

This resource listing is intended as a source of information that can be selectively cut, pasted and edited into Facilities and Other Resources sections of grant submissions.

## **BROWN ENVIRONMENT AND RESOURCES (QUICK SECTION LINKS)**

### [ACADEMIC INSTITUTIONS](#)

### [ACADEMIC HEALTH CENTERS](#)

### [ACADEMIC SCHOOLS, COLLEGES, DEPARTMENTS, CENTERS, INSTITUTES AND PROGRAMS](#)

### [CAREER DEVELOPMENT AND MENTORING ACTIVITIES](#)

### [COLLABORATING INSTITUTIONS](#)

### [COMMUNITY ENGAGEMENT ORGANIZATIONS](#)

### [COMPUTING - OFFICE OF INFORMATION TECHNOLOGY \(OIT\)](#)

### [CORE AND SHARED RESEARCH FACILITIES](#)

### [DIVERSITY PROGRAMS](#)

### [EDUCATION PROGRAMS](#)

### [EDUCATION TECHNOLOGY RESOURCES](#)

### [LIBRARY RESOURCES](#)

### [MULTISPECIALTY PRACTICE GROUPS](#)

### [RESEARCH ADMINISTRATION](#)

### [RESEARCH BUILDINGS](#)

### [RHODE ISLAND & RESEARCH ENVIRONMENT](#)

### [RHODE ISLAND STATEWIDE COLLABORATIVE PROGRAMS - NIH IDeA, NSF EPSCoR](#)

## **BROWN ENVIRONMENT AND RESOURCES – DETAILED TABLE OF CONTENTS WITH LINKS**

### [ACADEMIC INSTITUTIONS](#)

[Brown University - Long](#)

[Brown University - Short](#)

[University of Rhode Island \(URI\)](#)

### [ACADEMIC HEALTH CENTERS](#)

[Lifespan Health System](#)

[Care New England \(CNE\) Health System](#)

[VA Providence Healthcare System Medical Center \(VAPHS\)](#)

### [ACADEMIC SCHOOLS, COLLEGES, DEPARTMENTS, CENTERS, INSTITUTES AND PROGRAMS](#)

[Center - Advance-CTR: Comprehensive](#)

[Center - Advance-CTR: Summary](#)

[Center - Alcohol and Addiction Studies \(CAAS\)](#)

[Center - Alternatives to Animal Testing](#)

[Center - Biology of Aging](#)

[Center - Biomedical Engineering \(CBME\)](#)

[Center - Brown Center for Biomedical Informatics \(BCBI\)](#)

[Center - Brown Center for the Study of Children at Risk](#)

[Center - Children's Environmental Health \(CCEH\)](#)

[Center - COBRE for Addiction & Disease Risk Exacerbation \(CADRE\)](#)

[Center - COBRE Center for Computational Biology of Human Disease \(CBHD\)](#)

[Center - COBRE for Central Nervous System Function](#)

[Center - Computation and Visualization \(CCV\)](#)

[Center - Computational Molecular Biology \(CCMB\)](#)

[Center - Digital Health, Brown-Lifespan \(CDH\)](#)

[Center - Epidemiologic Research \(CER\)](#)

[Center - Evidence Synthesis in Health \(CEHS\)](#)

[Center - Gerontology and Healthcare Research](#)

[Center - Health Promotion and Health Equity \(CHPHE\)](#)

[Center - Legoretta Cancer Center and Affiliated Programs](#)

[Center - Plant Environmental Center](#)  
[Center - Primary Care and Prevention \(CPCP\)](#)  
[Center - Sheridan Center for Advanced Teaching and Learning](#)  
[Center - Statistical Sciences \(CSS\)](#)  
[Center - Swearer Center](#)  
[Center - Writing Center](#)  
[Department - BioMed Ecology and Evolutionary Biology \(EEB\)](#)  
[Department - BioMed Molecular Biology, Cell Biology and Biochemistry \(MCB\)](#)  
[Department - BioMed Molecular Microbiology and Immunology \(MMI\)](#)  
[Department - BioMed Neuroscience \(Neuro\)](#)  
[Department - BioMed Pathology and Laboratory Medicine](#)  
[Department - BioMed Psychiatry and Human Behavior \(DPHB\)](#)  
[Department - Chemistry](#)  
[Department - Computer Science](#)  
[Department - Earth, Environmental, and Planetary Sciences](#)  
[Department - Mathematics](#)  
[Department - Physics](#)  
[Department - SPH Behavioral and Social Sciences](#)  
[Department - SPH Biostatistics](#)  
[Department - SPH Epidemiology](#)  
[Department - SPH Health Services, Policy & Practice \(HSPP\)](#)  
[Division - Applied Mathematics](#)  
[Division - Biology and Medicine](#)  
[Initiative - Data Science Initiative \(DSI\)](#)  
[Institute - Brown for Environment & Society \(IBES\)](#)  
[Institute - Brown Institute for Translational Science \(BITS\)](#)  
[Institute - Carney Institute for Brain Science](#)  
[Institute - Hassenfeld Child Health Innovation Institute \(HCHII\)](#)  
[Institute - Institute for Computational and Experimental Research in Mathematics \(ICERM\)](#)  
[Institute - International Health \(IHI\)](#)  
[Institute - Molecular and Nanoscale Innovation Research Facilities \(IMNI\)](#)  
[Program - Biology](#)  
[Program - MD, PhD](#)  
[Programs - Medical Education](#)  
[School - Engineering](#)  
[School - Professional Studies](#)  
[School - Public Health](#)  
[School - Warren Alpert Medical School](#)  
[School - Warren Alpert Medical School – Alternative](#)  
[School and Affiliates - Warren Alpert Medical School and Affiliated Hospitals](#)

## **CAREER DEVELOPMENT AND MENTORING ACTIVITIES**

[BioMed Faculty Administration \(BMFA\)](#)  
[Research and Scholarship Mentoring via Advance-CTR](#)  
[Advance-K Career Development Program](#)  
[Mentoring Training Program via Advance-CTR](#)  
[Women in Medicine Mentoring Program](#)  
[Diversity and Inclusiveness](#)  
[Grant and Manuscript Writing](#)  
[Research Integrity Series for Junior Faculty](#)  
[Brown Ethics and Responsible Conduct of Research Education \(BEARCORE\)](#)  
[Educator Professional Development Program](#)  
[Entrepreneurship and Biomedical Small Business Training](#)  
[Brown Biomedical Innovations to Impact \(BBII\)](#)  
[Drug Discovery Bootcamp](#)  
[I-Trep Program](#)

DRIVENNew England Medical Innovation Center (NEMIC)RI Bio Programming**COLLABORATING INSTITUTIONS**Rhode Island Department of Health (RIDOH)Rhode Island Quality Institute (RIQI)Rhode Island Public Health Institute (RIPHI)**COMMUNITY ENGAGEMENT ORGANIZATIONS**Swearer CenterCenter for Prisoner Health and Human RightsRhode Island Foundation**COMPUTING - OFFICE OF INFORMATION SERVICES (OIT)**Office of Information Services (OIT), BriefAdvanced Research Computing (ARC)Stronghold Research Environment for Data ComplianceUnified Research Data Sharing and Access (URSA) InitiativeCybersecurity ProgramCCV- Computation and Visualization (CCV)CCV - Virtual Reality YURTCCV - Virtual Reality CaveHigh Bandwidth Fiber ConnectivityUFunds**CORE AND SHARED RESEARCH FACILITIES**BioMed - CoresRIBioMed - Core Research FacilitiesBioMed - Animal Care Facility (ACF)BioMed - Bioimaging Facility LeducBioMed - Drosophila Media FacilityBioMed - Flow Cytometry and SortingBioMed - GenomicsBioMed - HerbariumBioMed - Informatics Services - Brown Center for Biomedical Informatics (BCBI), Advance-CTRBioMed - Informatics Services - Computational Biology Core (CBC), COBRE CBHDBioMed - Magnetic Resonance ImagingBioMed - Molecular Pathology Core Research LaboratoryBioMed - Transgenics and Gene Targeting FacilityBioMed - Plant Environmental CenterBioMed - ProteomicsBioMed - RI BiobankBioMed - Structural BiologyBioMed - Water FlumeBioMed - X-ray Reconstruction of Moving Morphology (XROMM)Chemistry - Electronics ShopChemistry - Machine ShopChemistry - Mass Spectrometry FacilityChemistry - NMR FacilityChemistry - Research FacilitiesDEEPS - Climate& Environmental FacilitiesDEEPS - Geochemistry/Mineralogy/Petrology (GMP) FacilitiesDEEPS - Geophysics FacilitiesDEEPS - Mass Spectrometer Analytical FacilityIMNI - Electron Microscopy

[IMNI - Nanofabrication Central Facility \(NCF\)](#)  
[IMNI - NanoTools Facility](#)  
[IMNI - Joint Engineering and Physics Instrument Shop \(JEPIS\)](#)  
[Physics - Ladd Observatory](#)

## **DIVERSITY PROGRAMS**

[Brown Graduate School Diversity Commitment](#)  
[Office of Institutional Equity and Diversity \(OIED\)](#)  
[Brown Pathways to Diversity and Inclusion: An Action Plan \(DIAP\)](#)  
[Initiative to Maximize Student Development \(IMSD\)](#)  
[Leadership Alliance](#)

## **EDUCATION PROGRAMS**

[Graduate Programs - Biology and Medicine](#)  
[Graduate Programs - Brown University](#)  
[Graduate Programs - Public Health](#)  
[Program - Biological Sciences](#)  
[Program - Liberal Medical Education](#)  
[Program - Program in Innovation, Management and Entrepreneurship \(PRIME\)](#)  
[Programs - Computational Biology](#)

## **EDUCATION TECHNOLOGY RESOURCES**

[Center - Digital Scholarship](#)  
[Digital Scholarship Lab \(DSL\)](#)  
[Digital Learning and Design](#)  
[Multimedia Labs](#)  
[Sidney E. Frank Digital Studio](#)

## **LIBRARY RESOURCES**

[Library - Brown](#)  
[Researchers at Brown \(VIVO\)](#)  
[Scientific Data Management](#)  
[Health Sciences Library Resources](#)

## **MULTISPECIALTY PRACTICE GROUPS**

[Brown Physicians Inc. \(BPI\)](#)  
[Southeastern New England Primary Care Practice-Based Research Network \(PBRN\)](#)

## **RESEARCH ADMINISTRATION**

[BioMed - Research Administration \(BMRA\)](#)  
[BioMed - Evaluation](#)  
[BioMed - Translational Development: Brown Biomedical Innovations to Impact \(BBII\)](#)  
[BioMed - Brown University Oncology Group](#)  
[BioMed - Research Operations](#)  
[Office - Vice President for Research](#)  
[Office - Technology Innovations](#)  
[Office - Research Integrity \(ORI\)](#)  
[Office - Sponsored Projects \(OSP\)](#)  
[Office - Research Administration Information Services \(RAIS\)](#)  
[Office - Research Strategy and Development](#)

## **RESEARCH BUILDINGS**

[121 South Main St](#)  
[Applied Mathematics Building](#)  
[Barus and Holley](#)  
[Watson Center for Information Technology](#)

[Biomedical Center \(BMC\)](#)  
[Building for Environmental Research and Teaching \(BERT\)](#)  
[Plant Environmental Center](#)  
[Sidney E. Frank Hall for Life Sciences](#)  
[Laboratories for Molecular Medicine \(LMM\)](#)  
[233 Richmond Street](#)

### **RHODE ISLAND & RESEARCH ENVIRONMENT**

[State of Rhode Island and Providence Plantations](#)  
[Rhode Island Clinical Environment](#)  
[Rhode Island Collaborative Culture](#)  
[CoresRI](#)

### **RHODE ISLAND STATEWIDE COLLABORATIVE PROGRAMS –NIH IDeA, NSF EPSCoR**

[Rhode Island Statewide Collaborative Programs](#)  
[Centers of Biomedical Research Excellence \(COBRE\) Programs in Rhode Island](#)  
[Clinical and Translational Research \(IDeA-CTR\)](#)  
[Environmental influences on Child Health Outcomes \(ECHO\) Program](#)  
[IDeA Network for Excellence in Biomedical Research \(INBRE\)](#)  
[RI NSF Established Program to Stimulate Competitive Research \(EPSCoR\)](#)

### **ACADEMIC INSTITUTIONS**

#### **Brown University: Long**

<https://www.brown.edu/about>

Brown University: Brown was founded in 1764 — the third college in New England and the seventh in Colonial America. Brown was the first Ivy League school to accept students from all religious affiliations, a testament to the spirit of openness that still typifies Brown today. Originally located in Warren, Rhode Island, and called the College of Rhode Island, Brown moved to its current spot on College Hill overlooking Providence in 1770 and was renamed in 1804 in recognition of a \$5,000 gift from Nicholas Brown, a prominent Providence businessman and alumnus, Class of 1786.

Women were first admitted to Brown in 1891. The Women’s College was later renamed Pembroke College in Brown University before merging with Brown College, the men’s undergraduate school, in 1971. The northern section of campus where the women’s school was situated is known today as the Pembroke Campus. The first master’s degrees were granted in 1888 and the first doctorates in 1889. The first medical degrees of the modern era were presented in 1975 to a graduating class of 58 students. Today, Brown awards approximately 100 MD degrees annually from the Warren Alpert Medical School.

Undergraduate education changed dramatically in 1970 with the introduction of what has become known as the Open Curriculum. The idea for this change came from a report written by undergraduates Ira Magaziner, of the undergraduate Class of 1969, and Elliot E. Maxwell, of the undergraduate Class of 1968, as part of a GISP (Group Independent Study Project) that examined education at Brown. The new curriculum eliminated core requirements shared by all Brown undergraduates and created specific departmental concentration requirements. This approach has defined the undergraduate academic experience at Brown ever since, demanding that students serve as the architects of their courses of study.

Constant change defines Brown’s past and future, though the University’s culture is rich in tradition. Brown’s first building, the red-bricked University Hall, was built in 1770 and still stands on the College Green. Today, the University consists of nearly 230 buildings on approximately 150 acres, and includes undergraduate and graduate programs, plus the Warren Alpert Medical School, School of Public Health, School of Engineering, Industrial Engineering Brown Executive MBA, and executive masters of healthcare leadership, science and technology leadership, and cybersecurity.

