operations, Research, and Facilities account received a $60.6 million increase compared to the FY 2018 level.

Office of Oceanic and Atmospheric Research (OAR) is funded at $525 million, a $17.5 million increase above the FY 2018 enacted level. The FY 2019 minibus provides flat funding of $60 million for OAR's Competitive Climate Research program, although the House bill had proposed the program for elimination. Ocean Exploration and Research (OER) received $42 million, an increase of $5.5 million above the FY 2018 enacted level, but $6 million less than the House mark.

The National Ocean Service (NOS) Coastal Science and Assessment Competitive External Research account received a $5 million increase directed to research on harmful algal blooms in marine and freshwater. The conference explanatory statement directs NOAA to address the backlog in hydrographic surveys, as well as charting of the Arctic, and prioritize "waters impacted by disasters." The FY 2019 minibus provides $1.5 million directed to the Integrated Ocean Observing System (IOOS) regional ocean partnerships to "enhance their capacity for sharing and integration" of data. The bill provides $5.5 million directed to the National Oceanographic Research Partnership Program, an interagency research collaborative.

The conference explanatory statement explicitly rejects report language from both the House and Senate bills that would direct NOAA Fisheries to collaborate with other agencies and local communities on studying the impacts of offshore wind energy development on marine mammals and fish.

The FY 2019 minibus provides the National Mesonet Program $19 million and adopted Senate report language that prioritized the program and directed the continuation and expansion through a competitive weather data procurement.

The Space Weather Follow-on received a total of $27 million, a significant increase compared to the FY 2018 enacted level of $8.5 million. The conference explanatory statement directs continued development and construction of two compact coronagraphs. The bill maintains separate funding for the PAC account Joint Polar Satellite System (JPSS) and Polar Weather Follow-on (PFO), rejecting the budget request proposal to combine the accounts.

Economic Development Administration (EDA)

The Economic Development Administration (EDA) received $304 million in the final FY 2019 minibus, which is $2.5 million above the FY 2018 enacted level. This allocation represents predominantly flat funding and runs counter to the President's FY 2019 budget request, which once again proposed eliminating the agency outright. The final FY 2019 funding package provides $2.5 million more than the House bill, but $1.5 million below the Senate mark. The bill also provides continued support for assistance to drive economic revitalization in coal communities.

The bill enhances funding for the Regional Innovation Program (RIP) by $2.5 million over the FY 2018 enacted level. RIP is a popular initiative that has provided support for universities and research institutes to develop and scale-up commercialization centers through i6 Challenge grants and to cultivate funding campaigns for promising startups through Cluster Grants for Seed Capital Funds. This increase in funding for RIP follows a $4 million increase in last year's omnibus and is indicative of continued congressional support for the program over the years. The Senate Appropriations Committee's report further directed EDA to prioritize RIP funding for high-tech business incubators at universities, including collaborations between universities and federal labs. The Senate also emphasized the importance of geographic diversity and investing in rural areas. The House Appropriations Committee's report encouraged EDA to leverage RIP funding to promote the development of regional innovation clusters that focus on advanced wood products.

The FY 2019 minibus provides $37 million for the Economic Adjustment Assistance (EAA) program. EAA awards provide support for the planning and implementation of regional economic development strategies. The bill also provides flat funding of $117.5 million for the Public Works program, which provides funding for the construction of new infrastructure aimed at helping communities compete in the 21st Century global economy. This represents an increase of $17.5 million above the FY 2017 enacted level. Both EAA and Public Works commonly support university-driven projects that demonstrate the capacity to stimulate regional economic development and competitiveness.

Additionally, the House and Senate reports directed EDA to report to Congress on its work to develop best practices for assisting communities affected by nuclear plant closures.

Department of Homeland Security (DHS)

The Department of Homeland Security (DHS) received $49.4 billion in the FY 2019 minibus, which is $1.7 billion above the FY 2018 enacted level. This funding increase is due in part to the continuation of enhanced border security and immigration enforcement investments supported by Republicans, as well as disaster relief. While significant, the bill's investments in border fencing and enforcement would be well below the amounts requested by the President in his annual budget request. Still, a sizable amount of funding was also set aside for agencies like Customs and Border Protection, including $100 million for border security technology. To offset these investments, Congress cut funding for the research and development (R&D) of security technologies and methods within other agency functions.

Most notably, the minibus provides $820 million for Science and Technology (S&T), which is $21 million less than FY 2018 enacted and $237 million more than the FY 2019 request. The package also sustains $40.5 million in funding for the Office of University Programs (OUP) to maintain 10 DHS Centers of Excellence (COEs). The agreement adopts House language, directing DHS to report within 90 days on the process for determining how funding is allocated to each COE and their metrics to track center performance, as well as S&T's plans to ensure emeritus Centers "remain as critical assets serving the national interest."

The FY 2019 minibus directs DHS to prioritize investments for research on widescale issues like cybersecurity and infrastructure protection. Of note, the minibus provides $3 million for the establishment of a cyber testbed described in the House appropriations bill. According to the House

report, the testbed will "evaluate technologies, analytic tools, and propose cyber solutions to mitigate cyber threats across the utility sector and develop a platform for sharing information related to testbed activities, with a goal of developing cost-efficient and operationally effective sensor technologies to support small utility companies."[1] Moreover, the bill provides specific funding amounts for R&D related to the following topics:

- $31.7 million for Cargo and Port-of-Entry Security
- $12.9 million for Air Based Technologies
- $16.7 million for Port and Coastal Surveillance
- $8.5 million for Opioids/Fentanyl
- $12.3 million for Detection Canine
- $7 million for Soft Target and Crowded Places
- $18.7 million for Explosives Threat Assessment
- $13 million for Counter-Unmanned Aerial Systems (UAS)
- $4 million for Enabling UAS
- $7.3 million for Software Assurance
- $6.2 million for Cyber Physical Systems
- $16 million for First Responder Technologies

Finally, the minibus formally recognizes S&T as the central component for DHS R&D and rejects a proposal in the President's FY 2019 budget request to move cybersecurity research from S&T to the new Cybersecurity and Infrastructure Security Agency (CISA), the component responsible for cyber operations at DHS.

Department of Interior (DOI)

U.S. Geological Survey (USGS)

The FY 2019 minibus bill provides $1.161 billion for the U.S. Geological Survey (USGS), which is $12.1 million or 1.1 percent above FY 2018 enacted level. The topline USGS funding level in the minibus is almost $7 million lower than the House FY 2019 appropriations bill, but $12 million above the Senate version. Congress rejected President Trump's proposed budget that would have drastically cut the agency by 25 percent compared to the FY 2018 enacted level. The minibus provides increases to all mission areas except for Natural Hazards and Ecosystems, which were reduced by 7.9 and 0.5 percent, respectively.

