# University of Houston Strategic Plan for Research 2025

Submitted by
Division of Research
University of Houston

## Plan to Elevate Research Enterprise

In 2021, the University of Houston announced its bold, new vision to become a Top 50 public university. The University experienced explosive growth in the last decade. Since achieving Carnegie Tier One status in 2011, it has increased its research expenditures from $113.7 Million in FY 2011 to $239.0 Million in FY 2024. It reached record-breaking enrollments, increased graduation rates and academic program rankings, and established Houston's first medical school in more than 40 years.

### a. Goals and Priorities

#### Goals

**Innovation** is a cornerstone of the goals and priorities of the University of Houston to elevate the research enterprise. The University of Houston has prioritized innovation and entrepreneurship as crosscutting areas in the enhancement of the research enterprise. Building from the strength of the #1 ranked Wolff Center for Entrepreneurship in C. T. Bauer College of Business, UH has focused on growing use-inspired research and building pathways to connect early-stage technology developments to grow to commercial opportunities. UH has invested in the development of the office and wet lab incubator at the UH Technology Bridge, where currently over 30 start-up companies are being incubated. UH has also invested in the building of the Innovation Hub, a 75,000 square feet (gross) building with a floor dedicated to a maker space and a floor dedicated to entrepreneurship programs.

The University of Houston's **Strategic Plan**, "Together, We Rise. Together, We Soar." is a seven-year strategy to transform core initiatives of the University from 2021-2028. Goal 2 of the Strategic Plan is to Build a Research Powerhouse that Impacts our Region & the World. The Research Strategic Plan is built on five distinct strategies to advance **strategies through actions** (updated in 2025):

**Strategy #1:** Conduct innovative research in University of Houston's areas of strength: energy, infrastructure, health, data sciences, arts, and social sciences.
*Action 1.1.* Make UH one of the world's leading centers of energy research through the Energy Transition Institute, an academic research institute focused on advancing reliable, affordable, environmentally responsible energy for all.
Action 1.2. Increase the impact of UH's new research institutes (through initiatives, including ASPIRE and TUF) and other UH research units by developing groundbreaking research agendas and supporting the growth of the new research institutes in research priority areas.
Action 1.3. Build effective multidisciplinary models that improve health and train the next generation of health practitioners and medicine researchers through the newly created College of Medicine and the UH Population Health initiative.
Action 1.4. Through a new multi-story building, "the Innovation Hub," that is currently under design, create an innovation complex where partnerships among faculty, staff, and students generate and advance discoveries and ideas that lead to new products, services, licenses, and businesses for the benefit of society.
Action 1.5. Through fundraising, secure endowed professorships; through active engagement with funding agencies and monitoring of funding opportunities, secure research funding and scholarships.

**Strategy #2:** Create sustainable solutions to address local, national, and global challenges in energy and health.
*Action 2.1.* Through UH Energy and other centers and institutes, identify and address sustainability challenges through interdisciplinary research and policy considerations.
*Action 2.2.* Partner with local communities to leverage opportunities and build local solutions that will scale to global implementation.
*Action 2.3.* Establish research collaborations and networks to pursue grants from national and international funding sources to address complex sustainability challenges.
*Action 2.4.* Improve health in the Houston metro community through UH Health.

**Strategy #3:** Build infrastructure and networks to promote interdisciplinary and inter-institutional research.
*Action 3.1.* Through investments in research core facilities, enhance the physical research infrastructure. Through investments in people and incentives for conducting collaborative research, build connections among academic departments and colleges and with other institutions.
*Action 3.2.* Through the Presidential Frontier Faculty and the ASPIRE initiative, make UH a destination institution for talented faculty from around the world to conduct transdisciplinary, integrative, and convergent research.

**Strategy #4:** Support faculty and staff to compete in honors and recognitions at the highest level.
*Action 4.1.* Through the 50-in-5 initiative (2018-2024), followed by the Top 50 Initiative (2024-current), increase research, scholarship, and creativity, and boost the visibility and impact of UH intellectual output in high-ranked journals, news media, and public discourse.
*Action 4.2.* Actively nominate faculty and students to achieve national and international fellow designations, awards, and prizes across all disciplines through a concerted effort at the college level.
*Action 4.3.* Establish competitive compensation and support packages for faculty across all ranks.
*Action 4.4.* Expand the pool of candidates for faculty hires by all available means, including advancing outstanding graduate students into faculty positions.
*Action 4.5.* Through the creation of a Humanities and Arts Institute, create residencies for world-class artists and scholars who will enrich the student and faculty learning and work experiences.

**Strategy #5:** Build an immersive culture of research and innovation for all students.
*Action 5.1.* Expand and support undergraduate research opportunities and international experiences through the Honors College Undergraduate Scholars and Major Awards program to prepare students to be competitive for national and international grants and scholarships, including UH's first Rhodes Scholar.
*Action 5.2.* Provide research-oriented doctoral students with resources, support, and mentoring to develop into world-class researchers, innovators, and creative artists.

## Research Priorities

In Fall of 2024, the research priorities were renewed to reflect changes in strengths and highlight opportunities to become a Top 50 public research university:

**Energy, Security, and Sustainability**

Because of UH's location in Houston, the Energy Capital of the World, energy has been a priority of the University of Houston for decades. In 2013, the position of chief energy officer was created to lead research initiatives in this field. As the "Energy University," UH is at the forefront of energy research, integrating cutting-edge technologies, policy development, and responsible resource management. Our focus includes advancing clean energy access, enhancing resilience against environmental and geopolitical threats, and addressing the socio-economic dimensions of sustainability to shape a low-carbon, secure future.

The priority area "Energy, Security, and Sustainability" is driven by the University Initiative *UH Energy*. Through UH Energy and the newly created *UH Energy Transition Institute* (UH ETI), the University of Houston is developing multi-disciplinary research across a broad range of challenges in the production of energy, the movement of energy and energy goods, and the consumption of energy in delivering economic activity. UH ETI will have a dedicated floor in the Innovation Hub, a planned research building that is currently in the design phase, to advance interdisciplinary research and engagement in energy transition-related topics. Specifically, the research performed at the #7 nationally ranked petroleum engineering department and other science, engineering and technology programs address challenges in efficient and lowered-emission production of oil and gas and the use of those tools along with advancements in data sciences to address additional energy opportunities including geothermal, mining for critical minerals, carbon sequestration and hydrogen. UH continues to grow research strengths in electricity generation, grid operations and resilience, and continued end-use electrification. With nearly half of all the plastic materials consumed in the U.S. being manufactured along the Texas Gulf Coast, UH continues to build research strengths in plastics circularity through centers such as the Welch Center for Plastics Chemistry. UH Energy unites the University of Houston's endeavors to be a key energy industry partner through workforce training, leadership, R&D, and innovation, earning it the title "The Energy University." It receives advice from the Energy Advisory Board, which is a volunteer board appointed by the University of Houston President Renu Khator, composed of global C-suite energy industry experts and leaders serving to advance energy education and research. Contributing to the University of Houston as "The Energy University," these dedicated individuals enhance energy research initiatives and education on campus and throughout the City of Houston. Faculty Energy Fellows, who are elected from nine colleges across campus, work in collaboration with UH Energy and the Energy Advisory Board to shape the conversation on energy at UH and beyond.