In 2013, President Christina H. Paxson, Brown's 19th president, charted the course for the University's future with her strategic plan, *Building on Distinction: A New Plan for Brown*. The plan was launched in 2014, the 250th anniversary of Brown's founding. It provides a vision to achieve higher levels of distinction as a university that unites innovative education and outstanding research to benefit the community, the nation and the world. It calls for targeted investments to attract and support the most talented and diverse faculty, students and staff, and to support rigorous inquiry and discovery across the disciplines to address the world's most complex challenges. The plan highlights the need to keep a Brown education affordable for talented students from all economic backgrounds and to sustain a community with the diversity of thought and experience required for excellence.

### **Brown University: Short**

<https://www.brown.edu/about>

Brown University: Located in historic Providence, Rhode Island and founded in 1764, Brown University is the seventh-oldest college in the United States. Brown is an independent, coeducational Ivy League institution comprising undergraduate and graduate programs, plus the Alpert Medical School, School of Public Health, School of Engineering, and the School of Professional Studies. With its talented and motivated student body and accomplished faculty, Brown is a leading research university that maintains a particular commitment to exceptional undergraduate instruction. Brown's vibrant, diverse community consists of about 6,580 undergraduates, 2,255 graduate students, 545 medical school students, more than 6,000 summer, visiting, and online students, and more than 700 faculty members. Brown students come from all 50 states and more than 115 countries. Undergraduates pursue bachelor's degrees in 81 concentrations, ranging from Egyptology to cognitive neuroscience. Anything is possible at Brown—the university's commitment to undergraduate freedom means students must take responsibility as architects of their courses of study. Brown University has 51 doctoral programs and 32 master's programs. The broad scope of options vary from interdisciplinary opportunities in molecular pharmacology and physiology to a master's program in acting and directing through the Brown/Trinity Repertory Consortium. Additional programs include the Undergraduate Summer Session and Pre-College Programs for high school students — on campus, online, and abroad. Brown is frequently recognized for its global reach, many cultural events, numerous campus groups and activities, active community service programs, highly competitive athletics, and beautiful facilities located in a richly historic urban setting.

### **University of Rhode Island (URI)**

<https://www.uri.edu/>

The University of Rhode Island (URI) had humble beginnings as the state's agricultural school chartered in 1888. Today URI is a nationally recognized Land, Sea and Urban Grant public research institution, and the only public institution in Rhode Island offering undergraduate, graduate, and professional students. URI maintains a large focus on Allied Health programs including the College of Pharmacy, Nursing, and the new College of Health Sciences (2016). This Academic Health Collaborative brings together the previously individual schools of communicative disorders, health studies, human development and family studies, kinesiology, nutrition and food science, physical therapy, and psychology. Together the Allied Health expertise at URI in partnership with Brown's Alpert Warren Medical School, and School of Public Health, round out the health education and research expertise in the state.

URI has a long-standing collaboration with Brown University's Medical School, Lifespan, Care New England, the Providence Veterans Affairs Hospital and other hospital providers in the state. URI has more than 16,000 undergraduate and graduate students who work side-by-side with more than 721 full-time, tenure-track teaching faculty, as well as with hundreds of dedicated lecturers, researchers, and adjunct faculty. URI has over 120,000 alumni globally. The main campus is in the historic, rural town of Kingston, just 30 miles south of the metropolitan city Providence and Brown University. There is also a Providence Campus that is home to biomedical sciences and the Centers of Biomedical Research Excellence (COBRE) for Immunology and Infectious Diseases near the Jewelry District and the Brown Alpert Medical School.

## ACADEMIC HEALTH CENTERS

### Lifespan Health System

<https://www.lifespan.org/about-lifespan>

Lifespan Health System: Lifespan, Rhode Island's first healthcare system was founded in 1994 by Rhode Island Hospital and The Miriam Hospital. A comprehensive, integrated, academic health system affiliated with the Warren Alpert Medical School of Brown University, Lifespan's present partners also include Rhode Island Hospital's pediatric division, Hasbro Children's Hospital; Bradley Hospital; Newport Hospital and Gateway Mental Health Services. A not-for-profit organization, Lifespan is overseen by a board of volunteer community leaders who are guided by its mission: Delivering Health with Care.

**Rhode Island Hospital:** Rhode Island Hospital, with 750 beds, is the state's largest hospital and the third largest hospital in New England. It is designated as the Level 1 Trauma Center for southeastern New England, providing expert staff and equipment in emergency situations 24 hours a day. Rhode Island Hospital provides comprehensive diagnostic and therapeutic services to inpatients and outpatients, with particular expertise in cardiology, oncology, neurosciences and orthopedics, as well as pediatrics at its Hasbro Children's Hospital. Rhode Island Hospital is home to a Comprehensive Cancer Center. Its pediatric division, Hasbro Children's Hospital, opened in 1994 and cares for some 7,000 inpatients and 60,000 outpatients annually. Two distinct emergency departments exist on the RIH campus: the Andrew F. Anderson Emergency Center and Hasbro Children's Hospital ED's. The annual patient volume of these facilities is over 130,000 patient visits per year. Both ED's also house the American College of Surgeons approved Level 1 trauma center. The new Anderson Emergency Center was constructed in 2005, encounters > 80,000 adult visits per year, and is the tertiary care referral site for all of southeastern New England. Both ED's sponsor highly regarded PGY1-4 residency programs in emergency medicine with 48 residents in training and a pediatric emergency medicine fellowship. There are over 3000 new cancer cases diagnosed each year at RIH. The hospital has a new, state-of-the-art, cancer center integrating radiation oncology and medical oncology within three adjacent floors of the Ambulatory Patient Care (APC) building of Rhode Island Hospital. Full imaging facilities, including CT scan, MRI, PET scan, and other diagnostic imaging is directly connected to the cancer center via a walkway to the main patient building. There is a dedicated inpatient oncology floor on the fourth floor building. A dedicated hematology/oncology ward team follows the inpatient service. This includes a hematology oncology attending, fellow, two medical residents, a pharmacist and 1-2 Brown Medical students. RIH participates in cooperative group, pharmaceutical and investigator-initiated studies. The oncology research office has 17 full-time employees. The IRB meets twice a month.

**Hasbro Children's Hospital:** Hasbro Children's Hospital is deeply committed to advancing medical knowledge and improving patient care for children through the latest research. It currently has 53 principal investigators conducting more than 160 research initiatives, which are coordinated across Hasbro Children's Hospital, Bradley Hospital and Women & Infants Hospital and the Warren Alpert Medical School of Brown University. Hasbro researchers have made significant findings in cancer, liver disease, diabetes and asthma, and our research has appeared in more than 500 publications over the past five years. Pediatric cancer research is led by members of the Children's Oncology Group.

**The Miriam Hospital:** The Miriam Hospital is a 247-bed facility that provides a broad range of primary, secondary and tertiary medical and surgical services to adolescents and adults in 31 medical and surgical specialties and sub-specialties. The hospital provides a broad range of primary, secondary, and tertiary medical and surgical services. Miriam Hospital is noted for its specialty services in AIDS at the Samuel and Esther Chester Immunology Center and in cardiac care. The Women's Cardiac Center at The Miriam Hospital offers complete diagnostic and clinical cardiology services, cardiovascular surgery and cardiac rehabilitation to women. The Miriam Hospital is a major teaching hospital affiliated with Brown University. The hospital is home to the The Immunology Center, Sexually Transmitted Disease (STD) Clinic, Pre-Exposure Prophylaxis (PrEP) Program, Centers for AIDS Research (CFAR), Immunology Center Research Laboratory, and Centers for Behavioral and Preventive Medicine.

**Emma Pendleton Bradley Hospital:** The Emma Pendleton Bradley Hospital, founded in 1931, is the nation's first psychiatric hospital devoted to children and adolescents. It is the nation's only freestanding

child/adolescent psychiatric hospital. Bradley services include a 60-bed acute inpatient program for children and adolescents with emotional, behavioral, and developmental disorders and outpatient services (including a dialectical behavior therapy [DBT] program), day treatment, and five fully certified special education schools across RI for youth with psychiatric disorders.

### Care New England (CNE) Health System

<http://www.carenewengland.org/about/>

The Care New England Health System is a trusted organization that fuels the latest advances in medical research, attracts the nation's top specialty-trained doctors, hones renowned services and innovative programs, and engages in the important discussions people need to have about their health and end-of-life wishes. Care New England is helping to transform the future of health care, providing a leading voice in the ongoing effort to ensure the health of the individuals and communities we serve. Backed by a broad range of services—primary care, surgery, cardiovascular care, oncology, psychiatry, behavioral health, newborn pediatrics and the full spectrum of women's health services—CNE is reinventing the way health care is delivered, partnering with our patients to provide the best care possible while working to create a community of healthier people.

**Women & Infants' Hospital of Rhode Island:** Women & Infants Hospital, a Care New England hospital, is one of the nation's leading specialty hospitals for women and newborns. Women & Infants is the eighth largest stand-alone obstetrical service in the country with nearly 9000 deliveries per year. In 2009, Women & Infants opened the country's largest, single-family room neonatal intensive care unit. Women and Infants Hospital is a major teaching affiliate of the Warren Alpert Medical School of Brown University for obstetrics, gynecology and newborn pediatrics, as well as a number of specialized programs in women's medicine. Known as one of the nation's largest and most prestigious research facilities in high-risk and normal obstetrics, gynecology and newborn pediatrics, it is home to two National Institutes of Health (NIH) Centers of Biomedical Research Excellence for Perinatal Biology and Reproductive Health, respectively. Women and Infants is a member of NRG Oncology, a National Cancer Institute funded, multi-institutional, cooperative research group with a major focus on gynecologic and breast cancer treatment. It is also a member of the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Maternal Fetal Medicine Units Network, a consortium of 12 premier clinical centers across the U.S. whose charge is to investigate problems in clinical obstetrics. Women and Infants is a member of the 18-center NICHD Neonatal Research Network, investigating the safety and efficacy of treatment and management strategies to improve the outcome of sick newborns. It is a member of the Eunice Kennedy Shriver NICHD Pelvic Floor Disorders Network, conducting multi-centered trials studying pelvic floor disorders. In 2015, the NICHD awarded Women & Infants Hospital and Brown University an additional five years of grant funding to support the Women's Reproductive Health Research (WRHR) Career Development Program. With just seven active sites throughout the country, this highly competitive program provides a tailored research and career development plan to enable junior faculty obstetrician/gynecologists to develop into leaders in women's health research.

**Butler Hospital:** Butler Hospital is the only private, nonprofit psychiatric and substance abuse hospital serving adults, adolescents, and children in Rhode Island and southeastern New England. Founded in 1844, it was the first hospital in Rhode Island and has earned a reputation as the leading provider of innovative psychiatric treatments in the region. Affiliated with the Warren Alpert Medical School of Brown University, Butler Hospital's clinical research trials provide valuable information on brain-based diseases. Through research, new treatments are being discovered for diseases including depression and anxiety, obsessive-compulsive disorder (OCD), Alzheimer's disease, Movement Disorders, such as Parkinson's disease, and addictions. Butler Hospital is affiliated with the Norman Prince Neurosciences Institute, dedicated to advancing the neurosciences and reducing human suffering from disorders of the nervous system through world-class research, outstanding clinical care and advanced education. Butler's research activities have helped bring about groundbreaking treatments, including Transcranial Magnetic Stimulation (TMS), a treatment for depression recently approved by the U.S. Food and Drug Administration (FDA), and Deep Brain Stimulation, a "pace-maker for the brain" that is used to treat severe obsessive-compulsive disorder and depression.

**Kent Hospital:** Under the existing umbrella of Care New England (CNE) Health System the outpatient and research departments are located in Pawtucket, RI as part of Kent Hospital, successor to Memorial Hospital of Rhode Island (MHRI). The research department has had extensive experience in the



administration and execution of contracts and grants funded by a variety of sources including the National Institutes of Health, Department of Health and Human Services, drug companies, the Rhode Island Department of Health, and other health agencies and foundations such as the American Heart Association, Robert Wood Johnson Foundation, and the American Foundation for AIDS Research. In addition, the department oversees management of numerous subcontracts for activities that support funded grants. Since 1989, there have been a total of over 100 grants and contracts awarded to researchers for a total of approximately \$5-6 million per year.

Kent Hospital: is a nonprofit acute care academic teaching hospital affiliated with Warren Alpert Medical School of Brown University through the Family Medicine and General Internal Medicine residency programs and is the second largest hospital in the state. Kent partnered with Care New England (CNE) Health System to expand the scope of services available to its patients and as successor to MHRI provides a strong primary care focus within the system, as well as sustains the strong academic and research programs. This 359 community hospital located on 57 acres in Warwick, Rhode Island, serves a community of 300,000 residents in Warwick, West Warwick, East Greenwich, West Greenwich, Coventry and parts of North Kingstown, Exeter and Cranston, Rhode Island. In Pawtucket they operate a large ambulatory practice that houses their Primary Care practices and specialties to meet the needs of 190,000 people in Pawtucket and the surrounding Blackstone Valley region of Rhode Island and southeastern Massachusetts. Kent provides a full spectrum of clinical services with over 13,460 admissions, 818 deliveries, 9,452 operative procedures, 70,902 emergency room visits. In addition to the hospital services, Kent operates two satellite primary care centers and an express care center. Besides clinical services, Kent sponsors a wealth of teaching and research activities. Kent's Primary Care Center in Pawtucket serves as the Center for education and research in Primary Care for Brown University's Medical School. They sponsor two residency training programs, one in Family Medicine and another in General Internal Medicine, with a combined 80 resident trainees. Researchers in the primary care departments of Family Medicine and General Internal Medicine have joined forces with epidemiologists, anthropologists, biostatisticians, psychologists and other researchers to create a vibrant, multidisciplinary research center, the Brown University Center for Primary Care and Prevention (CPCP), which is under the umbrella of the School of Public Health.

### **VA Providence Healthcare System (VAPHS)**

<https://www.providence.va.gov/>

The VA Providence Healthcare System (VAPHS) is a major teaching hospital and research affiliate of the Warren Alpert Medical School of Brown University and delivers a broad range of services in medicine, surgery, and behavioral sciences. VA Providence Healthcare System is a 75-bed facility providing acute inpatient and ambulatory care in medicine, surgery, psychiatry and neurology. The hospital admits approximately 5,000 veterans annually and provides over 150,000 outpatient visits in 41 clinics. It is a VA regional center for treatment of post-traumatic stress disorder. The hospital also provides special medical services in the areas of dialysis, substance abuse treatment, rehabilitative medicine, and prosthetics. The medical center and its five community-based outpatient clinics in Rhode Island and southern Massachusetts serve as a primary care resource and a regional referral network for a variety of inpatient and outpatient programs. The VAPHS participates in the medicine, surgery, neurology, psychiatry and orthopaedic residency programs at Brown Medical School. The VAPHS has four buildings dedicated to providing research investigators with opportunity to collaborate on basic, animal and clinical research. VAPHS research resources are listed under Clinical Research Units.