The minibus funds the Natural Hazards account at $166 million, a $34 million or 7.9 percent decrease compared to FY 2018 due to cuts to the Volcano Hazards program. Specifically, the bill provides $16.1 million for continued development of the ShakeAlert Earthquake Early Warning System, an increase of $3.2 million over the last fiscal year. Additionally, $5 million is provided for capital costs for the warning system's buildout. The Advanced National Seismic System received $5 million for infrastructure and $1.2 million for staffing needs. The minibus provides $2 million for the Earthscope USArray. The

[1] https://docs.house.gov/meetings/AP/AP00/20180725/108623/HMKP-115-AP00-20180725-SD004.pdf.

minibus also includes funding for the Central and Eastern U.S. Seismic Network and other regional seismic networks.

The minibus provides $158 million for Land Resources, a 3.7 percent increase from FY 2018. Prior to FY 2018, this account was titled Climate and Land Use Change. Continuing support from both the House and Senate bills, the minibus protects existing funding for the eight Climate Adaptation Science Centers that were proposed for a 48 percent cut in the FY 2019 budget request. The bill additionally provides full funding of $32 million for the Landsat-9 satellite.

The bill ignores the Administration's continued proposed elimination of the Water Resources Research Institutes and funds this program at the FY 2018 enacted level of $6.5 million.

Within the Ecosystems mission area, the Cooperative Research Units received funding of $18.4 million including an increase of $1 million to address vacancies. As included in the Senate report, a portion of this funding is encouraged to support moose population research. $500,000 is included for "research transferred from curation activities," which refers to the Biological Survey Unit.

Energy, Minerals, and Environmental Health received the largest increase of 7.8 percent for a total of $112 million. The new Three-Dimensional mapping and Economic Empowerment Program (3DEEP) for assessment of domestic critical mineral resources received $9.6 million.

In Core Science Systems, the National Cooperative Geological Mapping Program is flat funded relative to FY 2018 at $24 million. The 3D Elevation Program received an increase of $1.5 million.

Department of Justice (DOJ)

The US Department of Justice (DOJ) received a $30.9 billion for FY 2019, an increase of nearly $638 million above the FY 2018 enacted level. While DOJ is funded at a 2.1 percent increase over the current enacted levels, funding for key research accounts is decreased. For instance, the National Institute of Justice (NIJ), DOJ's primary external research program that leverages university partnerships with the goal of strengthening science and enhancing justice, is cut by 11.9 percent. Funding from these offices is expected to be redistributed to initiatives that provide more direct support for local governments and law enforcement agencies, such as *Comprehensive Addiction and Recovery Act* (*CARA)* programs to combat the opioid epidemic and *Students, Teachers, and Officers Preventing* (*STOP) School Violence Act* programs to support safety upgrades for K-12 schools. Both CARA and STOP accounts saw major funding increases in FY 2019.

The minibus bill identifies very few specific research priorities, with limited set-asides listed for research to combat domestic radicalization and develop best practices for school safety. Also, the final FY 2019 conference package included the $3 million from the Senate FY 2019 appropriations bill to support the development of a National Center for Restorative Justice. According to the Senate bill report, the Center would establish a degree program or a summer institute aimed at developing the next generation of justice leaders through enhancing individuals' understanding of the justice system and restorative approaches. The Center is also directed to support research focused on how to best provide direct services to address social inequities, such as simultaneous access to substance abuse treatment and

higher education. Both the House and Senate FY 2019 bill reports listed several topics for research projects across the agency, which could appear in FY 2019 solicitations, including studies on campus-based sexual assault and cybercrime prevention with a heightened emphasis on juvenile victims.

Environmental Protection Agency (EPA)

The minibus provides the U.S. Environmental Protection Agency (EPA) with $8.06 billion, flat relative to both FY 2018 and the Senate bill and $100 million (1.3 percent) above the House bill. The FY 2019 minibus is also $1.87 billion (30.5 percent) above the budget request. Consistent with the FY 2018 omnibus, the explanatory report includes language that bars the Administration from implementing any of the large-scale restructuring activities it proposed in its budget request. Specifically, the FY 2019 final package prohibits both the reshaping of the agency's workforce and the closure of regional offices such as the National Center for Environmental Research (NCER), which administers much of EPA's external research funding.

The EPA Science and Technology account (S&T) received $706.5 million, the same as the FY 2018 enacted level, but $257.5 million, or 57.4 percent, above the request. This amount includes a $15.5 million transfer from the Hazardous Substance Superfund account to support ongoing relevant research. Given the flat funding, there will not be major reapportionment of money between various S&T programs in FY 2019.

Consistent with the FY 2018 omnibus, the FY 2019 minibus explicitly includes funding for the Science to Achieve Results (STAR) program, though the amount is unspecified. STAR is EPA's primary mechanism for funding external research, but the program has received declining budgets since 2002. The Administration has proposed eliminating STAR in the FY 2018 and FY 2019 budget requests.

The minibus provides $5 million to support water quality and availability research by nonprofit organizations through National Priorities grants, $900,000 more than in FY 2018. These grants are independent of STAR, and preference is generally given to research proposals that include a national scope and a 25 percent match. The report language directs EPA to "strive to award grants in as large an amount as is possible to achieve the most scientifically significant research."

The FY 2019 minibus maintains support for several initiatives from the FY 2018 omnibus, including a mandate for EPA to coordinate with other federal agencies on research activities aimed at using Enhanced Aquifer Recharge (EAR) to augment drinking water sources and mitigate seasonal water scarcity. The minibus also encourages the National Center for Computational Toxicology (NCCT) to expand its collaboration with the external research community on advances in human biology-based chemical risk assessment. The Directors of NCCT, the Office of Pollution Prevention and Toxics, the National Toxicology Program, and the National Center for Environmental Assessment are also directed to seek community input, via requests for information and public workshops, on the development of a strategic plan for alternative methods and integrated testing. Additionally, the minibus includes direction, originally contained within the House report, to EPA to support a Water Security Test Bed for pursuing research aimed at mitigating threats to drinking water sources and infrastructure.

Finally, the minibus adopts Senate report language encouraging EPA to provide funding for research grants related to harmful algal blooms (HABs). Research activities will focus specifically on evaluating existing mitigation methods, scaling up emerging technologies, and developing best practices for addressing HABs in both urban and rural communities. The minibus also specifically provides an additional $5 million to study the health impacts of exposure to both HABs and cyanobacteria toxins, as well as "to develop methods to monitor, characterize, and predict blooms for early action." This allocation was not included in the initial Senate mark.

National Endowments for the Humanities and Arts (NEA and NEH)

The FY 2019 minibus provides both the National Endowment for the Humanities (NEH) and National Endowment for the Arts (NEA) $155 million each, an increase of roughly $2 million compared to FY 18 levels, respectively. The $155 million for each agency is consistent with both the House and Senate FY 2019 bills. Once again Congress rebuffed the Administration's proposed elimination of NEA and NEH. Regarding NEH, the joint explanatory statement encourages expansion of programming with tribes, as well as veteran populations. The FY 2019 minibus conference report also includes new language encouraging both agencies to expand grant making to support rural and underserved areas. Similar to recent years, Congress also recommends that NEA focus on expanding its successful "Creative Forces: Military healing Arts Network" program in order to "assist service members and their families in their recovery, reintegration, and transition to civilian life."