Three additional centers and institutes are dedicated to energy:

- *Center for Carbon Management in Energy*: The center has the capability and capacity to meet the lower carbon future energy transition challenges. Multi-disciplined, collaborative research from the required fields of engineering and science, business, law, regulatory, and policy, as well as education for the marketplace, will be strategically aligned with our industry advisory board to address the needs of oil and gas, petrochemicals, and electric power markets.
- *Subsea Systems Institute*: The Institute advances offshore energy safety, efficiency, and innovation through applied research, technology validation, and workforce development.

Backed by the expertise of the University of Houston, Rice University, and NASA's Johnson Space Center, SSI is shaping the future of subsea systems and empowering energy leaders.

- The *Texas Center for Clean Engines, Emissions and Fuels* is a center of comprehensive research, development, and testing of advanced power-train, renewable or alternative fuels, and emission control systems for local, state, and federal governments as well as the energy, engine, and emission control industries. The center is staffed with engineers and researchers from the University of Houston Departments of Chemical and Biomolecular Engineering and Mechanical Engineering. Research projects incorporate the involvement of faculty and graduate students from many additional departments. The center has research capabilities spanning bench-scale testing of emerging technologies to full-scale testing of heavy-duty diesel vehicles. The main components of the facility are a 500hp AC chassis dynamometer test cell, a 600 hp AC engine dynamometer test cell, a portable emissions measurement system, and a comprehensive catalysis research laboratory. The main focus of the testing activities is on emissions control technologies to decrease NOx and particulate matter (PM) emissions from on-road and off-road vehicles and equipment, as well as greenhouse gas-reducing technologies. The research activities focus on the reaction engineering of advanced catalytic emission control technologies, synthetic fuels and additives, and alternative fuels in terms of emissions, fuel economy, and sustainability.

**Health and Well-being**

Our work explores the intricate connections between genetics, lifestyle, environment, and human health. From fundamental research to transformative therapies and biomedical innovations, we address health in communities, resilience to extreme weather events, effects of urbanization, and mental health. We examine the role of culture and creativity in promoting overall well-being.

Health and health-related research is a strength of the University of Houston and has been a major focus for increasing federal funding. Between FY 2018 and FY 2024, Human Health and Services (HHS) funding has nearly doubled from $25.6 Million to $51.0 Million. With the establishment of the **College of Medicine** in 2019, the expectation is to double research expenditures in health over the next 5-10 years.

This priority area is also supported by a University-wide initiative: **UH Population Health**. Population health aims to improve health for everyone and reduce healthcare costs by addressing the full range of factors that affect health. UH Population Health is a collaborative initiative to integrate population health into UH academics, build partnerships with multiple sectors, and conduct innovative research.

Furthermore, over twenty **centers and institutes** across colleges are dedicated to health-related research. A small sample illustrates the breadth of these centers and institutes:

- The *Drug Discovery Institute*, a university-wide research center dedicated to defining a new paradigm in academic drug discovery through multi-disciplinary collaborations that go beyond the life and physical sciences to include other disciplines such as engineering, computer science, mathematics, optometry, and many others. This multidisciplinary team will integrate new technologies, including but not limited to AI, to streamline and augment existing and emerging efforts to modernize the drug-discovery process.

- The *Prescription Drug Misuse Education and Research* (PREMIER) Center was established in 2018 with the goal of reversing the devastating effects of controlled substance prescription misuse on families, communities, and healthcare systems. The PREMIER Center team collaborates on projects both within the center and through an extensive network of clinicians and researchers in the Texas Medical Center and across the state to understand and propose solutions for the opioid crisis facing our community, city, state, and nation.

In addition to the centers and institutes, nine **core facilities** support the research, including Animal Care Operations, the College of Pharmacy Core Lab, the Mass Spectrometry Laboratory, and the Houston Omics Collaborative. These core facilities, with their shared equipment, are essential for our research community to compete effectively for research awards and conduct ground-breaking research.

**Advanced Materials and Manufacturing**

Through the design of novel materials and the development of sustainable manufacturing processes, we drive progress in a wide variety of application areas, including nanotechnology, quantum materials, biomanufacturing, and AI-powered material discovery. These innovations aim to enhance both economic vitality and societal well-being.

Five centers and institutes are dedicated to advanced manufacturing:

- The *Texas Center for Superconductivity at the University of Houston* (TcSUH) is a large multidisciplinary university-based superconductivity and advanced materials research center with over 200 faculty, postdoctoral fellows, graduate and undergraduate students, and visiting scholars from five departments who work to discover and improve new materials, advance science and engineering, and transfer breakthroughs in technology to the industrial sector, impacting the emerging high-temperature superconducting (HTS) electric power community, the medical community and other sectors. The Center focuses on the following primary research themes: In the Superconductivity Division, researchers search for new superconducting materials and room temperature superconductors, both theoretically and experimentally, and strive to understand the mechanisms of superconductors. Energy Materials Division scientists and engineers conduct theoretical and experimental research in thermoelectrics, batteries, catalysts for hydrogen generation, nanomaterials for oil recovery, high thermal conductivity materials, and other energy materials. Researchers in the Applications Division study advanced manufacturing of superconductors with record high critical current density and magnetic field, energy conversion and energy storage devices and systems, biomedical imaging devices and systems, flexible electronic devices and systems, and a superconducting superhighway.
- The *Advanced Manufacturing Institute* addresses the “valley-of-death” challenges to transition lab-scale technology to full-fledged manufactured products for the market. The ongoing research at the institute, especially in superconductor wire manufacturing and roll-to-roll manufacturing of crystalline semiconductors is a unique capability not found in other academic manufacturing centers nationwide.
- The *Center for Integrated Bio and Nano Systems* serves as a catalyst for development and support of the nano/bio research agenda. The research at the Center covers a range of

topics related to the development and applications of novel bio and nanomaterials and devices at nanoscale dimensions. These include battery and catalytic materials, biomolecular sensor technologies, materials and devices directly related to the current and future magnetic storage technologies, magnetic random-access memory (MRAM), and magnetic cellular logic (QCA).

In addition to the centers and institutes, eight **core facilities** support research in this priority area, including the Electron Microscopy Core, the Ion Beam Laboratory, the Mass Spectrometry Core, the Materials Characterization Facility, and the UH Nanofabrication Lab.