### **ACADEMIC SCHOOLS, COLLEGES, DEPARTMENTS, CENTERS, INSTITUTES AND PROGRAMS**

#### **Center - Advance-CTR: Comprehensive**

<https://www.brown.edu/initiatives/translational-research/home>

Advance Clinical and Translational Research (Advance-CTR, U54GM115677) is a statewide Institutional Development Award for clinical and translational research (IDeA-CTR) funded by the National Institute of General Medical Sciences. Based at Brown University, Advance-CTR is a statewide collaboration between Rhode Island's primary academic institutions, hospital systems, and community organizations. Advance-CTR supports Rhode Island investigators through funding, research resources and services, and professional

development offerings. Ultimately, Advance-CTR aims to fuel discoveries and collaborations that are responsive to the health priorities and disparities of Rhode Island's diverse communities.

Advance-CTR comprises two Administrative Cores (the Administrative Core and the Tracking and Evaluation Core), two Award Cores (the Pilot Projects Program and the Professional Development Core), and three Service Cores (the Biostatistics, Epidemiology, and Research Design Core, the Biomedical Informatics, Bioinformatics, and Cyberinfrastructure Enhancement Core, and the Community Engagement and Outreach Core).

**Administrative Core:** The Administrative Core serves as the central operations hub for Advance-CTR. It includes three Project Managers, a Communications Manager, a Data Manager and one Coordinator who each report to the Advance-CTR Administrative Director. These individuals support the PD/PI; Program Coordinator; Strategic Planning Coordinator, the IAC, EAC, Operations and Steering Committees; and the six Cores. Administrative Core personnel assist the Core Leads in program management and planning, tracking and evaluation, budget development, allocation of resources, reporting, and development of educational initiatives.

**Pilot Projects Program:** The Pilot Projects Program brings investigators together from institutions across the state to develop interdisciplinary collaborations that span the translational research spectrum. The program awards five to seven investigators per year with one-year grants of up to \$75,000 each in direct costs for clinical and translational research. Awarded proposals must be interdisciplinary with a focus on clinical, translational, or community research. Priority is given to proposals that address statewide health priorities set forth by the Rhode Island Department of Health. Awardees gain the opportunity to experience planning and preparing research applications in an NIH format, respond to reviews, and learn grant management skills in a collaborative, cross-disciplinary environment. Awardees may also leverage Advance-CTR's research services in both the pre-proposal and post-award stages of their projects.

**Professional Development Core:** The Professional Development Core equips early-career health researchers in Rhode Island with the resources and training they need to build competitive research programs that improve population health in our state. The Core provides educational and mentoring opportunities to investigators at all career stages. The Mentored Research Awards program (MRAs) is geared toward early-career stage investigators, especially those from historically underrepresented groups in STEM. The MRAs are given annually to two to three investigators from Brown University and the University of Rhode Island. They are two-year awards that cover up to 75% salary up to \$90,000 in direct costs. An additional \$25,000 per year is also provided to cover research-related expenses or tuition (a Master's degree in Clinical and Translational Research from the Brown University School of Public Health is encouraged). Finally, the awards provide a structured mentoring program and training in clinical and translational research. Awardees are encouraged to take advantage of Advance-CTR's research services in both the pre-proposal and post-award stages of their projects.

The Professional Development Core also offers the Advance-K Scholar Career Development Program (Advance-K) and the Advance-CTR Mentoring Training Program. Advance-K trains and supports highly qualified junior faculty in the preparation of individual, extramural career development award applications (NIH K series or equivalent), and connects them to resources, mentorship, and other career development opportunities. The program encourages applications that emphasize community engagement. Up to 10 Scholars are selected annually to participate in the program. Junior faculty candidates pursuing a career in clinical research or translational research from Brown, URI, and the affiliated hospital systems are eligible to apply. Advance-K Scholars follow a common curriculum along with a customized set of activities to meet individual learning goals and are required to participate in 2-hour, bi-weekly training sessions throughout the duration of the yearlong program. Scholars are expected to submit an application for individual funding (K01, K08, K23, or CDAs from the VA or foundations) by the end of the 12-month program period.

The Advance-CTR Mentoring Training Program is a 9-hour, peer-driven program that provides faculty mentors with skills and techniques to enhance communication with their mentees and improve outcomes for professional development and success. Five faculty from Brown University and the University of Rhode Island who are certified Mentor Facilitators from the National Research Mentoring Network (NRMN) lead the trainings. The training sessions are adapted from NRMN and the Center for Improvement of Mentored Experiences in Research (CIMER). It is designed to help research mentors maximize the effectiveness of their mentoring

relationships. All Rhode Island investigators and research staff are also eligible to receive clinical research training through various sponsored training, including but not limited to Public Responsibility in Medicine and Research (PRIM&R), and Good Clinical Practice (GCP) through the Professional Development Core. Finally, the Core offers regular workshops for entrepreneurship, team science, and grant writing.

**Biostatistics, Epidemiology, and Research Design Core (BERD):** The BERD Core aims to empower investigators to design, interpret, and publish impactful health research. It offers research consultations and support to Rhode Island investigators who are seeking quantitative, psychometric, and qualitative research design and analysis support. The Biostatistics Core links investigators with multidisciplinary faculty members and experts in various methodological techniques including biostatistics, epidemiology, research design, qualitative data techniques, and measurement and evaluation in health-related research. The Core also makes available a variety of research training, including monthly REDCap workshops, the Qualitative Methods and Machine Learning Seminar Series, and regular seminars on research design and analysis, systematic review, and biostatistical methodology.

**Bioinformatics, and Cyberinfrastructure Enhancement Core (BIBCE):** The BIBCE Core works to transform the research capacity in Rhode Island for big data health research by enabling access to electronic health data through secure, inter-institutional infrastructure. The Core works closely with the Center for Computation and Visualization (CCV) and Brown University Library to address the breadth of data, technology, and computing needs for clinical and translational research. Through the Unified Research data Sharing and Analysis (URSA) Initiative, the Core provides expertise and infrastructure for accessing and using large-scale datasets for health-related research. This includes storage, management, and analysis of health data within high performance and secure computing environments at Brown. The Core also participates in the National COVID Cohort Collaborative (N3C) Analytics Platform, which provides clinical data from more than 1.6 million COVID+ cases to RI investigators. The Core also offers consultative services for implementation science—from strategy and blueprints, to sustainability and policy implementation. Finally, BIBCE provides a wide variety of research training, including its annual Informatics and Implementation Science Learning Series and Machine Learning Seminar Series.

**Community Engagement and Outreach Core (CEO):** The CEO Core helps facilitate research endeavors that are relevant, accessible, and impactful to the entire state of Rhode Island. New in Phase II of Advance-CTR, this Core is built around a philosophy and culture of partnership and reciprocity. The CEO Core provides RI investigators with the training and guidance they need to conduct successful community-engaged research initiatives. These include offering investigators the opportunity to receive feedback from community stakeholders on their research ideas before they begin, and brokering partnerships between investigators and community stakeholders during each step of the research process. Community stakeholders, in turn, have the opportunity to participate in the dissemination of study results, including publication and dissemination of study findings to the public and the communities who stand to benefit from knowledge production. This culture and the Core's commitment to community participation at every stage of the research process will help ensure that the CEO Core's activities are relevant to populations who experience health disparities and to the Rhode Island community at-large.

**Clinical Research Support:** All RI investigators have access to support for clinical research via Advance-CTR and the Lifespan Clinical Research Center. Investigators may request support through Advance-CTR that includes regulatory support, subject recruitment, specimen collection and biobanking.

**Dedicated Space:** More than 7,000 square feet is dedicated to Advance-CTR across all partner institutions in Rhode Island. Central offices are located in downtown Providence, Rhode Island, adjacent to the Warren Alpert Medical School of Brown University and less than a mile from the Brown University School of Public Health, Lifespan and Care New England hospital systems. Other partners, including the VA Providence Healthcare System and the Rhode Island Quality Institute are less than three miles away from the Administrative Core offices. This includes contiguous workspace in two dedicated suites for the BIBCE and Administrative Cores in a building adjacent to the Warren Alpert Medical School. Shared building-wide resources include a small 209 square-foot conference room with capacity of 8 people and a larger 365 square-foot conference room with a capacity of 16 people. The building is serviced by a 10 Gigabits per second (Gbps) optical network (Cisco). State-of-the-art, audio visual conferencing equipment is used utilized for both internal and external audiences

to facilitate a spectrum of Advance-CTR needs, including administrative planning, professional development, educational outreach, local discussions, team project meetings, Advisory Committee meetings, NIGMS reporting, and multi-site forums.

### **Center - Advance-CTR: Summary**

<https://www.brown.edu/initiatives/translational-research/home>

Advance Clinical and Translational Research (Advance-CTR): Advance-CTR partners were awarded an IDeA-CTR grant by NIGMS in 2016 as well as a renewal award in 2021 (Advance-CTR, U54GM115677). Advance Clinical and Translational Research (Advance-CTR) is a statewide Institutional Development Award for clinical and translational research (IDeA-CTR) funded by the National Institute of General Medical Sciences. Based at Brown University, Advance-CTR is a statewide collaboration between Rhode Island's primary academic institutions, hospital systems, and community organizations. Advance-CTR supports Rhode Island investigators through funding, research resources and services, and professional development offerings. Ultimately, Advance-CTR aims to fuel discoveries and collaborations that are responsive to the health priorities of Rhode Island's diverse communities. Advance-CTR comprises two Administrative Cores (the Administrative Core and the Tracking and Evaluation Core), two Award Cores (the Pilot Projects Program and the Professional Development Core), and three Service Cores (the Biostatistics, Epidemiology, and Research Design Core, the Biomedical Informatics, Bioinformatics, and Cyberinfrastructure Enhancement Core, and the Community Engagement and Outreach Core).

More than 7,000 square feet is dedicated to Advance-CTR across all partner institutions in Rhode Island. Central offices are located in downtown Providence, Rhode Island, adjacent to the Warren Alpert Medical School of Brown University and less than a mile from the Brown University School of Public Health, Lifespan and Care New England hospital systems. Other partners, including the VA Providence Healthcare System and the Rhode Island Quality Institute are less than three miles away from the Administrative Core offices. This includes contiguous workspace in two dedicated suites for the BIBCE and Administrative Cores in a building adjacent to the Warren Alpert Medical School. Shared building-wide resources include a small 209 square-foot conference room with capacity of 8 people and a larger 365 square-foot conference room with a capacity of 16 people. The building is serviced by a 10 Gigabits per second optical network (Cisco). State-of-the-art, audio visual conferencing equipment is used utilized for both internal and external audiences to facilitate a spectrum of Advance-CTR needs, including administrative planning, professional development, educational outreach, local discussions, team project meetings, Advisory Committee meetings, NIGMS reporting, and multi-site forums.

### **Center - Alcohol and Addiction Studies (CAAS)**

<https://www.brown.edu/academics/public-health/research/alcohol-addiction-studies/>

Center for Alcohol and Addiction Studies (CAAS): The Brown University Center for Alcohol and Addiction Studies in the School of Public Health is an internationally renowned research center in alcohol research. The mission is twofold: to conduct collaborative research that will lead to more effective treatment for alcohol and drug abuse, and to create a nationwide program in substance abuse, education and training for psychologists, physicians, medical students, and health care professionals. CAAS faculty conduct empirical research in a variety of areas of alcohol abuse/dependence, drug abuse/dependence and tobacco use, ranging from laboratory investigations of mechanisms through treatment or early intervention to policy. Funding comes from the federal government and a variety of foundations.

Comprehensive training is provided in how to conduct excellent research to predoctoral and postdoctoral research fellows. Faculty conduct clinical training seminars for practitioners at national and regional conferences. Faculty are involved in developing training curricula for medical schools and addiction training for clinicians as part of the Addiction Technology Transfer Center (ATTC). The CAAS houses the largest library of material on Alcoholics Anonymous, in conjunction with the Brown University Library system. Faculty are involved in Physicians and Lawyers for National Drug Policy to align policy, practice, and public understanding with the scientific evidence that addiction is a preventable and treatable disease; to support the use of evidence-based, cost-effective approaches toward prevention and treatment; and to enable lawyers and physicians to provide effective and sustained leadership in this effort.

## **Center – Alternatives to Animal Testing**

<https://caat.brown.edu/>

The Center for Alternatives to Animal Testing is modernizing toxicity and drug testing by measuring and integrating the biologic responses of miniaturized human tissues. There is a large and growing number of potential toxicants and drugs whose concentration-dependent effects are unknown. Current animal and simple 2D cell culture models do not rapidly and effectively identify human health risks. Needed are new, cost-effective, and predictive assays that can assess adverse effects. Through an integration of biology and engineering, we have devised simple, high-throughput 3D microtissues as predictive biology platforms that reflect human physiology and disease, solving fundamental questions of adverse biological response. We use quantitative confocal imaging of 3D human microtissues to identify pathologic responses to chemical and drug exposures.

The Center for Alternatives to Animal Testing provides a scholarly environment for research and teaching in the development and use of state-of-the-art humane approaches to understanding the fundamental characteristics of health and disease, including identifying alternatives to animal testing for screen of environmental toxicants and new drugs. The Center is interested in collaborating with industry to accelerate the Center's mission and research and development programs. Types of support include general support for the Center, sponsored research, and collaboration around areas of mutual interest. The Center's strategy is to optimize and validate in vitro assays using human 3D micro-tissues visualized by high-throughput/high-content imaging. These novel platforms for predictive biology are designed to address the unmet need for screening and safety assessment of large numbers of environmental chemicals and emerging toxicants, thus protecting human health and the environment.

## **Center - Biology of Aging**

<https://www.brown.edu/research/projects/biology-aging/>

Center on the Biology of Aging: The mission of the Center is to promote at Brown University and at its affiliated hospitals research and education programs on the causes and treatment of aging. The Center complements already existing strengths such as clinical care and health services research by providing a focal point whose primary function is basic research on the biology of aging. The ultimate goal is to catalyze activity that will improve human health span. The Center for Aging Initiative seeks to: 1) identify biological mechanisms that can extend healthy life, 2) develop interventions to ameliorate the negative aspects of aging. By assembling a core group of experienced scientists the Initiative is increasing the interactions among investigators interested in aging, attracting talented students to their laboratories, and promoting growth by recruiting top-ranked new faculty. In addition to escalating research activity, the Initiative also strives to inform and educate the Brown community and the public. The Center also runs a monthly Providence Area Aging Research Forum, an extramural Aging Seminar Series, and the annual Colloquium on the Biology of Human Aging.