Note: More specific funding breakdowns for FY 2019 can be found in Appendix A at the bottom of this document.

Sources and Additional Information:

- The FY 2019 minibus explanatory statement is available at https://docs.house.gov/billsthisweek/20190211/116hrpt9-JointExplanatoryStatement.pdf.

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Drug Pricing Legislation Introduced with Implications for Tech Transfer

The new Congress has made addressing the high costs of prescription drugs a top priority. Multiple committees from both chambers have held hearings and members across the political spectrum have crafted legislative proposals to address the issue in recent weeks. Among the proposals are bills that, if passed, would adversely impact the research community by weakening intellectual property protections under the *Bayh-Dole Act of 1980 (Bayh-Dole)*. Although it's unlikely the most concerning bills will be signed into law in their current forms, the costs of prescription drugs remain a bipartisan priority in Congress and the Administration, and it is important for universities and research institutes to be cognizant of legislation that could hinder the lab-to-market pipeline. This memorandum provides a summary of these concerns and an overview of recent legislation. Lewis-Burke Associates LLC (Lewis-Burke) will continue to monitor the debate over drug pricing and the most problematic legislative proposals.

Emerging Threat to Bayh-Dole

Bayh-Dole authorizes universities to retain title to federally-funded innovations, allowing institutions to steward a generation of technologies and treatments from the lab to market through licensing agreements with the private sector. As the success of Bayh-Dole is contingent upon a robust and reliable patent system, the law only permits the federal government to leverage its authority to reassign a patent ("march-in rights") in the most extreme circumstances. March-in is one of a few federal compulsory licensing provisions, or laws that allow the government to take intellectual property without the patent holder's consent. Some advocacy groups have pushed for the federal government to use march-in and other forms of compulsory licensing to force pharmaceutical companies to address the price of prescription drugs. These provisions would adversely impact private sector confidence in the exclusivity of patents through licensing agreements with universities and could dry up investments in promising university research. In the past, federal agencies have also noted the destabilizing consequences of march-in, which is why it has never been used.

Among the legislative proposals to address drug costs introduced so far in the 116th Congress, two bills include provisions that would authorize compulsory licensing by the federal government. These proposals, if enacted, would undermine the U.S. intellectual property system under *Bayh-Dole* and threaten university efforts to transition scientific research and discoveries into new technologies. Overviews of the two bills are provided below.

Medicare Negotiation and Competitive Licensing Act of 2019

Rep. Lloyd Doggett (D-TX), Chairman of the House Ways and Means Subcommittee on Health, recently reintroduced H.R. 1046, the *Medicare Negotiation and Competitive Licensing Act of 2019.* Senator Sherrod Brown (D-OH) has also introduced a companion bill, S. 377.

- The Doggett-Brown bill directs the Secretary of Health and Human Services (HHS) to negotiate prescription drug prices under the Medicare Part D program. For new prescription drugs approved under the program, Medicare Part D is directed not to pay more than the average price that a drug is sold to other entities listed in the bill (HMOs, nonprofits, governments in OECD countries).
- If unable to negotiate a reasonable price, the Secretary is directed to authorize the use of any patent, clinical trial data, or other exclusivity granted by the federal government to a third party in order to manufacture the drug at a cheaper price. This undermines any intellectual property protection the original manufacturer had.
- There aren't substantial differences between this bill and its predecessor, which Rep. Doggett introduced in the 115th Congress, in terms of compulsory licensing provisions.
    - However, the new version directs the Secretary, when authorizing a license to be used by a third party, to give preference to entities that have high safety and security standards and will manufacture the drug in the United States.
- So far, this bill has 112 Democratic co-sponsors from across the ideological spectrum, but no Republicans.
- Senators Amy Klobuchar (D-MN) and Tammy Baldwin (D-WI) are also cosponsors of the Senate bill.

Prescription Drug Price Relief Act of 2019

H.R. 465 and S. 102, the *Prescription Drug Price Relief Act of 2019*, introduced by Senator Bernie Sanders (I-VT) and Rep. Ro Khanna (D-CA) in January, is a new bill that also contains compulsory licensing language.

- This bill has a broader scope than the Doggett-Brown bill, as it applies to all brand name prescription drugs, not just those under the scope of Medicare Part D.
- If enacted, the Secretary would determine if a drug has an "excessive price" as determined by looking at the median price in five countries. If that is not the case, the Secretary would still consider a number of factors to determine if the drug is excessively priced.
- If the drug is excessively priced, the Secretary is directed to "waive or void any government-granted exclusivity" for the drug and grant an open non-exclusive license that allows anyone to make, sell, or import the drug.
    - Unlike the Doggett-Brown bill, which authorizes all exclusivities to a specific third party, this bill would put the license out for anyone in the public to use.
- HHS would then expedite reviews for any applications for a drug that was licensed through this process.
- This bill has a smaller base of political support than the Doggett-Brown bill.
    - The House version only has 21 co-sponsors. Apart from Reps. Elijah Cummings (D-MD) and Rosa DeLauro (D-CT), most supporters are progressive freshman members, such as Rep. Alexandria Ocasio-Cortez (D-NY).
    - However, on the Senate side, the bill is supported by a number of Senators running for president such as Senators Sanders, Cory Booker (D-NJ), Kamala Harris (D-CA), Kristen Gillibrand (D-NY), and Elizabeth Warren (D-MA), as well as Richard Blumenthal (D-CT).

Other Legislation

It is important to note that there are other bills that address drug pricing without compulsory licensing. Senator Amy Klobuchar (D-MN) introduced S. 62, the *Empowering Medicare Seniors to Negotiate Drug Prices Act of 2019.* This bill would allow, but does not direct, the HHS Secretary to negotiate drug prices and does not have any language about compulsory licensing. It has 33 Democratic co-sponsors, including fellow presidential candidates like Senators Booker, Harris, Gillibrand, and Warren, as well as Senator Brown and Minority Leader Chuck Schumer (D-NY). Other current pieces of legislation address additional possible solutions to lower drug prices, such as the importation of cheaper drugs from outside the U.S. It is uncertain what impact, if any, these proposals would have on the university technology transfer enterprise.

Lewis-Burke will continue to monitor these and other pieces of legislation that impact intellectual property and the university research enterprise as the debate over drug pricing progresses.

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Funding Opportunities

National Science Foundation Releases Quantum Leap Challenge Institutes

On February 19, the National Science Foundation (NSF) released a solicitation for its new program, *Quantum Leap Challenge Institutes (QLCI).* The goal of the QLCI program is to fund large-scale multidisciplinary centers for quantum research and education research projects that advance the national understanding of quantum science and engineering, primarily in the focus areas of "quantum computation, quantum communication, quantum simulation, and/or quantum sensing". The creation of quantum centers was directed in the *National Quantum Initiative Act* (H.R. 6227) signed into law December of 2018. QLCI funds will be used to award both **Conceptualization Grants (CG)** which support teams envisioning future Institute proposals and **Challenge Institute (CI)** awards to establish and operate Institutes. The QLCI competition will offer two rounds with Round 1 occurring in 2019 and Round 2 taking place in 2020. Teams can submit either a CI or a CG proposal to Round 2, while Round 2 will only be for CI proposals.