**Aerospace and Earth and Planetary Sciences**

Located in "Space City," we lead in sustainable space exploration and planetary sciences. Our efforts include creating advanced materials for spacecraft, developing life-support systems for long-duration missions, and applying AI-driven technologies for disaster risk reduction and environmental resilience. We investigate Earth's formation and evolution alongside other planetary systems.

Four centers and institutes are dedicated to this priority:

- The *Institute for Climate and Atmospheric Science* engages in research of vital interest in the field of atmospheric chemistry and physics, including air quality and climate change. This includes measurement and modeling studies tackling complex challenges in atmospheric science over a wide range of different temporal and spatial scales. Modeling efforts address many critical components, such as emissions, meteorology, atmospheric chemistry, and climate change. Measurement programs emphasize the dynamical, physical, and chemical characterization of the atmosphere. The institute works closely with national, state, and local leaders to identify key scenarios to run on modeling systems so that public policy is guided by the best science.
- The *NASA MIRO Inflatable Deployable Environments and Adaptive Space Systems* (IDEAS2) was established in 2024 to support the space agency's strategic goal of extending human presence on the moon and Mars for sustainable, long-term space exploration, development, and utilization. The $5.0 million grant is funded by the NASA Office of STEM Engagement Minority University Research and Education Project (MUREP) Institutional Research Opportunity (MIRO) program. The Center will conduct cutting-edge research on inflatable and deployable structures and adaptive space systems in close collaboration with the adjacent NASA Johnson Space Center (JSC) to support NASA's Space Technology Mission Directorate (STMD) mission.
- The *National Center for Airborne Laser Mapping* is funded by the National Science Foundation and was created as a research center to support the use of airborne laser mapping technology for the scientific community. The Airborne Laser Swath Mapping (ALSM) observations are analyzed at both Houston and UC Berkeley and then made available to the Principal Investigator through an archiving and distribution center at UCB – building upon the Berkeley Seismological Laboratory's Northern California Earthquake Data Center system. Both the UH and UC Berkeley groups contribute to software development that increases the processing speed and data accuracy. Airborne Laser Swath Mapping has

proven to be a powerful tool for accurately and densely mapping large areas of land. Researchers have used ALSM data to explore geological and geomorphological processes such as faulting and channelization. The power of laser mapping lies not only in quantifying what is immediately visible but also in revealing the landforms that lie below natural and man-made obstructions. Researchers can now gain a clear glimpse of terrain features more rapidly than before. This Center also serves as a core facility to support research.

- The *Sasakawa International Center for Space Architecture* is the only one of its kind in the world. The Cullen College's space architecture program involves engineers and technical architects teaming up to design missions and operations from the ground up. The operational center for the program is the Sasakawa International Center for Space Architecture, or SICSA, which is internationally recognized as the center that both defines and leads the space architecture field. The Center is an academic leader in the field of space architecture and is also active in the planning and designing of facilities for extreme environments on Earth. These include ocean facilities, polar research stations, and human disaster accommodation. Collaborators have included NASA, The Boeing Company, Oceaneering, and the Houston Airport System/Houston Spaceport.

**Digital Futures and Human Experience**

We harness the potential of digital technologies—AI, quantum computing, and cybersecurity—to enhance knowledge and the human condition. Our research addresses the societal and ethical dimensions of digital transformation, privacy, and the creative possibilities of technology. Our initiatives focus on the ethical use of data, algorithmic transparency, and the intersection of data science with societal good. By safeguarding societal values, we aim to ensure digital advancements benefit humanity broadly.

Two centers and institutes support this research priority:

- The *HPE Data Science Institute* leads research, education, and service activities in the broad area of data science and scientific computing and their applications. This includes application areas that are important to the Houston economy: energy and health. Research in data science ranges from foundational research in data science and scientific computing to key application areas. The Institute houses the *Research Computing Data Core* (RCDC), a state-of-the-art high-performance computing core facility that is comprised of two research clusters that offer CPU and GPU nodes to the research community. High-performance computing (HPC) enables sophisticated and increasingly realistic modeling, simulation, and data analysis that profoundly advance theoretical knowledge and expand the realm of discovery, thereby propelling research and its applications to the leading edge of competitive advantage for higher education and commercialization. Scientific research relies heavily on the massive processing power and data analysis capabilities of HPC to design new products and processes, conduct experiments that are otherwise infeasible, analyze extremely large datasets ("Big Data"), and validate new theories that cannot be demonstrated through practical experimentation.
- The *BRAIN Center* is a Phase II National Science Foundation (NSF)-funded industry-university collaborative research center (IUCRC). It is a partnership among the University of Houston, Arizona State University, Miguel Hernandez University in Spain, Instituto

Tecnologico de Monterrey in Mexico, and three prospective national sites, University Georgia Tech, and University of Maryland Baltimore County, and West Virginia University, the BRAIN's Industry Advisory Board (IAB) comprised of national and international companies, start-ups, hospitals, and foundations. The Center's innovation ecosystem includes partnerships with institutions from Texas Medical Center (TMC) to conduct clinical trials; a Cooperative Research and Development Agreement (CRADA) with the FDA to collaborate in the study of human interaction with medical device technologies, real-world data collection using context-aware mobile brain-body imaging (MoBI) technologies for larger, smarter, and distributed clinical trials, and assaying the population variability of EEG biomarkers with potential diagnostic utility. The BRAIN Center is also actively engaged in the study of ethical, legal, and regulatory aspects of neurotechnologies, the development of standards for emergent neurotechnologies such as closed-loop brain-machine interfaces, electronic tattoos for health monitoring, and convergent research at the intersection of science, engineering, and the humanities.

In addition to the centers and institutes, two **core facilities** support the research: the *Research Computing Data Core* mentioned above and the *Digital Humanities Core*. The Digital Humanities Core consolidates technological infrastructure, research tools, and interdisciplinary expertise to establish digital project production and publishing capabilities for UH researchers.

**Education, Civic Engagement, and Workforce Development**

We prepare students for leadership in a globalized world by advancing critical thinking, cultural competence, and workforce readiness. Our research explores the nexus of education policy, economic growth, and technological innovation, emphasizing civic engagement and social responsibility to nurture adaptable, informed global citizens.