## **Center - Biomedical Engineering (CBME)**

<https://www.brown.edu/academics/biomedical-engineering/home>

The Center for Biomedical Engineering is the only joint academic program of the School of Engineering and the Division of Biology and Medicine. CBME's research improves human health through cross-disciplinary studies and educational activities that integrate the engineering, physical sciences, life sciences, and clinical practice. CBME also oversees and administers degree programs in Biomedical Engineering for undergraduates, master's students, and PhD students.

CBME faculty are drawn from across the campus academic departments as well as the School of Engineering and the clinical departments of the Division of Biology and Medicine. Their dual status as CBME faculty and members of academic departments makes them well poised to bring the very latest in their disciplines to bear on the complex and multidisciplinary problems of biomedical engineering. Many CBME researchers bridge the gap between clinical and basic research through interaction with Brown's affiliated hospitals including Rhode Island Hospital, Providence Veterans Affairs Medical Center, and Miriam Hospital.

The research, teaching, and service activities of the CBME community are diverse. However, much of the Center's fundamental capability can be captured in four topics of nationally recognized excellence: Mechanobiology, Regenerative Engineering, Neuroengineering, and Biomaterials and Sensing.

### **Center - Brown Center for Biomedical Informatics (BCBI)**

<https://www.brown.edu/academics/medical/about-us/research/centers-institutes-and-programs/biomedical-informatics/>

The Brown Center for Bioinformatics (BCBI) was established in July 2015 with a three-fold mission to: (1) innovate how electronic biomedical and health data are used, (2) implement digital solutions for improving biomedical research and healthcare delivery, and (3) inspire the next generation of biomedical researchers and clinicians in partnership with collaborators in existing areas of excellence at Brown, its healthcare affiliates, and statewide healthcare organizations. Faculty, staff, and students in BCBI offer experience in applying the breadth of informatics and data science approaches across the full spectrum of biomedicine and health care (translational bioinformatics, clinical research informatics, clinical informatics, consumer health informatics, public and population health informatics, and global health informatics). Specific areas of expertise include: biological sequence analysis; data extraction, integration, management, and analysis; data mining, machine learning, and deep learning; clinical decision support; evaluation; human factors engineering; information retrieval; knowledge engineering; natural language processing and text mining; and, software engineering and system development. BCBI is centrally located in office space in a building adjacent to The Warren Alpert Medical School of Brown University. This office suite space has 2,281 net assignable square feet and includes five administrative support workstations and eight offices. Shared building-wide resources include a 209 square-foot conference room with capacity of eight people and a larger 365 square-foot conference room with a capacity of 16 people. This area is serviced by a 10 Gigabits per second (Gbps) optical network (Cisco). Computers are available for basic programming and productivity tasks. Dedicated servers for BCBI research and educational activities are maintained by Computing and Information Services.

### **Center - Brown Center for the Study of Children at Risk**

<https://www.brown.edu/research/projects/children-at-risk/>

The Brown Center for the Study of Children at Risk (The Center) is located at the Alpert Medical School of Brown University and Women & Infants Hospital (WIH). The Center occupies 14,100 square feet of space and houses a 60 member staff. The laboratory and offices are located at 50 Holden Street, Providence, 2.28 miles from the WIH campus. The mission of the Center is: (1) to advance theories of the developmental pathways from fetal and infancy periods in at-risk children, (2) to enhance synergy between research and clinical practice that advances child development research, intervention programs and social policy, (3) to train scientists and practitioners in interdisciplinary methods from the field of child development. The Center's functions are: 1) fundamental research on mechanisms that explain long-term developmental outcome with emphasis on at-risk children, 2) applied research on interventions for children and their families, 3) education and training of students, scientists, and practitioners, and 4) services for populations of children of interest for fundamental and applied research.

**Clinical:** The Center is supported by WIH and is a Division of the Department of Pediatrics at WIH. WIH is located at 101 Dudley Street. The Holden St. facility provides office space and work stations for the 60 members of the Center including 12 Brown Medical School faculty, a reception/waiting area for research subjects and patients, four dedicated laboratories/evaluation rooms for research on fetal function and behavior, kinematic motor lab for children ages 3-5 years; eye tracking lab for high-risk children including those with autism spectrum disorder; medical examination room. 12 research and clinical testing and evaluation rooms with five one way observation rooms, physiological and videotape recording facilities, and a data center that includes biostatistical and technical support, and five video coding stations. The Center has two conference rooms for colloquiums, seminars presentations and work group meetings. Both rooms are equipped with audio-video equipment. Five workstations are also available with coding systems to extract data for data analyses.

**Computer:** All members of the Center, including trainees, have personal computers equipped for word processing, data analysis, and graphics. All Investigators and trainees have access to color laser printers and digital scanners. All computers have access to the internet, Email, library information and database searches

via connection to Brown University. Further, the Center has an internal network and dual servers that interface with the WIH network. The Center technical engineer is the network administrator with back up from WIH information services. The facility is site licensed for all statistical software proposed in this project (SPSS, MPLUS, SAS). The hospital main campus and the Brown Center are connected on the same system-wide secure network.

Other: The kinematics lab is designed to test visual-motor and fine motor control in young children when reaching and grasping a series of pegs. The Vicon Motus software was installed on the specialized computer that guided the procedure. The set up includes two cameras with infrared illuminator rings that recorded the procedure from different angles. Prior to the assessment, the reaching space was calibrated by a 12 by 12 frame with 16 markers by the two infrared cameras. With calibrated space, the software is able to determine the moving position of the child's hand.

Equipment: The biomarkers lab provides information on how children with autism spectrum disorder engage and respond to interesting stimuli. Visual attention is used (eye tracking measures of social attention) and tests of autonomic regulation (sympathetic and parasympathetic functioning) as a potential battery of biomarkers. The equipment required includes: REDn Eye Tracking System (system laptop, eye tracking hardware, and system software); MindWare Physiological Data Analysis Software (2 license keys); 2 Actiwave Cardio ECG Waveform Data Recorders; Dell Latitude Laptop; three Dell OptiPlex 9020 Computers (1 is refurbished); 2 E4 EDA recording wristbands; 2 Q-sensor EDA recording wristbands (on loan from Northeastern University); CIP Pupilometer with Laptop (on loan from Simons Foundation); 1 Macbook Air; Dell 24 Monitor. Eye tracking measures of visual attention to people and social stimuli indicate social attention and information processing. Autonomic nervous system (ANS) activation has bottom up influences on attentional and emotional responses, and ANS responses are influenced by top down higher-order processing of experiences. Activation of the sympathetic and parasympathetic branches of the ANS measure emotion regulation and social responsiveness. Skin conductance is one measure of sympathetic activity, whereas heart rate variability is a measure of parasympathetic activity. Together, emotion regulation, social responsiveness, and attention to social information can be expected to correlate with dysfunctions seen in ASD.

### **Center – Children's Environmental Health (CCEH)**

<https://www.brown.edu/academics/public-health/cceh/about>

The Center for Children's Environmental Health (CCEH) is dedicated to promoting the health of children by understanding the determinants, health effects, and biological action of environmental pollutant exposures from before conception until adolescence. The Center is engaged in studies examining pesticides, drinking water contaminants, metals, and chemicals used in consumer products.

The Center's interdisciplinary group of faculty, postdocs, clinicians, students, staff, and practitioners conduct research, teaching, and community engagement in Rhode Island and around the world. Members and affiliates of CCEH investigate the connections between human health and environmental pollutants (research), support trainees as they develop, learn or apply innovative approaches to important public health problems (training), and engage with governments, communities, and individuals to improve environmental conditions for children (translation and practice).

Specifically, the CCEH:

1. Provides a hub at Brown University and across the region for children's environmental health research and action;
2. Provides diverse learning opportunities for trainees from any academic background to engage in children's environmental health research or practice;
3. Facilitates translation of environmental health research into action through engagement of governments, communities, and individuals.

### **Center – COBRE for Addiction & Disease Risk Exacerbation (CADRE)**

<https://www.brown.edu/academics/public-health/cadre/home>

COBRE for Addiction & Disease Risk Exacerbation (CADRE): Established in 2019, CADRE is a federally funded NIH Center of Biomedical Research Excellence (COBRE). The CADRE's mission is to become a national leader in substance use bio-behavioral research and chronic disease manifestations in vulnerable populations (especially underrepresented ethnic or racial minorities), serving as a resource for training and research within Brown University as well as regionally and nationally.

Additionally, the overarching goal of CADRE is to create a thematically and technically linked center that will promote the research programs of 5 promising interdisciplinary junior faculty members, and in so doing, enhance their competitiveness for independent external funding. Brown University's commitment to supporting CADRE's goal of diversifying the biomedical workforce and addressing health disparities will be supported by (1) a pilot grants program that focuses on addressing the higher burden of illness related to substance use and chronic disease among racial and ethnic minorities, and (2) a postdoctoral position given to someone from a group underrepresented in biomedical sciences. Through its affiliation with the Center for Alcohol and Addiction Studies at the Brown University School of Public Health, CADRE will investigate mechanisms whereby substance use impacts disease, using a combination of behavioral and physiological laboratory-based approaches across several substances of abuse.

CADRE's research is supported by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM130414.

### **Center - COBRE Center for Computational Biology of Human Disease (CBHD)**

<https://www.brown.edu/research/projects/computational-biology-of-human-disease/home>

COBRE Center for Computational Biology of Human Disease (CBHD): The COBRE CBHD embraces the age of genomics medicine from an explicitly data-driven, computational perspective. By building a collaborative Center of empirical and computational scientists, this COBRE advances new discoveries, algorithms, and genomic screening approaches with direct relevance to several human diseases. This is consistent with NIH's mission of supporting bioinformatics and computational biology to advance all areas of biomedicine. This Center provides a centralized service to assist researchers in computational, bioinformatic, and data management challenges of analyzing large data sets made available by modern 'omics' technologies. In addition, this funding will support the research activities of junior investigators to ensure their transition to stand-alone extramurally funded research scientists. The COBRE CBHD uses an innovative joint mentoring process, where each junior faculty member is advised by both computational and biological or clinical senior faculty members. In addition, staff data scientists in the Computational Biology Core will be active members of each of these laboratory groups to better integrate all phases of the research activities.

### **Center - COBRE for Central Nervous System Function**

<https://www.brown.edu/research/projects/central-nervous-system-function/>

COBRE for Central Nervous System Function: Purposeful human behavior requires attention, decisions and construction and production of abstract sequences, all basic functions mediated by brain networks primarily located in the neocortex, but modulated and shaped by sub-cortical processing. In a general and even a specific sense, attention, decision making and production of abstract sequences are key components of human mental activities. Deficits in these functions are common in both neurological and psychiatric disorders and can result in a wide range of higher-order behavioral deficits, including anxiety. We propose to continue, for at least another five years, the COBRE Center for Central Nervous System Function at Brown University that will investigate the mechanisms of higher-brain function focusing on decision making, abstract sequence construction and attention, while developing statistically valid tools to reveal brain connectivity pattern. This COBRE consists of four research projects. A Design and Analysis Core and a Behavior and Neuroimaging Core will facilitate the research goals of these projects and benefit the broader Brown community by developing new tools and optimizing existing ones to image brain structure and function with MRI and EEG, while insuring proper experimental design and analysis procedures across the projects. Project Leaders will have senior faculty mentors who will provide support and guidance on research, publication, grant preparation, and career development. An Administrative



Core will oversee the operations of this COBRE Center. The COBRE Center for Central Nervous System Function will fall under the auspices of the Brown Institute for Brain Science. The COBRE Center will leverage the administrative resources available through the Brown Institute for Brain Science to ensure efficient operation and coordinate with other brain science research activities at Brown.

### **Center - Computation and Visualization (CCV)**

<https://ccv.brown.edu/>

Center for Computation and Visualization (CCV): The mission of CCV is to provide the scientific and technical computing expertise required to advance computational research and support Brown's academic mission. The accelerated transformation of the pace and impact of computational approaches led to Brown University's recognition of the importance of high performance computing across all of its disciplines. As a result, Brown and IBM developed in 2009 a \$4M investment in a high performance computing platform, known as Oscar, that is available statewide to researchers. Through grant funding and University investment, this platform has undergone continual hardware enhancement, and now includes Intel Scalable Processors and nVIDIA GPUs of the Pascal and Volta architectures, as well as 100Gb/s EDR Infiniband. The equipment is maintained and operated by the staff of the Center for Computation and Visualization (CCV), who have extensive experience in operating shared computational clusters. CCV staff are responsible for scheduled maintenance, access control as needed, and integration with research specific hardware as required by NIH-funded researchers. CCV staff also take care of all financial aspects of operating and maintaining the facility.