This solicitation falls under the "Quantum Leap: Leading the Next Quantum Revolution" Big Idea, which aims to develop next-generation technologies for sensing, computing, modeling, and communicating. To support this mission, QCLI is intended to engage a diverse academic community while developing collaborative, interdisciplinary approaches to national research challenges and enabling the preparation of a well-trained, cross-disciplinary workforce. NSF has previously released several solicitations through Quantum Leap, including those related to interdisciplinary research, materials foundries, faculty hiring, a topological quantum computer, quantum communications platforms, quantum logic, and quantum chemistry. Additional opportunities are expected this year and beyond.

Institutes will carry out their mission through major activities across four identified focus areas:

1. Cross-Disciplinary Research, which may but do not have to be in an identified subarea:
    a. Quantum Networks for Secure Long-Range Communication
    b. Software Stacks for Quantum Computers
    c. Algorithms, Architectures, and Platforms for Quantum Simulation
    d. Quantum Sensing
2. Education and Workforce Development,
3. Research Coordination, and
4. Synergistic Partnerships and Infrastructure Development

In carrying out their mission, Competitive CI proposals will demonstrate a:

- "long term, clearly defined Challenge Research Theme and Cross-Disciplinary Vision";
- Clear and compelling science-, algorithm- and engineering-driven goals, with "specific target milestones over the period of performance";
- Innovative and substantive workforce development activities to "enhance outreach and education, cross-disciplinary training, curriculum development and mentoring for a quantum-smart workforce";

- collaboration and development of shared infrastructure with other universities and colleges, national laboratories, private sector research laboratories, industrial partners, non-profit organizations, state and local government laboratories, and international partners; and
- justification showing how the "collective effort of researchers from different disciplines will enable transformative advances in quantum information science".

CG proposals should outline a clear strategy to support the formation of a convergent and interdisciplinary team and the development of a research vision for the intended CI proposal. Competitive CG proposals will demonstrate:

- "Stakeholder and community engagement for brainstorming of ideas for research, community building, infrastructure development, and workforce development.
- Plans to attract and engage research talent across different disciplines through collaborations, networks, seminars or other approaches.
- Identification of research theme(s) for advancing the state-of-the-art at one or more frontiers of quantum information science and engineering within a 5-year period.
- Formation of cross-disciplinary research teams for the chosen challenge research theme and the major activities, including research coordination and workforce development."

Eligibility: While there is no restriction on who may serve as a PI or the number of submissions an institution may submit, an individual can appear as a PI or Co-PI on no more than two Conceptualization Grant (CG) proposals and no more than one Challenge Institute (CI) proposal. Additionally, during Round I, prospective application teams can submit either a CG or CI proposal but not both.

Due Date: Letters of Intent for Conceptualization Grant proposals are due April 1, 2019. Conceptualization Grant proposals are due June 3, 2019. Letters of Intent for Round I of the QLCI are due June 3, 2019 with preliminary proposals due by August 1, 2019. and full proposals, by invitation only, due by January 2, 2019. Letters of Intent for Round II are due August 3, 2020, with preliminary proposals due September 1, 2020, and full proposals, by invitation only, due by February 1, 2021. Letters of Intent for all competitions are required.

Total Funding and Award Size: NSF anticipates up to $94 million in total funding, with 15 to 25 conceptualization grants being awarded between $100,000 and $150,000 for 12 months. NSF intends to award up to three Challenge Institutes during each round with up to $5 million per year for five years.

Sources and Additional Information:

- The full solicitation can be found at https://nsf.gov/pubs/2019/nsf19559/nsf19559.htm.
- The program page can be found at https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505634.
- Additional information on the NSF Big Ideas is available at https://www.nsf.gov/news/special_reports/big_ideas/.

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National Science Foundation Releases Production Engineering Education Research Solicitation

The National Science Foundation (NSF) recently released a solicitation for its new program *Production Engineering Education Research* (PEER) that is supported by funding from The Boeing Company. The solicitation is part of the Education and Human Resources (EHR) Directorate Core Research (ECR) program and looks to improve advanced manufacturing training. NSF welcomes two tracks of proposals: Track 1 is titled *Course, Curriculum and Evaluation* and would fund the creation of online curricula, and Track 2 is for *Workforce Development Workshops*. PEER supports education in production manufacturing though five focal areas: "model-based systems engineering, software engineering, mechatronics, data science, and artificial intelligence." NSF is looking for proposers to utilize a "convergent science approach" with contributions from multi-disciplinary experts. Through this program, NSF seeks to improve manufacturing education, enable workforce growth, and enhance diversity.

Projects in Track 1 will pursue foundational research to develop, implement, and evaluate online courses to teach production science principles. Online curricula should be "vertically coherent" to provide increasingly advanced learning opportunities. Courses should be targeted to professionals and students at two-year and four-year institutions, though NSF prefers that the initial courses be aimed at professionals. Assessments should enable predictive analytics on how students will perform in more advanced classes and the workforce. Strong proposals should use active learning methods and be informed by engineering education research. NSF expects proposers to collect data on both interactions with the online curricula and student psychometrics to evaluate the effectiveness of the course based on learning sciences principles. The data collected should be stored and made available to other educational researchers. Proposals should include information on how ethical and privacy issues will be addressed. The online courses should be scalable nation-wide and follow NSF's Open Educational Resources guidelines to allow others to make use of and adapt materials developed. Research and evaluation plans are both required as part of the proposal, and additional details can be found in the solicitation.

The workshop track is aimed at bringing together experts from academia as well as non-profits and for-profit organizations with capabilities in engineering, education, and other applicable interdisciplinary sciences to form a plan for national infrastructure for STEM workforce development. The infrastructure should enable personalized and distributed learning of production manufacturing relating to one of the focal areas mentioned above. Participation from a variety of disciplines is invited, including but not limited to "engineering, computer science, information science, computational science, mathematics, statistics, education research, and cognitive science." Applicants should additionally have a "creative" plan to widely share findings.

Boeing is offering engineering and science subject matter experts to share technical assistance and advise on workforce needs for both PEER tracks. Further details on the two tracks of proposals can be found in the solicitation.

This program builds on recent NSF workforce development and reskilling initiatives including a December 2018 Dear Colleague Letter (DCL) on *STEM Workforce Development Utilizing Flexible Personal Learning Environments*. On February 8, NSF released another opportunity connected to support from

Boeing with a DCL on *Supporting the Re-Entry of Women and Women Veterans in the STEM Workforce through NSF INCLUDES*. This program is also emblematic of NSF's increasing interest in public-private partnerships to leverage industry and foundation funding.

Total Funding and Award Size: A total of $10 million is anticipated for up to five Track 1 awards and up to five Track 2 awards. Track 1 awards may be up to $2 million for up to three years, and Track 2 awards have a maximum of $100,000 for up to a year.