Three centers and institutes support this research priority:

- The *Texas Center for Learning Disabilities* (TCLD) is a grant-funded research center designed to conduct research that leads to a more comprehensive understanding and classification of learning disabilities (LDs). The research will lead to a more integrated understanding of intervention for children with reading problems and important cross-discipline insights into the nature of LD.
- The *Center for the Success of English Learners* uses transdisciplinary approaches to improve English learners' outcomes by developing and testing interventions that leverage transdisciplinary approaches intended to improve instruction for English learners (ELs) in science and social studies. The center is identifying and removing barriers related to school tracking through analysis of administrative and newly collected data using a mixed methods approach.
- The primary purpose of the *Texas Institute for Measurement, Evaluation, and Statistics* (TIMES) is to advance knowledge about and to improve the behavioral, psychological, educational, and developmental outcomes of children and adults through the application and development of high-quality, cutting-edge research methods, and the delivery of state-of-the-art research and statistical support services. In addition, TIMES' broader mission is to promote, develop, and advance statistical knowledge and its application in research and

decision-making and to establish a university-based resource in measurement, evaluation, and statistics for faculty and administrators.

## b. Collaborations and Partnerships

The primary vehicle for fostering cooperative efforts among faculty across disciplines are centers and institutes. The University of Houston has seven **University-level Centers and Institutes** that promote research across key strengths and provide opportunities for the research community to conduct large-scale research across colleges (details for most of these are provided above):

- Advanced Manufacturing Institute (AMI)
- Drug Discovery Institute (DDI)
- HEALTH Research Institute (HRI)
- Hewlett Packard Enterprise Data Science Institute (HPE DSI)
- Hurricane Resilience Research Institute (HuRRI)
- Texas Center for Superconductivity at the University of Houston (TcSUH)
- Texas Institute for Measurement, Evaluation and Statistics (TIMES)

Except for HuRRI, these centers and institutes are associated with or built around core facilities, which provide critical research equipment and infrastructure to a broad user community—both internal and external to the institution. University-level centers and institutes are annually reviewed by the Research and Scholarship Committee, a subcommittee of the UH Senate. The review asks for performance measures related to personnel, student involvement, contract and grant activities, publications, and technology transfer.

An additional twenty centers and institutes are housed in colleges that support research across departments that are largely within a college. Many of these were also mentioned above.

New centers and institutes may be proposed following a rigorous approval process by the Research and Scholarship Committee, a subcommittee of the Faculty Senate. Particular attention is paid to the financial commitments of colleges involved in the center or institute and the plan for long-term financial sustainability.

Large initiatives, like UH Energy, provide an umbrella for a diverse set of activities and raise the visibility of research strengths:

**UH Energy** unites the University of Houston's endeavors to be a key energy industry partner through workforce training, leadership, R&D, and innovation, earning it the title “The Energy University.” UH Energy impacts research through its three dimensions:

- Educational Programs in Energy: UH offers several innovative educational programs at all levels and in the four major energy sectors: upstream, midstream, and downstream, alternatives and enablers, and policy and management.

- Energy Research: University faculty are continuously breaking new ground in their research. The UH Energy research hub provides regular updates on individual research projects.
- Energy Centers and Institutes: Centers and institutes collaborate to advance reliable, affordable, and sustainable energy solutions. Through research, innovation, and partnership, they support the evolving energy landscape.

UH has engaged with industry and the innovation ecosystem in the region to build partnerships in energy and innovation. UH has been one of the founding members of *EVolve Houston*, a public-private partnership to grow electric vehicle adoption. UH is a founding member of the *TEX-E* collaboration, with the aim to accelerate the growth of energy technologies through entrepreneurship in Texas. UH leads a collaborative partnership on Bio Manufacturing for commodity and specialty chemicals that will rapidly accelerate use-inspired research to commercial products.

UH leads the *Subsea Systems Institute*, a RESTORE Act Center of Excellence for the State of Texas, and promotes, through a collaboration with Rice University, NASA (JSC), and community college partners, the safe and resilient production of energy from offshore resources in the Gulf of America.

The *UH Energy Transition Institute* works with a broad partnership of industry (including Shell, Technip, Microsoft, Oxy), national lab partners (including Argonne, NREL, Oak Ridge), and non-profit entities (including AIChE, EDF, HARC) to foster reliable, affordable and sustainable energy for all. Similarly, the Center for Carbon Management in Energy has built a research consortium with over 20 industry partners from across the energy value chain and collaboration with over 75 national partners to provide feedback to the U.S. Department of Energy on the key enablers for broad commercial deployment of carbon management.

The University of Houston collaborates and partners with other Texas institutions. An example is the **Gulf Coast Consortia**. The GCC was founded in 2001. The membership of this organization draws from universities and medical centers across Houston and currently has eight members. It is a collaboration of basic and translational scientists, researchers, clinicians, and students in the quantitative biomedical sciences who help advance the region's scientific progress through participation in joint training and research programs, utilization of shared equipment and core facilities, and the exchange of scientific knowledge.

The University of Houston collaborates with other Texas institutions. Notable examples include:

- The *Consortium for Translational & Precision Health* (CTPH), a partnership between the University of Houston and Baylor College of Medicine funded by a $44.2 Million NIH award, unites healthcare, public health, and community organizations. Leveraging strengths in translational research, informatics, and more, CTPH develops and disseminates health innovations to the community and advances precision health across Texas and the US. Both organizations have collective strengths in translational research, basic science discovery, health informatics, pharmaceutical sciences, education, and community-engaged research. These strengths are leveraged to develop, demonstrate, and disseminate health-focused innovations across Texas and the US.
- The *Transportation Cybersecurity Center for Advanced Research and Education* is a U.S. Department of Transportation (USDOT) University Transportation Center (UTC), Tier 1. The

center is supported by a $10 million USDOT five-year award. UH is the lead institution in the consortium that includes Embry-Riddle Aeronautical University (ERAU); Rice University (RICE); Texas A&M University-Corpus Christi (TAMU-CC); University of Cincinnati (UC); and University of Hawai'i at Manoa (UHM). CYBER-CARE's mission is to promote interdisciplinary research and education across both transportation and cybersecurity domains. The research projects at CYBER-CARE will develop conceptual frameworks, construct comprehensive datasets, explore novel analytical approaches, support the implementation of public policies and infrastructure investments, and build a high-quality industry workforce through education. CYBER-CARE will accelerate industry collaborations, foster new technologies, and provide professionals with the skills and opportunities needed to become successful leaders in their fields.

The University of Houston collaborates extensively with Texas institutions. As of March 2025, UH has 178 awards totaling $41.7 million that involve Texas institutions either as the prime (i.e., UH is the subaward) or as a subaward (i.e., UH is the prime). The three largest collaborating institutions, as measured by the total award amount, are the University of Texas Austin, the University of North Texas Health Science, and Baylor College of Medicine. The University of Texas Austin collaborations span four colleges and are in the sciences and engineering. Research with the University of North Texas Health Science and Baylor College of Medicine are in the health sciences, and much of that research is supported by the National Institutes of Health.

### c. Economic Impact

Founded in 1927, the University of Houston plays an essential role in the overall economic vitality of Houston and the state of Texas. The University of Houston conducted an **economic impact study** in 2019. (Economic impact studies are typically conducted no more frequently than every ten years.) Here are the main findings from the report.