The high performance computing resources at CCV equip the Brown research community to undertake complex numerical simulation, modeling, and data analysis. Oscar is the primary research computing cluster with several hundred multi-core nodes sharing a high performance interconnect and file system. Applications can be run interactively or scheduled as batch jobs. Several large memory nodes provide substantially more memory than is available on typical workstations and laptops. A large collection of software is available on CCV systems, including: python, perl, R, Matlab, Mathematica, Maple, optimized math and science libraries, and domain-specific applications. CCV staff can help acquire and install most applications upon request. The technical specifications of Oscar are:

- Two login nodes provide access for application development, debugging and batch job management
- About 400 compute nodes up to current specs of dual multi-core processors and 128 GB of memory and a total of more than 8,000 cores
- Specialized nodes containing GPU processors or 512 GB of memory
- High-bandwidth/low-latency Infiniband interconnects
- All nodes are diskless with I/O provided by an IBM GPFS parallel file system
- 1 PB of usable disk space
- RHEL 7.3 Linux operating system
- SLURM workload manager

CCV provides storage for large research files connected to the high performance computing (HPC) system. A default allocation of 256 GB (also called RData) is given to all faculty members at Brown, on a per request basis, with the option of purchasing additional storage as needed. Long-term storage and backups are available on a fee basis. Storage can be purchased in increments of terabytes for periods of up to 6 years. The cost for backups is included when storage is purchased. Data is incrementally backed up to tape on a daily basis. In addition, snapshots for the last 7 days are available online for quick restores. Long-term archiving of files to tape (one or two copies) can be purchased as needed. Tape libraries are housed at two separate locations to enable disaster/recovery scenarios. In addition, a disaster recovery copy of the non-ephemeral data is kept on a lower-performance filesystem to permit immediate recovery and limited production computing in the unlikely event of the loss of the primary filesystem. These research storage allocations can be easily mounted to desktops or other computer systems to allow for easy access and sharing files. Details of HPC file storage at CCV:

- Rdata is accessible from all CCV systems (/gpfs/data)
- Can be mounted to all desktops on Brown's campus network
- Is backed up on a daily incremental basis

- Rdata allocations can be increased by purchasing additional storage
- Home directory on Oscar: All users will have access to a home (/gpfs/home) allocation of 10 GB. This allocation is backed up on a daily basis
- Group storage: Premium accounts will be entitled to an additional allocation of 256 Gb that may be merged with RData (for primary PI). Likewise, group premium accounts will be entitled to additional 25 GB per user
- Snapshots: Daily snapshots are available for both RData and Home file systems for seven consecutive days
- Scratch: Space for temporary files is available as (/gpfs/scratch). These files are not backed up and scratch space is strictly for temporary files. Files may be purged after 30 days or as the file system is being utilized. This allocation will be managed by an application called xdisk (time versus space) (work in progress)
- Sharing data: Sharing files that are too big to be sent via email. There is a 10 GB quota and a limit of 2 GB per file
- Users can access RData from the CIFS share. This can be mapped as a drive in Windows and mounted in Mac OS X and Linux from any campus system (off-campus use requires a VPN connection to campus). Users can also access files by using a file transfer tool like Secure Copy (SCP), Secure FTP (SFTP), or rsync

A key benefit of using these computing resources is that CCV installs and maintains a large collection of computational research software. CCV can install most software packages upon request. A full range of statistical and other scientific software is available on the CSS system, including standard statistical packages (including SAS, Stata, S-plus), specialized statistical software (such as DBMSCopy, ROCKIT, nQuery, East), scientific programming languages and software (such as Fortran, C++, Matlab) and office software. All data stored on the CSS network is secure: access to the system from outside our network requires the use of a software client that employs a point-to-point encryption. The UNIX operating system also provides the mechanism to limit access of specific directory trees to specific groups of users. CSS will supplement the funded Administrative Coordinator for the Core with a modest amount of in-kind administrative support in the form of existing clerical and secretarial help, assistance with grant and subcontract preparation, access to conference rooms and office equipment. The Core will pay a nominal fee to CSS to offset the cost of maintaining multiple-user site licenses for statistical software and for maintaining updated operating systems, having full access to the computing network (including associated software and dedicated hardware), and software and systems support for core personnel.

### **Center - Computational Molecular Biology (CCMB)**

<https://www.brown.edu/academics/computational-molecular-biology/>

Computational Molecular Biology (CCMB): CCMB was founded in September 2003 with the aim of establishing a world-class center for research and scholarship in this new discipline. CCMB's central mission is to make breakthrough discoveries in the life sciences at the molecular and cellular level through the creative application of existing data analytic methods, and the development of novel computational, mathematical, and statistical technologies required exploit the opportunities emerging from advances in genomics and proteomics. It is a research center unites existing faculty research programs and does not support service staff for computation or bioinformatics. CCMB occupies ~3000 square feet of space in the Watson Center for Information Technology (CIT) at 115 Waterman Street. This includes office space for graduate students, postdoctoral fellows, research staff and visitors, and a faculty member. In addition, there is a state-of-the-art seminar room with dual projectors, a smart board and a floor-to-ceiling white board along one entire wall, and is used for the weekly Computational Biology seminar series and research group meetings. CCMB has a full-time administrative staff member for grant preparation and other administrative duties. CCMB has 72 dedicated cores on the Oscar super computer.

### **Center – Brown-Lifespan Center for Digital Health (CDH)**

<https://digitalhealth.med.brown.edu/>

Brown-Lifespan Center for Digital Health (CDH): CDH is a collaboration between Lifespan and The Warren Alpert Medical School of Brown University. CDH's mission is to use digital health to transform the care of patients with acute care needs before, during, and after their visit by developing and deploying effective, evidence-based

digital health tools. The goal is to use technology to improve access to patients and increase the efficiency of health care delivery. As this field rapidly expands, it is critical for us to develop theoretically based interventions and to provide evidence that digital health tools are acceptable and effective, for both clinicians and patients. CDH's vision is for digital health to be an evidence-based, effective and well-integrated tool for creating and restoring health. Megan Ranney, MD MPH is the director and founder of CDH. She has a ten-year history of successful external funding to develop and evaluate digital health interventions. She has lectured and published internationally about mobile/digital health interventions in the acute care setting. Since 2014, CDH has mentored over 60 students, residents, fellows, and postdocs in digital health and has had more than 10 grants and 100 publications

### **Center – Epidemiologic Research (CER)**

<https://www.brown.edu/academics/public-health/cer/about>

The Center for Epidemiologic Research: The Center for Epidemiology and Environmental Health (CER) was founded in 2016, within Brown University's School of Public Health. In 2020, the name changed to Center for Epidemiologic Research. The goal of CER is to conduct epidemiologic studies of the causes, treatment and prevention of major health concerns at the population level. Members of the Center are epidemiologists, physicians and social scientists who combine state-of-the-art research methods with expertise in specific diseases, including cardiovascular, cancer, reproductive, nutritional, psychiatric and behavioral disorders.

### **Center - Evidence Synthesis in Health (CEHS)**

<https://www.brown.edu/public-health/cesh/home>

The Center for Evidence Synthesis in Health (CEHS): The CESH currently occupies 2,865 square feet on the 8th floor of 121 South Main Street housing faculty, research and administrative staff and graduate students. The mission of the Center is to promote rational decision making by means of conducting research in and teaching the principles of research synthesis (systematic review and meta-analysis) and evidence contextualization (decision and economic modeling). Members of the Center are physicians, methodologists, biostatisticians, statisticians and computer scientists who combine state-of-the-art research methods with expertise in applied research and evidence contextualization; and there is a strong culture of intellectual collaboration.

The Center provides support to investigators for pilot studies, professional development and administrative support for research-related activities. The financial support structure allows for protected time for research with salary support. Physical resources such as office space, conference rooms, teleconference equipment, computer resources and support staff have been allocated to the investigator's research efforts. Mentorship is available from senior faculty in the center and department. The CESH has strong record of federal funded and collaborative sponsored research with both seasoned and new investigators.

### **Center - Gerontology and Healthcare Research**

<https://www.brown.edu/academics/public-health/cghr/home>

Center for Gerontology and Healthcare Research: The Center for Gerontology and Healthcare Research in the School of Public Health is a nationally prominent research center that studies the diverse health and social service needs of elderly and other persons with chronic illnesses. Since the early 1980's, center faculty members have had substantial success in securing funding from the National Institutes of Health, the Agency for Healthcare Research and Quality, and the Health Care Financing Administration, as well as from numerous philanthropic foundations. The research findings of center faculty have, as intended, figured prominently over the years as valuable guides for government agencies making decisions regarding policy aimed at improving health and health care for aging and disabled populations. Initiating new lines of research on previously unstudied or understudied populations is a hallmark of the center work. The Center for Gerontology and Healthcare Research is located on the campus of Brown University in the city of Providence, Rhode Island and is the administrative home of the Center for Long-Term Care Quality & Innovation.

## Center - Health Promotion and Health Equity (CHPHE)

<https://www.brown.edu/academics/public-health/chphe/about>

The Center's mission is to improve health, especially in underserved populations, by conducting interdisciplinary research and education to empower individuals, providers, organizations, and communities to practice and promote healthier behaviors and environments.

## Legorreta Cancer Center and Affiliated Programs

[https://www.brown.edu/academics/biomed/cancer\\_biology/legorreta-cancer-center](https://www.brown.edu/academics/biomed/cancer_biology/legorreta-cancer-center)

The Legorreta Cancer Center is building world-class cancer research programs that bring basic science discoveries about cancer, interdisciplinary clinical, translational, and population research to innovative therapeutic, disease intervention and cancer prevention clinical trials to patients in the State of Rhode Island. The Cancer Center is an outgrowth of the Joint Program in Cancer Biology at Brown and Lifespan. In 2021, the Center received a generous \$25 million gift from life sciences entrepreneur and investor Pablo Legorreta and his wife, Almudena, that will help advance the Center's goals.

Legorreta Cancer Center members represent Brown University, the Lifespan Cancer Institute, the affiliated hospitals, the Warren Alpert Medical School, and Brown's School of Public Health and School of Engineering, among others. The Center's goal is to understand genetic and environmental risk of cancer, to prevent cancer whenever possible including by avoiding tobacco smoke, excessive sun exposure, alcohol, and cancer vaccination.

Center investigators are working to understand how cancer develops, grows and metastasizes, and to develop new biomarkers and treatments for patients in a personalized way that addresses their needs ranging from risk through survivorship. The goal is to impact on cancer in Rhode Island and beyond through outstanding research programs that uphold the high standards of excellence adopted by the National Cancer Institute.

Legorreta Cancer Center research activities span cellular, molecular analysis of the tumor microenvironment at high resolution, genomics and Precision Oncology, cell cycle, oncogenes and tumor suppressor genes, cell death, DNA repair, cellular senescence, cancer inflammation, cancer immunotherapy, drug discovery, first-in-human and other early phase investigator-initiated clinical trials across a range of tumor types, health services, addiction and disease epidemiology research.

Center clinical programs cover all tumor types through multidisciplinary teams of specialists and tumor boards with state-of-the-art clinical trials that are available conveniently within the State of Rhode Island. Center investigators have special interests in cancers with higher rates in Rhode Island such as bladder cancer, lung cancer, breast, thyroid and skin cancer, as well as issues of access to care and affordability of care within our population. Center researchers are working to bring new clinical trials for patients with all cancer types.

Legorreta Cancer Center research laboratories, clinics, and population research programs offer outstanding training opportunities for students, research and clinical fellows and offer a fertile environment for faculty career development.

**Legorreta Cancer Center Research Programs.** Three core Cancer Center Research Programs that bring investigators in cancer biology, therapeutics, and population science have been established. The Cancer Biology Program brings together basic and translational investigators with expertise in mechanisms of cancer development, cell signaling, DNA repair, aging, stem cells, genomics, and tumor heterogeneity. Program meetings are held every two weeks throughout the year. Several program members have expertise in toxicology including activity of heavy metals and toxic waste that may impact cancer rates in Rhode Island. The group is interdisciplinary and includes members from several basic and clinical departments with laboratories at Brown University, Lifespan and their affiliated hospitals. The Cancer Therapeutics Program brings together clinical investigators who work together with basic and translational scientists to advance promising therapeutic options to patients in clinical trials. Program meetings are held every two weeks throughout the year. There is a robust portfolio of early phase clinical trials led by investigators through the Brown University Oncology Group (BrUOG), Lifespan Cancer Institute and Women's and Infants Hospital. The Program has depth of expertise in disease-based adult and pediatric oncology, pathology, and clinical investigations. The early phase experimental therapeutics effort has a strong focus on cell death pathways and immunotherapy. The Population Science

Program includes investigators with focus on population and health services research, nicotine addiction, cancer prevention, biomarkers and disease epidemiology, comparative effectiveness research, and outcomes research. Program meetings are held every two weeks throughout the year. A number of investigators have expertise in computational biology, biostatistics methods, and behavioral medicine interventions. Investigators at the School of Public Health interact with colleagues at the Warren Alpert Medical School and the Brown University-affiliated hospitals. The Program has a major focus on cancers and problems that affect the population of Rhode Island. Each of these groups meets every two weeks. Their membership draws from Brown University, the Warren Alpert Medical School, the Brown School of Public Health, the Lifespan Cancer Institute, Rhode Island Hospital, The Miriam Hospital, Women & Infants Hospital, and the VA Providence Healthcare System, among others. These research groups are intended to capture all cancer-relevant research within the university, academic medical center, and throughout the affiliated hospitals.

**Translational Research Disease Groups (TRDGs).** Translational Research Disease Groups provide a regular venue for discussion of opportunities for translational research and the means to support them. By February 2019, 11 TRDGs were formed around specific cancer types or groups of related cancers. Each TRDG meets every 2-3 months at either the Brown University Molecular Medicine Building at 70 Ship Street or an alternative hospital location to maximize participation. While some meetings use a roundtable format with a standing agenda, most TRDG meetings have designated speakers. Minutes are generated at the meetings and are circulated internally among group members. With invited speakers, presentations typically include 30-40 minutes of presentation time, with about 20-30 minutes of discussion and feedback including during the presentations. Goals of the TRDG meetings include the development and prioritization of translational research concepts, collaboration among TRDG members and others, and the identification of working groups in specific areas that may benefit from project development leading to new translational clinical protocols and grant submissions, eventual publications in high-impact journals, and new opportunities for collaborative studies. Both graduate and postgraduate training is available in cancer biology and the various oncologic disciplines. Training is available in public health, biomedical engineering, or computational molecular biology.

### **Brown University Oncology Group (BrUOG)**

<https://bruog.med.brown.edu/>

Brown University Oncology Group (BrUOG): BrUOG was established in 1994. BrUOG has become a highly respected cancer research group because of its history of innovative clinical trials. These investigations evaluate early, cutting-edge applications of chemotherapy, biologic agents, and other cancer treatments in both Phase I (which determine the optimally tolerated dose of an anticancer treatment regimen) and Phase II trials (which assesses the potential therapeutic effectiveness). BrUOG has provided essential preliminary data for definitive Phase III trials, which are being conducted nationwide, often under the auspices of the National Cancer Institute.

BrUOG teaches the fundamental of clinical cancer research and provides outstanding research opportunities for physicians in training. In addition to protocols coordinated by BrUOG, patients at the affiliated hospitals also have access to a large variety of other clinical trials through national cooperative groups such as Cancer and Leukemia Group B (CALGB), the National Surgical Adjuvant Breast and Bowel Project (NSABP) and the Radiation Treatment Oncology Group (RTOG). Only through the resources of such large organizations can such randomized trials of cancer therapy take place. Pharmaceutical industry-sponsored trials of novel agents are also available. Sponsorship for clinical trials is derived from the National Cancer Institute and from numerous pharmaceutical industry sponsors.