Due Dates: Full proposals are due by **May 15, 2019** at 5:00 PM submitter's local time.

Eligibility: There is not a limit to the number of proposals from any institution, though a principal investigator (PI) may only be listed as "senior personnel" on one proposal per track. The team of senior personnel in Track 1 must have skills in:

- "the specific discipline that is being taught;
- working with students at all relevant educational levels;
- learning sciences and/or cognitive sciences; and
- learning analytics or assessment."

Experts involved in the Track 2 workshops may be from "academic, for-profit, and non-profit sectors" and may be from the U.S. or international institutions.

Sources and Additional Information:

- The solicitation is available at https://www.nsf.gov/pubs/2019/nsf19557/nsf19557.htm.
- The DCL on *STEM Workforce Development Utilizing Flexible Personal Learning Environments* is available at https://www.nsf.gov/pubs/2019/nsf19025/nsf19025.jsp.
- The DCL on *Supporting the Re-Entry of Women and Women Veterans in the STEM Workforce through NSF INCLUDES* is available at https://www.nsf.gov/pubs/2019/nsf19038/nsf19038.jsp.

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Office of Naval Research Seeks Proposals for Manufacturing Engineering Education Program

The Office of Naval Research (ONR) released a Funding Opportunity Announcement (FOA) for the Manufacturing Engineering Education Program (MEEP). The MEEP program, which was established in the *National Defense Authorization Act for Fiscal Year (FY) 2017* (NDAA) and is administered by the Office of the Secretary of Defense, seeks to establish programs "to better position the current and next-generation manufacturing workforce to produce military systems and components that assure technological superiority for the DoD." Through MEEP, DOD supports industry-relevant, manufacturing-focused, engineering training at a variety of U.S. institutions; the program does not support manufacturing research. This is the second year for the MEEP program, and program officials intend to double the number of awards from four in FY 2018 to about eight in FY 2019, as well as increase the size of each award.

For FY 2019, proposals should develop curricula to foster skills sets needed by students to work effectively in multidisciplinary design and manufacturing environments, including those where design and manufacturing are informed by computational tools for modeling and simulation. DOD seeks to develop education programs that emphasize instruction and projects; faculty and instructor development; involvement of industry and DOD laboratories; and outreach to members of the armed forces, dependents and children of such members, and veterans. Curricula and programs that develop shop-floor capabilities are also sought. Proposals should demonstrate an understanding of current manufacturing engineering challenges and potential solutions especially with respect to "distinct manufacturing technologies of DoD interest, such as: manufacturing of lightweight structures, systems and materials; robotics for manufacturing; manufacturing to exploit nanotechnology; manufacturing of components and systems for power generation, storage, or distribution; or manufacturing of multi-functional electronics and/or optical devices."

Lewis-Burke has learned that in its second year, the program will emphasize retraining specifically for veterans and military families, a better balance between four-year colleges and universities and community colleges and trade schools, apprenticeship programs, and geographic diversity. Proposals should also address long-term sustainment models for programs funded through MEEP.

For the FY 2018 solicitation, DOD received 103 white papers, from which it requested 14 full proposals, which resulted in four awards listed below.

- Battelle Education (Columbus, OH) will leverage public private partnerships to strengthen the manufacturing engineering education at the high school level.
- Clemson University (Clemson, SC) will develop immersive and personalized instruction to strengthen learning and retention for high-school through graduate school students.
- Massachusetts Institute of Technology (Cambridge, MA) will develop a comprehensive 15-month apprenticeship training program in support of a highly-skilled manufacturing workforce. This program will teach general and specific manufacturing competencies (ex., introductory quantum mechanics, electrical technology, and design principles) that demonstrate the interrelation of various manufacturing sectors.
- National Center for Defense Manufacturing & Machining (Blairsville, PA) will develop and launch a series of new virtual courses, inclusive of additive manufacturing and related technologies, to broaden and extend the scope of the Society of Manufacturing Engineers' long-standing certificate programs.

Proposers are required to submit white papers and will be notified if they are invited to submit a full proposal to ONR. It should be noted that the full FOA contains detailed instructions for required information that should be addressed in the white paper.

Due Dates: White papers should be submitted via email to the attention of Dr. William Mullins at william.m.mullins@navy.mil no later than **March 28, 2019 at 3:00 PM EST**. If invited, applicants must submit a full proposal through grants.gov no later than **June 20, 2019 at 11:59 PM EST.**

Total Funding and Award Size: ONR intends to award up to an estimated total value of

$40 million subject to the availability of funds, with individual awards not exceeding $5,000,000 for a period of up to three years. Applications for larger amounts will be considered on a case-by-case basis. To enhance diversity, ONR intends to reserve some awards for secondary and post-secondary vocational and technical schools or similar programs at community colleges that focus on participant career choices and training in the respective fields. Projects addressing a larger community effort must consult with Dr. William Mullins at william.m.mullins@navy.mil

Eligibility and Limitations: Organizations representing academia, the non-profit sector, and industry are eligible to apply. Federally Funded Research and Development Centers (FFRDCs) are not eligible to apply but are able to participate in teaming arrangements under certain conditions.

Sources and Additional Information:

- The full ONR FOA is located at www.grants.gov under solicitation number N00014-19-S-F006.

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Department of Defense Releases Defense University Research Instrumentation Program Competition

The Department of Defense (DOD) released the broad agency announcement (BAA) on February 15 for the fiscal year (FY) 2020 Defense University Research Instrumentation Program (DURIP) competition. DURIP, an annual program under DOD's University Research Initiative (URI), provides acquisition funding for equipment and instrumentation used to support defense-related research activities. DURIP funding supports the purchase of major, state-of-the-art equipment (from $50,000 to $1.5 million, with an average award of approximately $300,000) that augments current research institutions' capabilities or develops new capabilities to perform cutting edge defense research and associated graduate student research training in disciplines of importance to DOD.

According to DOD, DURIP funding is not appropriate for the construction or modification of buildings, building support systems, fixed equipment (i.e. clean rooms or fume hoods), general-purpose computing facilities, or purely instructional equipment. DURIP remains an extremely competitive funding program with the decline in similar instrumentation programs across federal agencies. For FY 2018, DOD awarded $53 million dollars in awards to 175 university researchers at 91 institutions in 36 states. A list of the FY 2018 DURIP awardees is available here.

As in previous years, the Army Research Office (ARO), Office of Naval Research (ONR), and the Air Force Office of Scientific Research (AFOSR) jointly support the solicitation, which is issued in cooperation with the Office of the Director of Basic Research in the Office of the Secretary of Defense. DOD recommends that proposers review each Service branch research agency's interests contained in recent long-range BAAs to align proposals with stated DOD research needs. Proposals must address research of interest to one or more Services and may be submitted to more than one Service for consideration. While an application may be submitted to multiple Services, funding can only be received from one. DOD encourages interested researchers to contact the appropriate program managers relevant to their field to discuss the relevance of proposed ideas.