Developing a skilled workforce, inspired leaders and expert managers, providing research-based solutions to real-world problems, encouraging cultural advancement, and serving as an anchor institution for the community, UH generates a remarkable $6.4 billion annual impact on Greater Houston – and $7.7 billion impact on Texas. For every $1 invested in UH, its students gain $4.20 in lifetime earnings; taxpayers reap $6 in savings, and society enjoys $12.60 in added benefits.

With Houston known as the Energy Capital, it is fitting that UH has established itself as the Energy University. Drawing on a rich array of academic and research resources, UH Energy has positioned itself as a strategic partner to the energy industry by producing specialized personnel, technical leadership, innovative scholars, and technological experts from its considerable student ranks. Nearly 8,000 students belong to the Energy Coalition, a collection of energy-related organizations on campus, while the Energy Advisory Board, made up of C-level executives, keeps the University perfectly aligned with this important industry. The results add up to $1.6 billion in income to Greater Houston and $2.2 billion to Texas each year.

Houston is home to the world's largest medical center, and UH has played a crucial supplementary role with its own extensive assembly of healthcare-related programs, ranging from instruction and training to research and clinical treatment. UH Health focuses on integrating all these activities in order to effectively address a wide range of issues, both locally and on a broader scale. Nine of UH's

colleges are involved with the UH Health initiative, and more than one in every four students is pursuing a health or health care degree. Not surprisingly, the economic impact is significant, generating $939 million annually in the Greater Houston region and 1.3 billion statewide.

Established in 2018, the College of Medicine was created to allow UH to play a greater role in improving the overall health and healthcare resources of Greater Houston and Texas. In particular, this medical school addresses the state's critical shortage of primary care physicians and provides coverage to underserved communities. This study analyzed the projected value impacts the College of Medicine will have from its launch in fiscal year 2019 through its first decade in operation, estimating a $377 million addition to the regional economy by fiscal year 2029 with a $4.13 return for every $1 invested.

UH has built a strong **innovation ecosystem** and currently has 21 Fellows and 23 Senior Members of the National Academy of Inventors. UH is striving to increase the number of invention disclosures from 70 (average over the last 10 years) to 120 in the next three years and the number of issued U.S patents from 35 (average over the last 10 years) to 60 in the next seven years. UH continues to build strong partnerships with industry and anticipates growing the annual number of licenses from six to 15 over the next three years and creating more than 10 start-ups annually (from a baseline value of 4). UH currently receives more than $7 Million in licensing revenue, and we are seeking to double this in the next ten years.

UH engages and partners with the energy industry through education, research, and outreach activities. UH students and alumni are employed broadly across the over 5000 companies in the Greater Houston area engaged as a part of the energy industry. UH has collaborated with industry and regional agencies in research, development, and deployment of new energy technologies through projects with over $1 Billion in U.S. federal government investment.

## Plan to Increase Research Funding and Productivity

### a. External Funding

Increasing external funding has been a long-standing priority of UH, in particular, increasing federal funding. Between 2019 and 2024, external expenditures, as measured in the NSF HERD survey, increased by 27% from $129.7 million to $165.3 million. The growth has been primarily due to increases in federal expenditures by over 50%, from $68.5 million in 2019 to $104.9 million in 2024 (Figure 1).

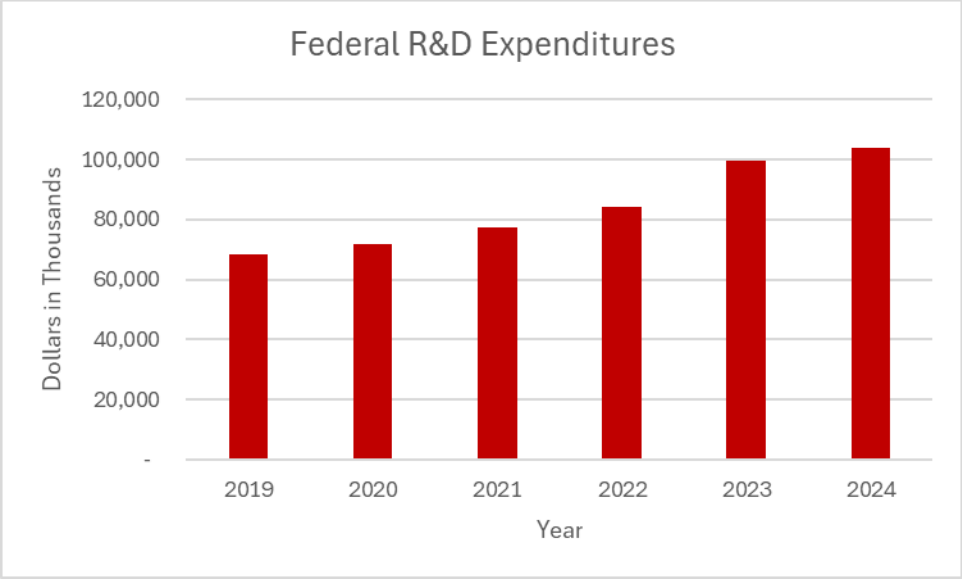


*Figure 1: University of Houston Federal Research Expenditures (Source: NSF HERD)*

UH's research priorities are aligned with federal funding opportunities and local strengths of the private sector. The Division of Research publishes weekly a widely disseminated list of funding opportunities, has a contract with a proposal writing company to support the preparation of proposals, and offers annually a 2-day proposal writing workshop. In addition, the Office of the Provost and the Division of Research partnered on a liaison position (0.5 FTE) to work directly with colleges and departments to build competitive teams to respond to funding opportunities.

The Division of Research offers an internal award focused on team formation to respond to national center or large team science funding opportunities. Funding can be obtained for up to 18 months prior to the proposal deadline to form competitive teams, collect preliminary data, and write the proposal.

Research with the private for-profit sector is critical to UH's research portfolio. Annually, research expenditures in this sector reach about $10 million. Key industries that support research at UH are energy, technology, and the biomedical sector.

UH plans to expand its partnership with industry through research collaborations and through growth of start-ups that can rapidly advance technologies. By developing master-research agreements and flexible intellectual property partnerships with industry, UH aims to double industry-funded research in the next three years. UH's Honors College has developed a unique UH Energy Scholars program that is funded by a consortium of industry partners to provide experiential learning for UH undergrads through research focused on industry challenges. We plan to increase the enrolment from 30 students annually to over 100 in the next three years.