**The Lifespan Cancer Institute (LCI)** is the largest program of its type in Rhode Island, with four treatment locations – Rhode Island Hospital, Miriam Hospital, Newport Hospital and an East Greenwich outpatient center. Nationally renowned physicians at the LCI include surgical, medical, interventional and radiation oncologists who sub-specialize in specific cancer types and work together in multidisciplinary clinics to provide state-of-the-art care to both adults and children. LCI is an active clinical trial site, committed to providing patients with the latest protocols. Patients have access to groundbreaking immunotherapies and other new and emerging cancer treatments at various stages of diagnosis and across many cancer types. LCI represents the clinical outlet for trials as part of the Cancer Center at Brown University.

**The Oncology Data Management Department (Cancer Registry)** is an essential component of the Lifespan Cancer Institute at Rhode Island Hospital, The Miriam Hospital and Newport Hospital. The Cancer Registry maintains a computerized data system that collects, manages, and analyzes information on patients that are diagnosed and/or treated at Lifespan Cancer Institute. Information on cancer site, stage, histology, treatment, survival, and epidemiological characteristics is collected and maintained in accordance with the Commission on Cancer quality and confidentiality standards.

**COBRE Center for Cancer Research Development:** In 2002, Rhode Island Hospital received an \$8.2 million grant from the National Institutes of Health Centers of Biomedical Research Excellence (COBRE) to establish the COBRE Center for Cancer Research Development at Rhode Island Hospital (COBRE CCRD). In July 2009, the CCRD received a five-year renewal of \$11.2 million in total funding to continue the development of the cancer research effort at Rhode Island Hospital, and this was renewed one more time. The COBRE Center provides junior investigators access to the wisdom and experience of senior faculty mentors as well as cutting-edge technologies in biomedical research that were previously unavailable in Rhode Island. The mentoring relationship helps investigators hone their research and investigative skills so that they will ultimately be able to support their research through their own grant awards.

### **Center - Plant Environmental Center**

<https://www.brown.edu/academics/ecology-and-evolutionary-biology/about-us/plant-environmental-center>

Plant Environmental Center: The Plant Environmental Center at Brown University consists of six environmentally controlled research greenhouses, a conservatory, two laboratories and a classroom. The facility is comprised of six computer controlled research greenhouses totaling approximately 5,000 square feet. These greenhouses are used for research experiments, as well as various plant collections used to support biological science classes. In addition, this roof top space includes an 1800 square-foot conservatory open year around. The collection in the conservatory includes many plant families, including a diverse collection of Cycads, Orchids, Aroids, and many plants from the Amazon region. Many of these plants have medicinal and ceremonial uses and are part of our Ethnobotanical collection.

The greenhouse facility also consists of a head house for potting and other prep work, classroom, and plant growth chamber laboratory. The plant growth laboratory consists of eight E7/2 Conviron Plant growth chamber units, as well as two eighty square-foot walk-in chambers and one 80 square-foot cold room. These units are primarily used by graduate students and faculty performing research with very specific cultural requirements that cannot be maintained in the greenhouses.

### **Center – Brown Center for Primary Care and Prevention (CPCP)**

<http://med.brown.edu/CPCP/>

Brown Center for Primary Care and Prevention (CPCP): The CPCP, based at the Pawtucket large ambulatory practice has sole use of a 6,000 square-foot floor in a new building with offices and fireproof data storage facilities. The CPCP with over \$44 million dollars in funded research and contracts, and 20 active projects in the field has an excellent record of accomplishment for performing cutting-edge clinical, translational and educational research. The CPCP has implemented many large-scale, community-based research and education projects and multi-site clinical trials, as well as research in primary care physicians' offices. Our group has devised a highly successful system for data management, ensuring participant confidentiality and data security. This system has managed data from approximately 45,000 program participants from a variety of research studies.

The CPCP is a collaborative effort between Brown University and Kent Hospital, where the Center serves as a base of operations for faculty and staff. The Center promotes interdisciplinary research by offering an array of support services to faculty and investigators ranging from research assistance (i.e. biostatistics, study and survey instrument design, clinical trials recruitment, statistical programming, data analysis and management, etc.), to underwriting key central support needs (administrative/grants/budget oversight support), to funding for pilot studies. Dr. Eaton has been working with core CPCP staff and investigators for many years, and they have worked out efficient and effective means of project management and brainstorming successful strategies for addressing the small and large issues that arise during the course of complex research project implementation.

The CPCP facility houses both the research components of CPCP and the academic physician practices in family medicine and general internal medicine. It provides a unique learning laboratory where innovations in research, medical education, and patient care are united. The CPCP is structured to maximize potential for intellectual stimulation, collaboration, and research productivity. The Center has a diverse staff and investigator membership of doctoral and masters' level researchers in family medicine, general internal medicine, community health, health education, nutrition, epidemiology, anthropology, psychology, and biostatistics. Many of these researchers in the CPCP are core staff as well, and receive some level of salary support to consult with other investigators from each of their areas of expertise. This system ensures that the CPCP has in-house expertise in numerous academic disciplines and areas of both quantitative and qualitative research, and greatly facilitates investigators' abilities to design and conduct their research, and analyze, interpret and disseminate their findings.

The CPCP has implemented many large-scale, community-based research and education projects and multi-site clinical trials, as well as research studies in primary care physicians' offices. Our group has devised a highly successful system for data management, ensuring subject confidentiality and data security. This system managed data on approximately 45,000 program participants from a variety of research studies. The Care New England's Information Services Department (CNE IT) is committed to providing a secure, reliable computing environment. CNE IT practices "defense-in-depth" security to assure maximum security and protect against unauthorized access, while supporting staff and researchers. The CNE system has detailed System Security policies addressing how we ensure data integrity, security, and confidentiality. All data is protected and secured in a HIPAA-compliant computing facility within the CNE IT infrastructure that complies with strict legislation and Joint Commission standards. Access to the Data Center is card-controlled and all access to the core server room is recorded. CNE IT Security staffs are acknowledged professionals with Global Information Assurance Certification (GIAC) certifications. Many CNE IT staff members are also certified IT professionals with Cisco and Microsoft Corporations. All research data is stored in a secure and backed up database doubly protected by two enterprise firewalls from Care New England meeting HIPAA specifications regarding the encryption of PHI in transmission ("Data in Motion") and in storage ("Data at Rest") with appropriate data level firewall protection. Database integrity is further ensured through the utilization of uninterruptable power supplies, redundant arrays of drive storage, daily backup, and secured off-site tape storage. In addition to database-level password security, all backup files and tapes employ an additional layer of file encryption. Secure database access is managed through a combination of role-based and context-based controls. Investigators, clinicians and data entry personnel will have minimally necessary views of study data and/or protected health information. Only authorized users are able to perform specific tasks (e.g., exports, reports, etc.). All CPCP staff is required to sign a confidentiality agreement. They are informed about the importance of and the definitions of confidentiality and informed that any breach of confidentiality will result in disciplinary action up to and including termination of employment as per hospital policies. All research staff have completed Brown University's rigorous IRB training and are recertified on a regular basis.

The CPCP includes all the necessary statistical software, network access, laser printers, a copy machine, and a fax machine for smooth operation of grants and projects. The PC statistical software and database management package includes SPSS for Windows, SAS, SYSTAT, SUDAAN, BMDP, S-PLUS, FoxPro, and Microsoft Access, Power, Precision, N-Query, and Qualitative analysis software, NVivo and Weft QDA. The CPCP is equipped with a multi-server, IP protocol Microsoft network. The system consists of over 32 workstations plus 12 laptops running Windows 2007 or Windows 2000. The system offers data encryption, all connected to the servers, up to 500 gigabytes of network storage space on several server file shares; domain access to hospital-wide Windows 2003, Windows 2008 and Windows 2010 Active Directory servers; lines for remote access; and links to the Brown University Computer Systems. The system is backed up nightly with offsite storage. Library facilities are available at Kent Hospital and at Brown University's nearby sciences library.

Clinical Studies Center: A Clinical Studies Center (CSC) occupies 1570 square feet of clinical research space and is located on the 2nd floor next to CPCP above the Ambulatory Outpatient area. The CSC consists of a separate 150 sq ft waiting room with snacks and refrigerator for after fasting blood-drawing refreshments, 300 square-foot phlebotomy unit, 3 dedicated examining rooms for ongoing research studies (220 sq ft), a reception area, medication storage area, Clinic Director and data entry space, 2 handicap accessible bathrooms and a radiology suite with digital mammography, fluoro unit, Lunar Prodigy Advance DEXA scanner (GE Healthcare, Madison, WI) and two x-ray units. An additional 700 sq ft is available for research staff to accommodate higher clinic volume as needed. The center employs a Clinic Manager, 3 research RNs, 3 research assistants,

receptionist, lab processor and data entry clerk who are involved in a cadre of epidemiologic studies and clinical trials.

### **Center - Sheridan Center for Advanced Teaching and Learning**

<https://www.brown.edu/sheridan/sheridan-center>

The Sheridan Center for Advanced Teaching and Learning is a place where faculty, graduate students and postdocs come together from across the disciplines to inquire about, explore, and reflect upon teaching and learning as ongoing and collaborative processes. Sheridan Center programs, services and resources are available to all members of the Brown community, including full-time and part-time faculty, postdoctoral fellows, teaching fellows, and teaching assistants. The Sheridan Center provides practical advice about teaching and professional development and promotes best practices and promising new practices in teaching. Advanced T32 students use this center to work toward various teaching certificates. Graduate students can move through to Certificate IV, which is the teaching consultant program. There is a graduate student liaison to the Teaching Center. The Sheridan Center resources are especially valuable to students interested in future careers that involve college level teaching. Programs offered include the following:

- The Brown Learning Collaborative, offering rigorous academic courses for undergraduate teaching fellows and evidence-based course design institutes for faculty and GTAs, to enhance student learning in key liberal arts skill areas, such as writing, problem-solving, and research.
- Inclusive teaching, embedded in Sheridan programs and offered as customized workshops for departments, drawing upon pedagogical research in the disciplines.
- Writing, academic tutoring, and English language expertise to offer direct support to students and to develop peer fellows and tutors, as well as faculty and department practices to help all students succeed as learners and communicators.
- Interdisciplinary learning communities, such as certificates on reflective teaching and course design, a Junior Faculty Fellows program, dissertation writing groups, and writing and problem-solving course design institutes.
- Assessment and research support for program review, cross-institutional grants supporting educational innovation, and initiatives to enhance teaching and learning at Brown.
- Confidential consultations – classroom observations; early student feedback; consultations on inclusive teaching, course design, writing pedagogy, assessment, student evaluations, and graduate and undergraduate TA training.
- Services to enhance student learning – Excellence at Brown pre-orientation program on writing, conversation partners program, classroom-based writing workshops on topics such as peer review, academic tutoring.
- Programs on teaching - orientations for instructors and students, certificate programs, institutes, disciplinary and interdisciplinary workshops.
- Educational research and assessment – collaboration on course and curricular assessment, consultations on the scholarship of teaching and learning, assistance with evaluation sections of postsecondary educational grants. The Center also has a resource library open to the Brown community.
- Community - programs and projects that bring together faculty, graduate students, postdocs, and undergraduates from across the disciplines.

### **Center - Statistical Sciences (CSS)**

<http://www.stat.brown.edu/Faculty.aspx>

Center for Statistical Sciences (CSS): The Center for Statistical Sciences was founded in 1995 as a unit of Brown Medical School, funded by research projects. Over the years, CSS has developed a robust research enterprise and provided the academic strength and infrastructure for the formation of the Department of Biostatistics. The Center organizes the Brown Statistics Seminar, which is held throughout the academic year and features talks on current developments in statistical methodology from invited external speakers. In addition, Center faculty host regular working groups in which topics of current research are discussed. Presenters in these informal seminars include Brown graduate students and faculty as well as other campus- and hospital-based researchers. The Center's work is focused on methodologic research in biostatistics and interdisciplinary research across the spectrum of medicine, public health, biology, and health-related topics in the social sciences,



with local, national, and international collaborations. It houses several interdisciplinary research groups listed below.

Biostatistics Core for Lifespan/Tufts/Brown Center for AIDS Research (CFAR). The Outcomes and Biostatistics Core of the Lifespan/Tufts/Brown CFAR is a major collaborative activity between CSS biostatisticians and HIV scientists and has been successfully sustained since 1999. The Core's personnel include three faculty, one staff biostatistician, graduate research assistants, and informatics and administrative support staff. Core faculty and staff collaborate with CFAR investigators in the development and conduct of studies in HIV/AIDS, including studies of the progression of HIV in women, behavioral interventions to increase compliance with antiretroviral therapy (ART), policy interventions and substance abuse, antiviral therapy adherence, and international studies of HIV drug resistance. The collaboration has also led to productivity in statistical methods work motivated directly by problems in HIV and AIDS, including published work on methods for informative dropout, causal inference and associated sensitivity analyses, and modeling HIV disease parameters and progression. Core faculty serve as mentors and consultants for a number of K award recipients who are junior faculty at Lifespan and/or Brown.

Biostatistics Core for AMPATH Consortium. The Academic Model for Providing Access to Healthcare (AMPATH) Consortium is collaboration between Moi University in Eldoret, Kenya and 18 universities in North America. A core subgroup of these universities is involved in research using data from over 100,000 individuals with HIV in western Kenya. Dr Hogan oversees a staff of seven faculty and masters-level statisticians at Brown, Indiana University, and Moi University in the Biostatistics Program of AMPATH. He is involved in both research and statistical training with Kenyan and American investigators.

Eastern Cooperative Oncology Group/American College of Radiology Imaging Network (ECOG/ACRIN) is a cooperative group funded by the Cancer Imaging Program of the National Cancer Institute to conduct multi-center, interdisciplinary clinical evaluations of diagnostic imaging in cancer. CSS is home to the network's Biostatistics Center for which Dr. Gatsonis is Director. The current research portfolio of ACRIN includes 9 trials with active participant accrual or follow-up, eight trials with ongoing analysis of primary or secondary endpoints, and eight trials in development. ACRIN's research program includes imaging in cancer, early detection, diagnosis and staging, disease management and image guided treatment. ACRIN is now expanding its research portfolio with studies of imaging for cardiovascular and neurologic diseases; it conducted the Digital Mammography Screening Trial (DMIST), which enrolled 49,500 women and compared the diagnostic accuracy of digital and film mammography, the National CT Colonography Trial evaluating the accuracy of CT Colonography for colon cancer screening, and the ongoing National Lung Screening Trial (NLST) which enrolled more than 50,000 participants at high risk for lung cancer and randomized them to annual screening with helical CT or X-ray. More than 100 centers across the U.S., Canada and other countries participate in ACRIN studies. The Biostatistics Center of ACRIN provides methodologic leadership and support to ACRIN investigators in the design, implementation, and analysis of network studies. Center personnel includes five faculty, ten professional biostatisticians, graduate research assistants, and administrative and informatics support staff.