In addition to research efforts, DURIP emphasizes related educational enhancement and requires proposals to address how DURIP funding would strengthen educational opportunities for students in DOD-relevant fields.

Lewis-Burke also recommends that proposers may want to identify how research efforts supported by the instrumentation align with the Undersecretary of Defense for Research and Engineering's top-10 list of technology focus areas from the 2018 *National Defense Strategy*. Those focus areas are:

- hypersonics
- directed energy
- command, control and communications
- space offense and defense
- cybersecurity
- artificial intelligence/machine learning
- missile defense
- quantum science and computing
- microelectronics
- autonomy

Question Submission Deadline: Questions to respective program managers concerning the BAA are encouraged and must be submitted by **April 26, 2019.** Appropriate points of contact can be found in each of the respective agencies' BAAs (links included in the DURIP BAA and below). For general questions, ARO, ONR, and AFOSR each have a corresponding point of contact listed under "Agency Contacts" in the BAA (see link below).

Full Proposal Deadline: Full proposals should be submitted no later than **May 17, 2019 at 11:59 PM ET**.

Total Funding and Award Size: DOD anticipates awarding approximately $47 million under the FY 2020 DURIP competition, with individual awards ranging from $50,000 - $1.5 million.

Eligibility: The competition is open to accredited U.S. institutions of higher education with degree-granting programs in science, mathematics, or engineering.

Sources and Additional Information:

- The full FY 2020 DURIP solicitation issued by each military Service is available at www.grants.gov by searching "FOA-AFRL-AFOSR-2019-0001" (Air Force), "W911NF19S0005" (Army), and "N00014-19-S-F007" (Navy).
- The Army Research Office Broad Agency Announcement and Army Research Laboratory Broad Agency Announcement are available at https://www.arl.army.mil/www/default.cfm?page=8 or at www.grants.gov by searching for "W911NF-17-S-0002" and "W911NF-17-S-0003."
- The Long Range Broad Agency Announcement for Navy and Marine Corps Science and Technology is available at www.onr.navy.mil, under "Contracts and Grants," "Funding Opportunities" or at www.grants.gov by searching for "N00014-18-S-B001."
- The Research Interests of the Air Force Office of Scientific Research Broad Agency Announcement is available at www.grants.gov by searching for "FA9550-18-S-0003."

- The National Defense Strategy can be found at https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.

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Department of Energy Announces $66 Million Funding Opportunity for Genomics-Based Research

On February 11, the Department of Energy's (DOE) Biological and Environmental Research program within the Office of Science announced a $66 million investment in genomics-based research through two separate funding opportunities entitled *Systems Biology Enabled Research on the Roles of Microbiomes in Nutrient Cycling Processes* and *Genomics-Enabled Plant Biology for Determination of Gene Function.* These two initiatives are intended to take a more comprehensive approach to understanding genetic functions in plants and how they can be utilized for bioenergy and bioproducts.

DOE typically releases a funding call every three years on systems biology enabled research and the roles of microbial communities in carbon cycle processes, but the new microbiome solicitation is the first with a specific emphasis on microbial signaling in and among microbial communities. This advances DOE's support of microbiome research as part of a larger federal microbiome initiative. Specifically, the microbiome solicitation, a part of the BER Genomic Sciences program, is requesting high-risk, high-reward proposals that address critical knowledge gaps in the areas of "systems biology studies on regulatory, metabolic, and signaling networks of microbes, microbial consortia, and microbe-plant interactions involved in biogeochemical cycling of nutrients" and the "development and application of -omics approaches to investigate microbial community processes involved in biogeochemical cycling in terrestrial and sedimentary ecosystems." By investigating the way microbes cycle nutrients in the soil and surrounding environment, DOE looks to better understand the role of microbes in the larger ecosystem as well as the impact of soil on bioenergy crop yields and growth.

DOE is also seeking proposals for genomics-based research that will lead to the improved use of plant biomass and feedstocks for the production of biofuels and renewable chemical feedstocks. DOE's goal is to use genetics and genomics, including synthetic biology, to overcome the biological barriers to low-cost, high-quality, scalable and sustainable production of dedicated bioenergy biomass feedstocks. Specifically, the genomics solicitation looks to deepen understanding of the "properties of individual components within their molecular, cellular, and organismal contexts" to predict organismal behaviors in fluctuating conditions. The current knowledge gap surrounding these fundamental processes has become a significant barrier in answering some of the fundamental biological questions and impedes the development of models capable of predicting organismal behavior in these fluctuating environments. The Agency is looking to utilize research into these fundamental processes to make connections between specific "regions of plant genomes" and observable traits in potential bioenergy crops.

Deadlines: The submission deadline for mandatory pre-applications is **March 13, 2019**. The submission deadline for full applications is **May 17, 2019**. Submission deadlines are the same for both solicitations.

Eligibility: Eligible applicants to lead a proposal include universities, industry, and non-profit research institutions with opportunities to collaborate with National Labs and federal agencies.

Award Information: DOE anticipates awarding a total of $66 million through two solicitations. Under the Systems Biology FOA, the Agency anticipates making 10-12 awards for a total of $36 million over three years, with individual award amounts ranging from $250,000 to $1.25 million annually for up to three years. DOE will provide $16 million in FY 2019 with an additional $12 million annually in FY 2020 and FY 2021, contingent on the availability of appropriated funds. There is no cost sharing requirement.

Under the Genomics-Enabled Plant Biology FOA, DOE anticipates making 10 to 12 awards for a total of $30 million over three years, with individual award amounts ranging from $250,000 to $1 million annually for up to three years. DOE will provide up to $10 million in FY 2019 with an additional $10 million annually in FY 2020 and FY 2021, contingent on the availability of appropriated funds. There is no cost sharing requirement.

Sources and Additional Information:

- The full Systems Biology solicitation is available at https://science.energy.gov/~/media/grants/pdf/foas/2019/SC_FOA_0002059.pdf.
- The full Genomics-Enabled Plant Biology solicitation is available at https://science.energy.gov/~/media/grants/pdf/foas/2019/SC_FOA_0002060.pdf.
- A press release announcing the opportunity is available at https://www.energy.gov/articles/department-energy-announces-66-million-research-plants-and-microbes.
- For more information on research priorities in genomics science, the White Paper on Basic Research Opportunities in Genomic Science to Advance the Production of Biofuels and Bioproducts from Plant Biomass is available at https://genomicscience.energy.gov/biofuels/BER-Bioenergy-WhitePaper_06-11-2015.pdf.
- The Biological Systems Division Strategic Plan is available at https://genomicscience.energy.gov/pubs/BSSDStrategicPlanOct2015.pdf.