Research with the private for-profit sector is facilitated through the **Consortia** mechanism. Sponsored Project Consortia are a gateway for launching and conducting frequent, open communication between participating researchers and the corporate community. Companies gain direct access to the capabilities of university faculty members and their students in exchange for annual membership fees, which primarily fund basic research. Sponsored Project Consortia

typically focus on an area of research that looks at a general problem that a group of industries may be facing. The affiliate members do not receive intellectual property (IP) ownership rights in return for their membership fees but are granted a license to use any IP developed by the consortium. UH currently has 17 consortia, more than half are with companies in the energy sector. Others are in materials or biomedical research.

### b. Research Facilities

The University of Houston has centralized and college-level **core facilities**. Currently, UH has seven centralized core facilities: Animal Behavior Core, Animal Care Operations, Digital Humanities Core, Electron Microscopy Core, Mass Spectrometry Core, Research Computing Data Core, and a core facility housed in the Texas Center for Superconductivity.

The Research Computing Data Core is housed in the HPE Data Science Institute and offers leading edge-computing resources to over a hundred research groups. Capabilities include high-capacity storage and backup, parallel and big data applications, high-speed networking, and access to widely used software. It offers two large clusters, Carya and Sabine, to support scientific computation, big data/analytics applications, and large-scale data storage, and also manages individual clusters procured by faculty.

In 2021, the University initiated a planning process for a large investment in core facilities in five strategic areas: (i) Advanced Materials; (ii) Automation; (iii) Data and Sensing; (iv) Imaging; and (v) Advanced Manufacturing. The Core Facilities project was launched in 2023 with a commitment of $20 million in space renovation and $22 million in equipment purchase. These investments will provide equipment for UH's research community to compete effectively for research awards and excel at delivering the goals and objectives of their research projects. The equipment will be made available to UH's research community at competitive rates. In addition, recurrent funds are being made available to staff the core facilities with technical experts and provide funding for operation, upgrades, and future replacements. Two of the core facilities mentioned above (Digital Humanities Core and Electron Microscopy Core) are already in operation. The Advanced Manufacturing Core facility and the Solid State Battery Prototype Core Facility are in the design phase. The Advanced Imaging Core Facility and the Advanced Surface Analysis Core Facility are in the planning stages. Planning for core facilities for Autonomy will commence in the future.

Colleges and departments maintain an additional 23 core facilities, ranging from sequencing facilities to chemistry service facilities and earth & atmospheric sciences laboratories.

The **UH Technology Bridge** is a unique asset in the Innovation Ecosystem in Houston and boasts a 30,000-square-foot laboratory incubator that houses start-ups and mature research and industrial partners. With planned efforts to add core facilities focused on advanced manufacturing and battery testing, the UH Technology Bridge will continue to be at the forefront of accelerating commercialization of UH technologies.

The planned 75,000-square-foot, 4-story Innovation Hub at UH will bring together faculty researchers, entrepreneurial students, and engaged industry partners to advance use-inspired research through rapid commercialization. Each floor of the building has a specific focus. To support the education of the next generation of innovators and entrepreneurs with a focus on

undergraduates, the first floor of the building offers a maker space in combination with collaboration areas to promote hands-on, experiential learning and discovery not specifically tied to an academic class experience. On the second floor, the Wolff Center provides a large co-working space with adjacent collaborative learning areas supporting a wide range of entrepreneurial activities, including undergraduate and master's degrees, certificates, programming, and consulting support for local businesses. The Energy Transition Institute on the third floor offers research labs, project space, and highly flexible work areas focused on supporting evolving research in energy decarbonization and sustainability. The top floor provides space for the Presidential Frontier Faculty program, a university-wide integrated interdisciplinary faculty hiring campaign to recruit research faculty in priority areas including Health, Energy, Security, and Sustainability.

### c. Commercialization

UH has prioritized growth of licensing, entrepreneurship, and commercialization as a key strategy for growth of research productivity. Building strategic partnerships with industry, such as those developed previously with Shell and HPE, is critical to increase pathways to commercialization. UH has recently signed an agreement with the Houston Angel Network to create additional pathways to fund early-stage start-ups emerging from UH. UH is partnered with the Small Business Development Center (SBDC) and is creating additional mechanisms to provide wrap-around services for start-ups.

UH maintains a strong intellectual property portfolio that continues to gain momentum every year. UH has been in the National Academy of Inventors (NAI) top 100 for four of the last five years. At this point, 21 faculty are fellows, and 23 faculty are senior members of the NAI, with some holding both recognitions. Senior members are rising stars, whereas the fellow category is the highest distinction. In 2024, the licensing income was $7 million, 89 inventions were disclosed, and 38 patents were issued. Nearly 440 licensable intellectual properties are available.

UH has pioneered and delivered the Innov8 Hub program. This is a founder-driven series of entrepreneurial programs to support technology commercialization for early-stage ventures and entrepreneurs who are faculty, students, and staff in partnership with UH SBDC. These programs are run at the UH Technology Bridge in person and virtually. The program consists of a series of accelerator programs based on the Wendy Kennedy Inc. curriculum and run in collaboration with SBDC advisors by the UH Technology bridge team at the UHTB Innovation Center. Programs are catered to scientists, students, and researchers looking to apply for SBIR/STTR grants, business plan competitions, access mentors, advisors, and pro-bono services. At the end of the programs, each participant has the opportunity to pitch their business on a Pitch Day. The goal of these programs is to launch new ventures, develop business plans that they can use to raise money, and attract C-suite level employees to join their team.

UH's innovation efforts are also developing additional mechanisms to build multi-disciplinary teams in collaboration with the Wolff Center for Entrepreneurship to grow commercialization of intellectual property developed by UH staff, faculty, and students. Newly issued patents that have not already been licensed are made available to students from the Wolff Center for Entrepreneurship to help build business plans and identify use cases for commercial development. Similarly, faculty and research students and staff are incentivized to develop commercialization paths for IP developed at UH through innovation challenges (such as the Chevron UH Energy Innovation Challenge, the TEX-E Innovation Challenge and the UH Energy Hackathon).

## Doctoral Programs

In Fall 2024, the University of Houston enrolled 2,264 students in 49 research doctoral programs. Over half (54.3% in Fall 2024) of the students are enrolled in science and engineering research doctoral programs in two colleges: Cullen College of Engineering and College of Natural Sciences and Mathematics.

Enrollment in research doctoral programs has been steady over the past ten years (Fall 2015-Fall 2024), with a minimum of 2,189 and a maximum of 2,295 students. In Fall 2024, 54.2% of research doctoral students were international students. Prior to Fall 2024 (between Fall 2015 and Fall 2023), about half of the students were international students (minimum: 48.6%; maximum: 51.6%).

**a. Research Doctorate Awards.** The University of Houston (UH) awarded 358 research doctorates in Academic Year 23-24 and the 5-year average of research doctorates awarded is 389 (Figure 2 for doctoral degree data for the past ten years). The number of degrees awarded by college have been steady over the years.