ACRIN Outcomes and Economics Assessment Unit (OEAU) was formed to support the operations of the ACRIN Outcomes and Economics Committee and to perform the collection of patient reported outcome data in ACRIN studies. The Assessment Unit has extensive experience with the instruments used to collect patient reported outcomes and cost data, and is responsible for the collection of quality of life data for the National Lung Screening Trial and data on screening-associated costs and test preferences for the National CT Colonography Trial.

### **Center - Swearer Center**

<https://www.brown.edu/academics/college/swearer/>

The Swearer Center: The Howard R. Swearer Center of Brown University works with more than 1,200 Brown students, through and with 100+ community partners -- more than half of which are in the greater Providence area. In its 30-year history, the center has developed and nurtured many deep — and deeply rewarding — relationships with individuals and organizations in Providence. The center connects students, faculty and community partners through community engagement, engaged scholarship and social innovation -- three key

perspectives that are the foundations of its work. Swearer Center programs and fellowships provide students with community engaged, cohort-based experiential learning opportunities. Through programs and fellowships, students link their passion for social justice and community engagement with their academic and career goals. The Swearer Center partners with a wide range of organizations (nonprofit, LEAs, state and local government agencies etc.) that wish to access the resources of the Swearer Center or the university to advance their mission and work. Partnering organizations work with Swearer Center and university staff as co-educators, co-developers and co-creators of knowledge in our community engagement and engaged scholarship work.

Swearer Center partnership practices are centered around the values of Community Agency and Reciprocity. Community-based organizations are best situated to design, create and deliver programs and services in their own communities and therefore our work is that of capacity building partner, technical assistance, and conduit to access other university resources like community-based research. We work to ensure that both partners realize the desired benefits of the partnership. The Swearer Center offers partner organizations a variety of supports, resources, scholarship, student time and effort, funding for social innovation projects and membership in the Community Partner Network. In turn, partner organizations provide essential learning and engagement opportunities for students, as well knowledge and expertise to Swearer Center and institutional staff as we seek to understand and better inform the field of higher education and community engagement.

### **Center - Writing Center**

<https://it.brown.edu/services/type/lynda>

The Writing Center is an academic support service, staffed by graduate students from a variety of academic disciplines, available for all members of the Brown Community. Writing Center staff members are experienced writers and teachers who participate in ongoing training in composition theory and practice. Along with holding one-on-one conferences, Associates in the Writing Center offer various workshops on writing for interested groups. Writing Center conferences generally last an hour. Writing Center Associates are prepared to discuss all stages of the writing process, from finding a topic up through revision and editing strategies. Associates can help writers deal with writer's block, audience awareness, argumentation, organization, grammar, research skills, and the conventions of academic writing

### **Department - BioMed Ecology and Evolutionary Biology (EEB)**

<https://www.brown.edu/academics/ecology-and-evolutionary-biology/>

Ecology and Evolutionary Biology (EEB): Research and instruction in the Department is directed toward understanding biological systems at the individual, population, and community levels of organization utilizing both plant, animal, and microbial systems. Major research areas pursued by faculty and students include functional morphology, foraging ecology, the adaptive significance of animal behavior, sexual selection in plants and animals, insect mating behavior, plant population genetics, molecular population genetics and evolution, marine community ecology, theoretical population and community ecology, and ecosystem ecology. Graduate study in ecology and evolutionary biology at Brown University leads to the PhD degree. A core of faculty and postdoctoral researchers engaged in cutting-edge research guides students. Students further benefit from the Department's academic collaborations across University and Alpert Medical School departments and programs. Faculty and students are also active prominently in the Environmental Change Initiative, a multidisciplinary center at Brown tackling the complex issues undergirding environmental change.

### **Department - BioMed Molecular Biology, Cell Biology and Biochemistry (MCB)**

<https://www.brown.edu/academics/biomed/molecular-cell-biochemistry/>

Molecular Biology, Cell Biology and Biochemistry (MCB): The Department of Molecular Biology, Cell Biology and Biochemistry is a basic science department within the Brown University Division of Biology and Medicine. Its core areas of scholarship are broad and encompass biochemistry, cell biology, developmental biology, and genetics. The department supports undergraduate, graduate, and medical education in these fields, offering a large variety of courses from introductory to highly specialized levels. The department currently houses 28 primary faculty whose research programs cover a wide array of biological questions, model systems, and methodological approaches. The biological phenomena under investigation range from embryonic and neuronal development, reproduction and genetics of behavior to neurodegeneration and aging. The biological

mechanisms being addressed include DNA replication, recombination and transcription, RNA processing and transport, protein translation, protein folding and turnover, vesicular transport, and numerous aspects of molecular signaling. Model systems range from prokaryotic, through plant and several metazoan species to mammals including humans. Classical biochemical and genetic approaches are used alongside innovative technologies including genomics, proteomics, X-ray crystallography, and mouse transgenics. The department is also the centerpiece of an interdisciplinary and interdepartmental graduate program in Molecular Biology, Cell Biology and Biochemistry leading to the PhD degree

#### **Department - BioMed Neuroscience (Neuro)**

<https://www.brown.edu/academics/neuroscience/>

Neuroscience: The mission of the Department of Neuroscience is to do excellent teaching and research on the basic functions and diseases of the nervous system. Areas of interest include neural plasticity, information processing, and neuronal and synaptic functions, particularly as they relate to development, sensory perception, motor behavior, and cognition. The 20 campus-based neuroscience faculty train undergraduate, graduate, postdoctoral, and medical students in molecular, cellular, developmental, systems, cognitive, and theoretical neuroscience. There are currently 42 doctoral students in the Neuroscience Graduate Program and the innovative Brown-NIH Graduate Program Partnership, and 122 undergraduate students are enrolled in the neuroscience concentration. Members of the Department also participate in the MRI Research Facility, the Center for Vision Research, and several NIH and NIMH training grants for graduate and postdoctoral fellows studying neuroscience and vision sciences. The Department is also a cornerstone of Brown's Institute for Brain Science, a multidisciplinary consortium of about 90 faculty from 11 departments that promotes collaborative theoretical and experimental studies of the brain, and the Norman Prince Neurosciences Institute at Rhode Island Hospital.

#### **Department - BioMed Molecular Microbiology and Immunology (MMI)**

<https://www.brown.edu/academics/medical/molecular-microbiology-and-immunology/>

Molecular Microbiology and Immunology (MMI): The MMI Department supports undergraduate, graduate, and postdoctoral education by providing an interdisciplinary structure for training programs. The department's overall mission is to maintain an active and integrated research program for studying the interactions between pathogenic microbes and their hosts that influence the outcome of infections. MMI fosters collaborative studies within the department as well as with faculty in other departments, both on campus and hospital-based. MMI provides instruction and a nurturing environment for undergraduate, graduate, and medical students in the areas of microbiology and immunology. MMI's instruction includes lecture courses, seminar courses, and laboratory research (undergraduate independent study and graduate thesis).

#### **Department - BioMed Pathology and Laboratory Medicine**

<https://www.brown.edu/academics/biomed/departments/pathology/home>

Department of Pathology and Laboratory Medicine forms a bridge between the basic sciences and clinical medicine, bringing the newest scientific concepts to enhance understanding of the biologic basis of disease. Basic science research in pathobiology addresses how a sequence of biologic events leads to a disease state. Translational and clinical research bridges basic mechanistic research to advances in clinical diagnosis and treatment of human disease. Diagnostic testing in Pathology and Laboratory Medicine at Warren Alpert Medical School of Brown University is performed at the hospital affiliates; 90 faculty are located at Brown University, Rhode Island Hospital, The Miriam Hospital, Women & Infants' Hospital, and the Office of the Medical Examiner at the Rhode Island Department of Health. All campus and hospital-based faculty participate in teaching and advising undergraduates, graduate students, medical students, residents, and postdoctoral and clinical fellows. These trainees work together in multidisciplinary teams involving pathologists, biomedical scientists, clinicians, chemists, and engineers on basic and applied research projects related to human disease.

#### **Department - BioMed Psychiatry and Human Behavior (DPHB)**

<https://www.brown.edu/academics/medical/psychiatry-and-human-behavior/home>

The Department of Psychiatry and Human Behavior (DPHB) within the Warren Alpert Medical School of Brown University has a research infrastructure that is designed to facilitate the development and continued success of

a structured and comprehensive program of research. The Department has more than 100 academic faculty and 65 postdoctoral trainees, plus dozens of residents and psychology interns. The university and department have a well-established administrative and financial structure. The DPHB also has a well-established research infrastructure, which includes a Research Technology Service Core, comprised of technology infrastructure units directed by nationally recognized senior scientists who are experts in the technology. DPHB was recently cited by an external panel of peers as one of the seven-benchmark academic departments of psychiatry in the country. The high caliber of education, training, research, community service, and national and international publications and presentations conducted and produced by DPHB faculty and trainees are a major reason why many are considered leaders in their respective specialties. Research activities conducted by DPHB faculty include close to 200 ongoing studies funded by more than 50 external sources such as the National Institute of Mental Health (NIMH), National Cancer Institute (NCI), National Institute of Child Health and Human Development (NICHD), National Institute on Drug Abuse (NIDA), National Institute of Alcohol Abuse and Alcoholism (NIAA), and that National Alliance for research on Schizophrenia and Depression (NARSAD).

The **Brown University DPHB Research Group** is currently comprised of 12 academic psychologists, 3 academic psychiatrists, and 5 post-doctoral fellows in psychology. There are also 5 administrative and support staff, and Information Technology Specialists are available through the university. The DPHB research core contains the Clinical Assessment and Training Unit, Quantitative Sciences Program, and **Implementation Science Core**, which provide trainings across the Department. Brown University leases 10,000 square feet of office space, specifically designed for research, on the Butler Hospital campus. Faculty members meet regularly to discuss and critique each others' grant proposals and manuscripts.

The Brown University DPHB Research Group office space has a significant number of private offices and storage space to house the program. All staff have access to telephones, printers, fax machines, photocopiers, etc. Brown University provides its community with extensive choice of work-related tools, including electronic access to the library, computer systems, servers, software, databases, campus email, voice mail systems, and the Internet. These systems are made available to the University community through an advanced broadband, coaxial and fiber local area network that features data transfer rates up to 100 MBPS. Every employee has a desktop computer, to be used for data entry, data analysis, and centralized communications among investigators and research staff. For data analysis, the system offers SAS, S-Plus, Stata, and SPSS, as well as database languages such as SQL and CACHE.

**Implementation Science Core.** The Implementation Science Core collaborates with the other DPHB Cores, the Quantitative Science Program and Qualitative Science and Methods Training Program (QSMTP), to foster the translation, spread, and scale-up of evidence-based practices into routine clinical care. **A. Rani Elwy, PhD, Associate Professor and Director of the Implementation Science Core**, hosts regular office hours each week to work with faculty across the six Brown affiliated hospitals (including Providence VAMC), along with psychiatry residents and clinical psychology interns and fellows, to 1) provide consultation on dissemination and implementation (D&I) science models, theories and frameworks to guide studies, 2) develop qualitative and quantitative methods specific to D&I science research questions (such as formative evaluations, stakeholder engagement methods, implementation strategies, hybrid designs, etc.) and 3) serve as co-investigator on projects as the implementation science expert. Dr. Elwy also mentors those developing NIH K or VA Career Development Awards in implementation science. In addition to specific consultations, Dr. Elwy runs two different educational sessions for DPHB faculty, residents, fellows and interns: 1) a six-week fundamentals of D&I science series, held each semester; and 2) intermediate level workshops on D&I science, held twice per semester. Additional workshops are held each year for the T32 training program in clinical psychology and QSMTP. The Implementation Science Core also hosts an annual D&I Forum, where individual faculty projects are highlighted, and which culminates in a Grand Rounds lecture given by an invited, internationally-known researcher in D&I science.

## Department - Chemistry

<https://www.brown.edu/academics/chemistry/about>

Chemistry: The Chemistry Department at Brown engages scientific problem-solving that advances our understanding of chemistry from the most fundamental level and addresses the needs of today's society. Chemists at Brown advance knowledge and discovery in theoretical, physical, inorganic, organic, materials, and biological chemistry. Innovative research areas include sustainability and green chemistry, chemistry and

medicine, design and application of new materials, and novel methods of understanding molecular dynamics and reactions. Brown Chemistry research groups, in collaboration with other Brown schools and departments, as well as national laboratories, prepare students to succeed in a complex and changing world.

The department offers academic programming that includes introductory and advanced courses, a doctoral program, and three undergraduate concentrations: Chemistry, Biochemistry, and Chemical Physics. To complement academic programs, the department's weekly colloquium series and other seminars and events connect Brown with faculty and industry leaders throughout the world—including departmental alumni—to enrich students' learning as they engage and develop their intellectual independence.

### **Department - Computer Science**

<https://cs.brown.edu/>

Department of Computer Science: Since its inception in 1979, the Computer Science Department at Brown has forged a path of innovative information technology research and teaching at both the undergraduate and graduate levels. From modest beginnings as an interest group within the Divisions of Applied Mathematics and Engineering in the 1960s to its current stature as one of the nation's leading computer science programs, the Computer Science Department has continuously produced prominent contributors in the field, at both the undergraduate and graduate levels. The Department is a diverse community of scholars engaged in all aspects of research, teaching and mentoring in computer science and its related interdisciplinary disciplines. Realizing the importance of computing and algorithmic thinking in so many scientific, social and technological endeavors, the faculty collaborate extensively with colleagues in archaeology, applied mathematics, biology, cognitive and linguistic sciences, economics, engineering, mathematics, medicine, physics and neuroscience.

Computer Science undergraduate offerings reflect the department's multidisciplinary orientations, with joint concentrations in mathematics, applied mathematics, computational biology and economics. There are strong undergraduate research groups in graphics, neuroscience and robotics as well as a long history of involving undergraduates in projects that span disciplinary boundaries. Graduate students find it easy to tailor their education to meet the challenges of multidisciplinary research and commonly have advisors in two or more departments.