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Department of Energy Announces $20 Million Funding Opportunity for Data Science in Chemistry and Materials Research

On February 8, the Department of Energy's (DOE) Basic Energy Sciences (BES) program released a new funding opportunity announcement (FOA) entitled *Data Science for Discovery in Chemical and Materials Sciences.* This FOA will provide a total of $20 million to explore opportunities for fundamental advances in the understanding of basic physical and chemical behavior through data-driven approaches, applying artificial intelligence and machine learning to "fill knowledge gaps, correct erroneous predictions based on existing models, extract knowledge from noisy data, and ideally extrapolate beyond the range of available data sets." This is the first funding opportunity from the Office of Science that is directly targeting artificial intelligence and machine learning applications. The agency looks to build off recent advances in other disciplines through the integration of data science with the overarching goal of

accelerating fundamental discoveries in chemical and physical properties, behaviors, and physical laws. Applicants are encouraged to review the DOE BES Basic Research Needs Workshop reports for additional information regarding the program's priority research directions.

Successful applications must address at least one of the following focus areas:

- "Reaction chemistry across multiple scales in complex environments important in geosciences, catalysis, biochemistry or electrochemistry;
- Synthesis science including nucleation, growth and restructuring of hybrid, hierarchical or other complex materials;
- Far from equilibrium phenomena where dynamics is fast, such as in transport and separation in complex systems;
- Behavior of properties and processes in extreme environments (e.g. radiation, corrosion, stress, pressure, temperature, electric and magnetic fields); and
- Discovery of quantum materials and/or their collective, coherent, and strong correlation phenomena."

Eligibility: Eligible applicants under this solicitation include universities, industry, National Laboratories, and non-profits.

Deadlines: The submission deadline for mandatory pre-applications is **March 8, 2019**. The submission deadline for full applications is **May 15, 2019**.

Award Information: It is anticipated that DOE will have $6.7 million in FY 2019 to fund up to 15 Single Investigator or small group awards over three years, for a total of $20 million. Individual awards will range from $150,000 to $500,000 annually over three years.

Sources and Additional Information:

- A press release announcing the opportunity is available at https://www.energy.gov/articles/department-energy-provide-30-million-new-data-science-approaches-chemistry-and-materials.
- The full FOA is available at https://science.energy.gov/~/media/grants/pdf/foas/2019/SC_FOA_0002082.pdf.
- The DOE BES Basic Research Needs Workshop reports are available at https://science.energy.gov/bes/community-resources/reports/.

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Appendix A

Analysis Charts of Fiscal Year 2019 Appropriations Minibus Package

National Aeronautics and Space Administration

(In thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Minibus	FY 2019 Minibus vs. FY 2018
NASA, total	**20,736,140**	**21,545,740**	**21,323,400**	**21,500,000**	**763,860 (3.7%)**
Science	**6,221,500**	**6,680,600**	**6,400,300**	**6,905,700**	**684,200 (11.0%)**
Earth Science	1,921,000	1,900,000	1,931,000	1,931,000	10,000 (0.5%)
Planetary Science	2,227,900	2,758,500	2,201,500	2,758,500	530,600 (23.8%)
Astrophysics	850,400	1,029,000	1,243,200	1,191,600	341,200 (40.1%)
James Webb Space Telescope	533,700	304,600	304,600	304,600	229,100 (42.9%)
Heliophysics	688,500	688,500	720,000	720,000	31,500 (4.6%)
Education and Public Outreach (EPO)[2]	44,000	44,000	45,000	45,000	1,000 (2.3%)
Aeronautics	**685,000**	**715,000**	**725,000**	**725,000**	**40,000 (5.8%)**
Space Technology	**760,000**	**--**	**932,800**	**926,900**	**166,900 (22.0%)**
Exploration	**4,790,000**	**5,083,900**	**5,338,700**	**5,050,800**	**260,800 (5.4%)**
Space Operations	**4,751,500**	**4,624,700**	**4,639,100**	**4,639,100**	**112,400 (2.4%)**
STEM Engagement[3]	**100,000**	**90,000**	**110,000**	**110,000**	**10,000 (10.0%)**
Aerospace Research & Career Dev.	58,000	58,000	65,000	65,000	7,000 (12.1%)
Space Grant	40,000	40,000	44,000	44,000	4,000 (10.0%)
EPSCoR	18,000	18,000	21,000	21,000	3,000 (16.7%)

[2] In keeping with Senate direction and the Administration's request, funding for SMD-wide EPO activities is administered by the Astrophysics Division and included within the Division's budget.

[3] The FY 2019 minibus renamed the NASA Education program to "Science, Technology, Engineering, and Mathematics (STEM) Engagement."

Minority University Research and Education Project	32,000	32,000	33,000	33,000	1,000 (3.1%)
Safety, Security, & Mission Services	**2,826,900**	**2,850,000**	**2,750,000**	**2,755,000**	**71,900 (2.5%)**
Construction and Environmental Compliance and Restoration	**562,240**	**562,240**	**388,200**	**348,200**	**214,040 (38.1%)**
Office of Inspector General	**39,000**	**39,300**	**39,300**	**39,300**	**300 (0.8%)**

National Science Foundation

(In millions of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Minibus	FY 2019 Minibus vs. FY 18 Enacted
NSF, total	**7,767.36**	**8,174.89**	**8,068.67**	**8,075.00**	**307.64 (4.0%)**
Research & Related Activities	**6,334.48**	**6,651.5**	**6,556.18**	**6,520.00**	185.52 (2.9%)
Education & Human Resources	**902.00**	**902.00**	**915.00**	**910.00**	8.00 (0.9%)
MREFC	**182.80**	**268.04**	**249.25**	**295.74**	112.94 (61.8%)
Agency Operations and Award Management	**328.51**	**333.63**	**328.51**	**329.54**	1.03 (0.3%)
NSB	**4.37**	**4.37**	**4.37**	**4.37**	--
Office of Inspector General	**15.20**	**15.35**	**15.35**	**15.35**	**0.15 (1.0%)**

Department of Agriculture (USDA)

(In thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Omnibus	FY 2019 Minibus vs. FY 2018 Enacted
Agricultural Research Service	**1,343,366**	**1,394,666**	**1,300,966**	**1,684,466**	**341,100 (25.4%)**
National Institute of Food and Agriculture	**1,407,797**	**1,458,518**	**1,423,227**	**1,471,341**	**63,544 (4.5%)**
AFRI	400,000	415,000	405,000	415,000	15,000 (3.8%)
Hatch Act	243,701	259,000	243,701	259,000	15,299 (6.3%)
Smith-Lever Act 3(b) and 3(c)	300,000	315,000	300,000	315,000	15,000 (5.0%)

McIntire-Stennis	33,961	36,000	36,000	36,000	2,039 (6.0%)
Hispanic Serving Agricultural Colleges and Universities Endowment Fund	9,219	9,219	9,219	9,219	--
Food Safety and Inspection Service (FSIS)	**1,056,844**	**1,049,344**	**1,049,344**	**1,049,344**	**7,500 (0.7%)**
Animal and Plant Health Inspection Service (APHIS)	**981,893**	**998,353**	**1,003,668**	**1,011,136**	**29,243 (3.0%)**
FDA, Discretionary	**2,800,078**	**3,107,789**	**2,595,078**	**3,068,678**	**268,600 (9.6%)**