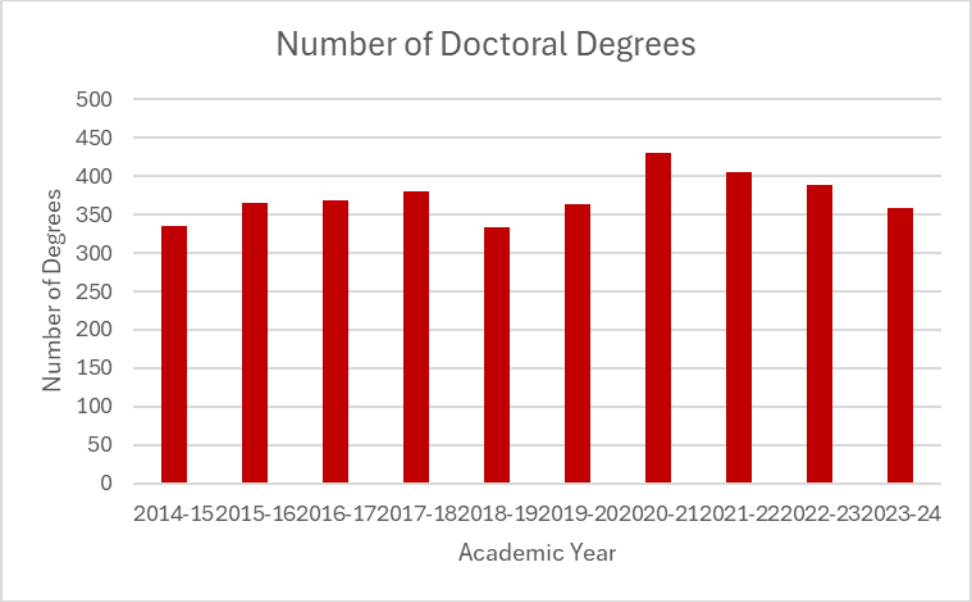


*Figure 2: Number of doctoral degrees over the past ten academic years*

The 10-year doctoral graduation rate for research doctorate students is currently (2014 cohort) 73.9%. For 2023-2024, the average time to degree for a research doctorate at UH was 5.3 yrs. In the short term, UH plans to maintain the current number of research doctorates awarded. In the longer term, UH plans to grow the number of research doctorates in line with the efforts to increase the number of faculty through the Presidential Frontier Faculty initiative, as described in the next section.

In collaboration with academic colleges, the Graduate School is offering enhanced graduate student success initiatives, such as dissertation/writing, communication, leadership and teaching opportunities.

**b. Support for Doctoral Candidates.** UH provides competitive financial support packages for eligible full-time doctoral students through teaching and research assistantships and scholarships, including recruitment scholarships.

In the sciences and engineering, doctoral students are often supported by research grants. In Fall 2024, more than half of graduate students in Engineering were supported on graduate assistantships, funded on research grants, with most of them receiving an additional Graduate Tuition Fellowship, which is competitively awarded and covers the cost of in-state tuition and mandatory fees.

**c. Areas of emphasis.** Based on Fall 2024 enrollment data, the largest UH doctoral programs (in alphabetical order) are Biomedical Engineering, Chemistry, Chemical Engineering, Computer Science, Electrical Engineering, and Physics PhD programs and the Professional Leadership EdD program. UH has PhD programs in fast-growing areas such as Electrical Engineering and Computer Science and recently started a new PhD program in Computer Engineering (Fall 2024) to address the growing workforce demand in these related areas. UH has recently submitted a proposal to the THECB to create a PhD in Statistics and Data Science, which is another area with a strong

workforce demand. More generally, UH has seen a 17% growth in Cullen College of Engineering doctoral enrollment over the last 5 years.

In 2024, 17 of UH's graduate programs ranked in the top 50 in U.S. News and World Report. Among these programs are Petroleum Engineering (#7), Chemical Engineering (#30), Pharmacy (#41), Industrial/Manufacturing Engineering (#44), and Speech-Language Pathology (#44).

## Plan for Faculty Development

### a. New Faculty

The University of Houston launched its **Presidential Frontier Faculty** (PFF) initiative in 2022 to recruit top scholars from around the globe. These researchers and teachers engage in interdisciplinary research that responds to societal challenges facing communities around the globe. The priority research areas are Aerospace, Artificial Intelligence, Engineering, Sustainability, and Health. As of Fall 2024, UH has hired 35 PFF. A total of about 100 PFF are planned, supported by the Texas University Fund (TUF).

Centrally established research priorities and hiring timelines will guide the recruitment process. Colleges suggest PFF positions to the Provost, who reviews and approves positions based on alignment with research priorities. Position postings are developed by departments and colleges for review by the Provost. Departments and colleges conduct national searches and forward finalists and hiring recommendations to the Provost for review and approval. To maximize the success of faculty in the PFF initiative, they will participate in organized mentoring programs, collaboration workshops, proposal development training, and networking events. They will visit with program officers in federal funding agencies on a regular basis.

PFF hires are expected to perform at or above the level of currently highly research-active UH faculty. PFF are evaluated on both traditional individual success metrics and for their synergistic contributions to collaborative research within research thrusts, including joint scholarship and research grants, and their impact on the community and the regional innovation ecosystem.

Early successes of the first cohort are already visible. More than half of the PFF hired in Fall 2022 are externally funded, and many have developed collaborations across colleges and with other universities.

The **Aspire Fund** is a $100 million challenge from an anonymous donor to recruit the highest-quality faculty, fueling our learning in areas of worldwide impact. Supported by the Aspire Fund, UH's Aspire Faculty are recruited to lead interdisciplinary research in strategic areas, including health and energy. These researchers will be engaged in groundbreaking research and are expected to be at the level of members of the National Academies and other prestigious organizations. As of Fall 2024, two Aspire positions have been filled, one in Petroleum Engineering and one in Music. In addition, the Aspire Institute for Global Engagement, led by Former U.S. Ambassador Michael Pelletier, was established. The new interdisciplinary institute aims to enhance students' international and cultural understanding by embedding learning and research experiences focused on globally relevant topics within all academic programs and disciplines. By expanding the University's international footprint, graduates will become global change makers known for their capacity to innovate solutions to complex challenges and devise strategies to drive systemic

change. Three more positions are currently posted, two in Industrial Engineering, and one in Mechanical Engineering.

The **Texas University Fund** (TUF) provides the University of Houston with approximately $50 million annually to provide reliable funding for faculty, research and graduate studies at rising universities with proven track records in research and innovation. The University has created a comprehensive and strategic resource allocation plan for TUF funds received and expected to be received in the future. This plan is designed to meet the objective for which TUF was approved and provided, which was to enable institutions to achieve national prominence as major research universities and drive the state economy.