National Institute of Standards and Technology

(In thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Omnibus	FY 2019 Minibus vs. FY 2018 Enacted
NIST, total	**1,198,500**	**985,000**	**1,037,500**	**985,500**	**213,000 (17.8%)**
Scientific and Technical Research and Services	**724,500**	**720,000**	**724,500**	**724,500**	--
Industrial Technology Services	**155,000**	**145,000**	**155,000**	155,000	--
Hollings Manufacturing Extension Partnership (MEP)	140,000	140,000	140,000	140,000	--
Manufacturing USA	15,000	5,000	15,000	15,000	--

National Oceanic and Atmospheric Administration

(In thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Omnibus	FY 2019 Minibus vs. FY 2018 Enacted
NOAA, total	5,909,364	5,158,616	5,482,954	5,424,695	484,669 (8.2%)
Operations, Research and Facilities (ORF)	3,536,331	3,473,654**	3,599,126	3,596,997	60,666 (1.7%)
Oceanic and Atmospheric Research (OAR)	507,519	462,339	508,256	525,060	17,541 (3.5%)
Climate Research	158,000	98,643	160,000	159,000	1,000 (0.6%)
Competitive Climate Research	60,000	--	60,000	60,000	--
Weather and Air Chemistry	131,516	131,516	115,622	135,380	3,864 (2.9%)
Ocean, Coastal and Great Lakes Research	205,823	220,000	220,500	218,500	12,677 (6.2%)
National Sea Grant College Program	65,000	68,500	71,000	68,000	3,000 (4.6%)
Ocean Exploration Research (OER)	36,500	48,000	35,000	42,000	5,500 (15.1%)
National Weather Service (NWS)	1,014,119	1,015,000	1,019,219	1,020,719	6,600 (0.7%)
National Ocean Service (NOS)	561,187	552,679	583,900	581,567	20,380 (3.6%)
Coastal Science and Assessment: Competitive Research	13,000	20,000	18,000	18,000	5,000 (38.5%)
Ocean and Coastal Management and Services: Coastal Management Grants	75,000	75,000	110,000	75,500	500 (0.7%)
National Marine Fisheries Service (NMFS)	882,957	875,260	924,889	908,832	25,875 (2.9%)
Procurement, Acquisition, and Construction (PAC)	2,303,684	1,607,613	1,806,749	1,768,349	535,335 (23.2%)

National Environmental Satellite, Data, and Information Service	1,859,699	1,414,713	1,500,542	1,457,181	402,518 (21.6%)

**Note that these figures do not reflect transfers or funds derived from recovery of prior year obligations.

Economic Development Administration

(In thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Minibus	FY 2019 Minibus vs. FY 2018 Enacted
EDA, total	**301,500**	**301,500**	**305,500**	**304,000**	**2,500 (0.8%)**
Economic Development Assistance Programs	**262,500**	**262,500**	**266,500**	**265,000**	**2,500 (0.9%)**
Public Works	117,500	117,500	117,500	117,500	--
Economic Adjustment Assistance Program	37,000	37,000	37,000	37,000	--
Regional Innovation Program	21,000	21,000	25,000	23,500	**2,500 (11.9%)**
Partnership Planning	33,000	33,000	33,000	33,000	--
Technical Assistance Program	9,500	9,500	9,500	9,500	--
Research and Evaluation	1,500	1,500	1,500	1,500	--
Salaries and Expenses	**39,000**	**39,000**	**39,000**	**39,000**	--

Department of Homeland Security

(In thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Minibus	FY 2019 Minibus vs. FY 2018 Enacted
DHS, total	47,723,000	51,435,000	48,334,000	**49,411,000**	**1,688,000 (3.4%)**
Science and Technology Directorate	840,943	802,159	813,116	819,785	21,158 (2.5%)
University Programs	40,500	40,500	40,500	40,500	--

U.S. Geological Survey

(In thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Minibus	FY 2019 Minibus vs. FY 2018 Enacted
USGS, total	**1,148,457**	**1,167,291**	**1,148,457**	**1,160,596**	**12,139 (1.1%)**
Natural Hazards	**178,613**	**170,108**	**157,253**	**166,258**	**12,355 (7.9%)**
Earthquake Hazards	83,403	83,403	74,003	83,403	--
Global Seismographic Network	6,653	6,653	6,653	6,653	--
Ecosystems	**157,732**	**157,748**	**158,232**	**156,882**	**850 (0.5%)**
Land Resources	**152,499**	**158,299**	**158,299**	**158,299**	**5,800 (3.7%)**
National and Regional Climate Adaptation Science Centers	25,335	25,335	25,335	25,335	--
Energy, Minerals, and Environmental Health	**102,838**	**106,900**	**113,638**	**111,736**	**8,898 (7.8%)**
Water Resources	**217,554**	**231,123**	**220,054**	**226,308**	**8,754 (4.0%)**
Water Resources Research Act	6,500	6,500	6,500	6,500	--
Core Science Systems	**116,302**	**119,102**	**118,062**	**117,902**	**1,600 (1.4%)**
Science Support	**102,828**	**103,628**	**102,828**	**102,828**	**--**

Facilities	**120,091**	**120,383**	**120,091**	**120,383**	**292 (0.2%)**

Department of Justice (DOJ)

(In thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Minibus	FY 2019 Minibus vs. FY 2018 Enacted
DOJ, total	**30,296,264**	**31,101,251**	**30,698,764**	**30,934,388**	638,124 (2.1%)
Research, Evaluation, and Statistics	**90,000**	**94,000**	**90,000**	**80,000**	10,000 (11.1%)
National Institute of Justice	42,000	44,000	42,000	37,000	5,000 (11.9%)
Juvenile Justice Programs	**282,500**	**199,000**	**297,000**	287,000	4,500 (1.6%)
Community Oriented Policing Services	**275,500**	**N/A**	**310,000**	303,500	28,000 (9.6%)
Office on Violence Against Women	**492,000**	**493,000**	**497,500**	497,500	5,500 (1.1%)

Environmental Protection Agency

(in thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Minibus	FY 2019 Minibus vs. FY 2018 Enacted
EPA, total	**8,058,488**	**7,958,400**	**8,058,400**	**8,058,488**	--
Science and Technology	**706,473**	**643,763**	**706,473**	**706,473**	--

National Endowment for the Humanities & National Endowment for the Arts

(in thousands of $)

	FY 2018 Enacted	FY 2019 House	FY 2019 Senate	FY 2019 Minibus	FY 2019 Minibus vs. FY 2018 Enacted
NEH, total	**152,848**	**155,000**	**155,000**	**155,000**	**2,152 (1.4%)**
Research Programs	15,000	15,000	15,000	14,500	500 (3.3%)

Education Programs	12,750	12,750	12,750	12,250	500 (3.9%)
Federal/State Partnerships	47,200	48,730	48,730	48,000	800 (1.7%)
NEA, total	**152,849**	**155,000**	**155,000**	**155,000**	**2,151 (1.4%)**
Grants	72,419	72,419	72,419	73,710	1,291 (1.8%)
State and Regional Partnerships	48,280	50,431	50,431	49,140	860 (1.8%)

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