The plan for use of TUF funds will provide approximately $48M in recurring funds and $52M in one time cash to support the research enterprise and double the research profile and impact of the University as it strives to become a top 50 Public Research University. Efforts include increasing the number of faculty through the Presidential Frontier Faculty initiative to educate and increase the number of PhD graduates as well as conducting interdisciplinary research; ensuring that research lab space is available for all faculty hires; creating, managing, and maintaining core research facilities in priority areas such as Data and Sensing, Imaging and Scanning, and Advanced Manufacturing. TUF funds are also allocated to build and sustain central core facilities and to staff the core facilities with technical staff to fully utilize the capabilities.

The University of Houston has benefited significantly from the **Governor's University Research Initiative** (GURI) to recruit distinguished faculty. UH has received 5 GURI Grants to recruit national academy members to the Lone Star State, serving as a catalyst for further economic development. Four of the hires were members of the National Academy of Engineering, and one was a member of the National Academy of Science. Their research areas are mostly related to energy, spanning from seismic tomography to conventional and unconventional reservoirs and enhanced oil recovery. The most recent GURI hire, whose award is still active, was recruited to lead the new Energy Transition Institute after having spent 36 years in industry. Collectively, they have led research programs that increased our collaborations with industries that are particularly relevant to the Greater Houston Economy. As opportunities arise, UH will continue to apply for funding from this initiative.

1. Birol Dindoruk, Ph.D. Member of the National Academy of Engineering Dr. Birol Dindoruk is currently American Association of Drilling Engineers Endowed Professor of Petroleum Engineering at the University of Houston; previously he was the Chief Scientist of Reservoir Physics and the Principal Technical Expert of Reservoir Engineering in Shell with 28 years of industrial experience. In 2017, he was elected as a member of the National Academy of Engineering for his significant theoretical and practical contributions to enhanced oil recovery and CO2 sequestration.
2. Dr. Ganesh Thakur is a pioneer and world authority in the field of integrated petroleum reservoir management of conventional and unconventional reservoirs and CCUS (carbon capture, utilization, and storage). Dr. Thakur started at the University of Houston (UH) as a Distinguished Professor of Petroleum Engineering in the Cullen College of Engineering. He also serves as the Director for Energy Industrial Partnerships (EIP), making an immense impact on the state of Texas in the field of energy.

3. Dr. Joseph B. Powell is an internationally recognized leader in Energy, Chemicals, and Sustainability. He had an illustrious career in industry, including first Chief Scientist for Chemical Engineering at Shell. He has demonstrated a unique ability to lead research and development efforts and solve complex multidisciplinary problems as evidenced by his accomplishments that led to more than 120 distinct patent applications with more than 60 issued patents. The University of Houston (UH) has established an Energy Transition Institute (ETI) and Dr. Powell serves as Director of the ETI.
4. Dr. Andrea Prosperetti is an expert on the physical and computational aspects of multiphase flows, flows in which liquid, gas, and solids coexist. Such flows are widely encountered in the oil industry, in mechanical and chemical engineering, geosciences, medicine, biomedical technology, heat transfer, and many other fields. Dr. Prosperetti joined UH as a Distinguished Professor of Mechanical Engineering in the Cullen College of Engineering from the Johns Hopkins University where he held the Charles A. Miller Chair of Mechanical Engineering.
5. Dr. John Suppe is a world leader in structural geology and tectonics, and his research focuses on seismic tomography and their multiscale application for fundamental discoveries concerning the deep interior of the Earth, the structure of mountain belts, and fine structure of petroleum basins. Dr. Suppe joined the University of Houston as a Distinguished Professor of Earth & Atmospheric Sciences in the College of Natural Sciences and Mathematics.

The Science and Engineering colleges encourage and assist their high-potential, early career faculty to apply for **early career awards**, in particular the NSF CAREER award, which is NSF's most prestigious award of early career faculty. Since 1997, UH has received 97 CAREER awards, with more than a third over the past five years.

## b. Faculty Research

The **Center for Faculty Engagement and Development** (FED) at the University of Houston, housed in the Office of the Provost and overseen by the Associate Provost for Faculty Development and Faculty Affairs, offers training and support for collaborative activities in scholarship and teaching for faculty and postdocs. This is accomplished by providing programs on innovation, writing workshops and workgroups, virtual reality development in teaching and research, global partnerships, leadership training, active learning, and more.

The mission of the Office of Faculty Engagement and Development (FED) is to support and increase student success by promoting, supporting, and fostering a culture of excellence through the comprehensive development of the UH faculty. The FED provides resources to support growth in teaching proficiency and effectiveness, successful faculty career progress, research productivity, and service to the University and broader communities. Professional development is supported at all stages of faculty careers and for all faculty groups, including actively promoting existing opportunities for professional development.

The FED provides access to resources in the **career planning** of faculty. It assists in creating a roadmap of professional activities that align individual goals with requirements for promotion and tenure to support overall professional development. Faculty benefit from a self-reflection exercise

that guides the development of short- and long-term goals, as well as the identification of skills, training, and steps required in each of the three professional activities required in your academic career.

The FED provides various approaches to **skill development**: Faculty professional development builds an interdisciplinary learning community. FED partners with departments across campus and national organizations to provide a multiplicity of resources for faculty and postdoctoral fellows to cultivate their professional skills, including Faculty Development Programs, Scholarly Writing, Mentoring, and links faculty to various faculty support resources across campus, including the University Libraries and HR training opportunities.

The UH **Postdoctoral Fellows Association** was created to enhance networking, connect postdoc researchers across the university campus, and support an interdisciplinary environment. It provides professional development programming, including career options, grantsmanship, travel and career development awards, an annual postdoc symposium to include faculty and graduate students, offer negotiation, mentorship training, and more.

The **Division of Research** supports research through *internal awards*. In FY 2025, a total of $1.84 million were allocated to support and catalyze research. Internal awards are given in the form of Seed Grants that support research labs and groups with funds that would permit submission of competitive research proposals in UH's research priorities. Grants to Enhance and Advance Research (GEAR) are given to fund bold new ideas, with evidence of high likelihood of securing extramural funding. To catalyze teams who compete for large national centers or large team science projects, the National Center and Team Science Planning Award is available. Equipment grants support the purchase of smaller pieces of equipment that are shared among laboratories. Finally, to support primarily the arts and humanities and other areas with limited federal funding opportunities, Small Grants and New Faculty Research grants are available that support individual projects for up to $10,000, with the New Faculty Research grants targeted at high-potential, early career faculty.

The Division of Research organizes *visits at federal agencies* or hosts program managers from federal agencies. Since Covid, these visits have largely moved to virtual visits.

Research support in the form or *proposal review and proposal writing support* is provided by Hanover Research, a proposal writing company. In addition, the Division of Research offers an annual 2-day workshop in grant writing that is tailored to proposals submitted to federal agencies.