Computer Science graduate students find it easy to tailor their education to meet the challenges of multidisciplinary research and commonly have advisors in two or more departments. Research in the department crosses traditional boundaries and projects spring from shared interests more than from established groups. Faculty work with postdoctoral students, graduate students and undergraduates with ideas and expertise are drawn from other disciplines and departments at the University. A long tradition of combining theory and practice is as strong and relevant today as it ever was. Research areas the department participates in include: algorithms; cloud computing; computational biology; computational geometry; computational neuroscience; computational photography; computer graphics; computer networks; computer vision; cryptography; data management; distributed systems; educational technology; electronic commerce; information visualization; intelligent agents; machine learning; mobile and ubiquitous computing; nanocomputing; natural language processing; operating systems; optimization; parallel computing; programming languages; robotics; scientific visualization and modeling; security and privacy; sensor networks; software engineering; user interfaces; theory of computation; verification and reliable systems; virtual reality.

### **Department - Earth, Environmental, and Planetary Sciences**

<https://www.brown.edu/academics/earth-environmental-planetary-sciences/>

Department of Earth, Environmental, and Planetary Sciences (DEEPS): With its unique interdisciplinary research opportunities and collegial atmosphere, DEEPS is rated among the top programs in the world. Our internationally-known faculty engage in externally supported research in the following research fields: geochemistry, mineral physics, igneous petrology; geophysics, structural geology, tectonophysics; environmental science, hydrology; paleoceanography, paleoclimatology, sedimentology; and planetary geosciences. Emphasis in these different areas varies, but includes experimental, theoretical, and observational approaches as well as applications to field problems. Field studies of specific problems are encouraged rather than field mapping for its own sake. Interdisciplinary study with other departments and divisions is encouraged.

Students in DEEPS develop a comprehensive grasp of principles as well as an ability to think critically and creatively. Formal instruction places an emphasis on fundamental principles, processes, and recent developments, using lecture, seminar, laboratory, colloquium, and field trip formats. Undergraduates as well as graduate students have opportunities to carry out research in current fields of interest.

### **Department - Mathematics**

<https://www.brown.edu/academics/math/>

Department of Mathematics: The Department of Mathematics enjoys a rich historical tradition of research and education in many fields of pure mathematics, with particular strengths in algebra and number theory, geometry and topology, probability, and analysis. The Department, which counts many internationally recognized researchers among its faculty ranks, nurtures an informal environment for students that emphasizes creative models for scholarship and learning. As data science challenges require increasingly complex methodologies and algorithms, the Department's expertise in tools from cryptography, harmonic analysis, probability, and even topology has become central to developing our understanding of data science's foundational questions, and the Department's courses in these areas serve as a theoretical foundation to the methodological research and curricular offerings in data science.

The undergraduate program in mathematics at Brown is designed to present students with challenging courses that will train them for any future they desire be it in the economy, in government, or in academe. It is also quite flexible in placing students, the goal being to discover a student's level of competence and then offering a stimulating course. The department supports approximately 40 to 50 graduate students in a PhD program whose graduates populate top mathematics departments and prominent positions in industry. Joint graduate courses and seminars with the adjacent Division of Applied Mathematics add to the breadth of offerings available to our graduate students.

The Mathematics Department at Brown balances a lively interest in students and teaching with a distinguished research reputation. Several strong research groups, Analysis, Algebraic Geometry, Geometry and Topology, and Number Theory, all have active weekly seminars that draw speakers ranging from the local to the international.

### **Department - Physics**

<https://www.brown.edu/academics/physics/welcome>

Department of Physics: Physics has been in the Brown curriculum since 1772; today, Brown University has a vibrant Physics department with 27 faculty members and 12 joint and affiliated faculty members, all pursuing the frontiers of physics. Some members are developing advanced theories to explain phenomena as grand as the origin of our universe and the nature of matter. Others are pushing the limits of physics to detect new fundamental particles and dark matter, as well as building incredibly sensitive devices based on quantum physics. The Department has multiple strong research clusters spanning the discipline of physics, including high energy, cosmology/astrophysics, condensed matter, and biophysics. The Department boasts two Nobel Laureates (Leon N. Cooper and J. Michael Kosterlitz), the co-discoverer of the Higgs mechanism and Higgs boson (Gerald Stanford Guralnik), and the 2011 Fritz London Memorial Prize winner (Humphrey J. Maris).

Graduate students and postdoctoral researchers are trained to become next generation physicists and future leaders in academia, government, NGOs, or the private sector. Physics graduate students receive the most comprehensive education in scientific and mathematical methods, as well as the problem-solving process. Students have full access to the most advanced research facilities and our world-renowned faculty, who care very much about them. Students also benefit from strong links to the School of Engineering, Chemistry, and Earth, Environmental and Planetary Sciences departments, and, with this application, the Biological Data Science community.

**Department - SPH Behavioral and Social Sciences**

<https://www.brown.edu/academics/public-health/bss/home>

School of Public Health (SPH) Department of Behavioral and Social Sciences (BSS) is a multidisciplinary academic department in the Brown University School of Public Health. Over 50 BSS faculty members are actively engaged in research and teaching to understand the behavioral and social determinants of public health problems and to develop interventions to change behaviors and improve social contexts related to public health. BSS faculty conduct collaborative research with a substantive focus on behavioral health issues such as alcohol and other drug abuse; smoking and tobacco use; obesity, nutrition, and physical activity; HIV and sexually transmitted infections; and health disparities and culture. The Department of Behavioral and Social Sciences offers courses of study leading to Master of Science (ScM) and Doctor of Philosophy (PhD) degrees in Behavioral and Social Health Sciences. BSS faculty also teach and advise Brown undergraduates and train and mentor postdoctoral research fellows

**Department - SPH Biostatistics**

<https://www.brown.edu/academics/public-health/biostats/home>

School of Public Health (SPH) Department of Biostatistics: The mission of the Department of Biostatistics at Brown is to conduct fundamental research that generates new discoveries in theory and methods of statistics and data science; to provide expertise and leadership and to promote interdisciplinary research in domain areas related to human health and the life sciences; to develop future researchers and professionals in the field of biostatistics through a graduate program that combines rigorous training in theory and methods with meaningful engagement in interdisciplinary research; to provide high-quality courses and mentoring in biostatistics and data science for the broader community of students and researchers at Brown; and to serve the academic community at Brown and the scientific community at-large by providing intellectual and organizational leadership and collaboration on programs in the statistical and data sciences.

**Department - SPH Epidemiology**

<https://www.brown.edu/academics/public-health/epi/home>

School of Public Health (SPH) Department of Epidemiology: The primary mission of the Department of Epidemiology is to provide excellence in teaching and training in the field of epidemiology. The graduate program offers master's and doctoral degrees to prepare students for careers in research or professions in public health which require knowledge of advanced epidemiologic methods. The department excels in research, education, and service covering the entire life-course for health outcomes in diverse populations, particularly focusing on critical windows of development (i.e., during and after pregnancy and during childhood and young adulthood). There are 19 primary faculty and more than 25 additional faculty associated with the Department of Epidemiology at the Brown School of Public Health. The faculty are world-renowned researchers whose expertise include cancer, environmental health, global health, mental health, infectious disease, maternal and child health, molecular, health disparities, obesity, substance use, mindfulness, and epidemiologic methods. The Department also collaborates with faculty in social sciences, basic biomedical sciences, and clinical departments at Alpert Medical School and its affiliated hospitals (e.g., Cardiology, Endocrinology, Obstetrics/Gynecology, Pediatrics, and Psychiatry). The department includes faculty engaged full-time in research and teaching, as well as importantly clinical faculty and faculty members jointly appointed with Brown University and the Rhode Island Health Department.

**Department - SPH Health Services, Policy & Practice (HSPP)**

<https://www.brown.edu/academics/public-health/hssp/home>

School of Public Health (SPH) Department of Health Services, Policy & Practice (HSPP) includes 25 full-time faculty based at 121 South Main Street in Providence, 73 faculty from other Brown University departments that have secondary appointments and other affiliated faculty. The Department's mission is to develop and disseminate new knowledge that helps to deliver effective, efficient, continuously improving and just public health and health care services. This is accomplished through innovative research, engaged teaching, creative training and mentoring and collaborative engagement with policy makers and service providers. The Department values innovation, creativity, promotion of diversity, multidisciplinary collaboration, community engagement, and

excellence. The long-term goal is to catalyze the delivery of higher quality and more cost-effective public health and health care services.

The Department has developed relationships with a wide variety of partners and collaborators. Within Brown University these include the Departments of Medicine, Surgery, Psychiatry and OB/Gyn at the Medical School, and the Departments of Economics, Sociology and Computer Science on campus. The Department has a strong and long-standing relationship with the VA Providence Healthcare System. In addition, the department has relationships with a number of important Rhode Island state agencies including the Department of Health, the Executive Office of Health and Human Services (EOHHS) and the RI Medicaid Program. These and other partners and collaborators allow faculty and trainees to participate in multidisciplinary collaboration in a variety of academic and policy setting.

### **Division - Applied Mathematics**

<https://www.brown.edu/academics/applied-mathematics/>

Division of Applied Mathematics: The Division of Applied Mathematics is one of the most prominent departments at Brown, and one of the oldest and strongest of its type in the entire country. The Division had its origin in the program of Advanced Instruction and Research in Mechanics, established in 1941 on the recommendation of a committee of the National Research Council. This early program focused on solid and fluid mechanics, electromagnetic theory, mathematical methods in applied physics, numerical analysis and probability theory—the principal interests of the faculty for many years. Since then the interests of the faculty have expanded and diversified, as the Division has maintained a leading role in the development of applied mathematics both in the United States and throughout the world. In 1964, for example, the Center for Dynamical Systems was established to coordinate the research of a large group of people working in ordinary and partial differential equations and their applications. More recently, programs at the forefront of research in scientific computing and in applied probability and statistics have been established.

The Division's mission rests in research, education, and scholarship. The faculty engages in research in a range of areas from applied and algorithmic problems to the study of fundamental mathematical questions. By its nature, the Division's work is and always has been inter- and multidisciplinary. Among the research areas represented in the Division are dynamical systems and partial differential equations, control theory, probability and stochastic processes, numerical analysis and scientific computing, fluid mechanics, computational molecular biology, statistics, and pattern theory. The graduate program in applied mathematics includes around 50 Ph.D. students, with many of them working on interdisciplinary projects. Applied Math offers undergraduate degrees in Applied Mathematics, Applied Math–Biology, Applied Math–Computer Science, and Applied Math–Economics. The faculty actively involve undergraduates in summer research projects and offer many independent studies every year.

The Applied Math graduate program provides training and research activities in a broad spectrum of applied mathematics. The principal areas of research activities represented in the Division of Applied Mathematics are ordinary, functional, and partial differential equations; probability, statistics and stochastic systems theory; neuroscience, pattern theory, and computational/mathematical biology; numerical analysis and scientific computation. The effort in virtually all the research areas ranges from applied and algorithmic problems to the study of fundamental mathematical questions; many of our faculty are engaged in interdisciplinary research collaborations with colleagues here at Brown or elsewhere. This breadth is one of the great strengths of the program and is further reflected in the courses we offer. Brown guarantees financial support for five years, including summer support for 2.5 months, and generous health benefits. The Applied Math graduate program focuses on doctoral training.

### **Division - Biology and Medicine**

<https://www.brown.edu/academics/biomed/about-division-biology-and-medicine>

Division of Biology and Medicine: Comprising the Program in Biology and the Warren Alpert Medical School (AMS), the Division is home to five biology departments offering undergraduate and graduate courses, 14 clinical departments, and one hybrid department (with both clinical and campus-based faculty). The Division of Biology and Medicine (BioMed) is the administrative home for faculty whose primary roles are in research, education, or



clinical care in the domains of biology and medical science. This organizational structure encourages multidisciplinary instruction and research, a hallmark of education at Brown and unites the departments into a cohesive unit with a common mission: to understand the underpinnings of human life and the study, prevention, and treatment of disease.

### **Initiative - Data Science Initiative (DSI)**

<https://www.brown.edu/initiatives/data-science/home>

Data Science Initiative (DSI): The DSI is a new collaboration at Brown between Applied Mathematics, Biostatistics, Computer Science, and Mathematics, that seeks to develop research and training around methodologies in Data Science and applications to domains. The DSI leverages established academic strength to build a campus hub for research and education in foundational methodologies of data science, maintaining an outward focus on application areas and critical engagement with questions of the impact of the data revolution on society, culture, and social justice. Academic and professional programs are offered for a rigorous, distinctive, and innovative approach to learning and collaboration for anyone building a career in data-enabled fields. Building on Brown's strength in the computational, mathematical, and statistical sciences, the DSI reaches out to support and connect with data-driven work across the campus, driving research in an increasingly interconnected University. The DSI focuses on the foundations of model-driven discovery from massive data. It supports broad engagement with the campus community through public lectures, panel discussions, boot camps, and other projects, and explores the challenges in translating data into knowledge and in understanding its impact. DSI industrial partners give students and faculty the opportunity to work hands-on, addressing problems arising in industrial settings, while giving partners the chance to leverage cutting-edge research and student creativity in their domains.

### **Institute - Brown for Environment & Society (IBES)**

<https://www.brown.edu/academics/institute-environment-society/>

Institute at Brown for Environment & Society (IBES): The Institute at Brown for Environment & Society (IBES) supports research to understand the interactions between natural, human and social systems. IBES teaching programs prepare future leaders to envision and build a just and sustainable world. The Institute's engagement programs take research from the lab to the statehouse, the hospital, and the public sphere. The Institute has five strong disciplinary areas: Conservation Science, Land Change Science, Climate Science, Environmental Health, and Institutions and Human Behavior.

### **Institute – Brown Institute for Translational Science (BITS)**

<https://medical.brown.edu/research/brown-institute-translational-science>

The Brown Institute for Translational Science (BITS) provides an infrastructure that builds on strengths while expanding our capabilities for translational science. It is composed of horizontally integrated research teams that allows scientists and clinicians to work together along a common continuum. Many kinds of integrating continuums are possible: focusing on a disease, a biologic pathway, an investigative approach, or a problem in society (such as asthma or aging).

So far, research centers have been formed in biology of aging, cancer biology, vaccine biology, translational neuroscience, respiratory disease and alternatives to animal testing. In these teams, basic scientists make lab or data-based (computational) discoveries and then work with master clinicians and physician-scientists to evaluate the importance of their findings in well-characterized patient populations. These investigators also work with faculty in other parts of Brown, such as the School of Engineering, the School of Public Health and the Watson Institute, to foster and evaluate the impact of these findings on patients, populations, and policy. They will also work with experts in commercialization to address ways this knowledge can be used to generate commercial products for patients and companies that augment our regional economy.

## **Institute - Carney Institute for Brain Science**

<https://www.brown.edu/carney/node/1>

Carney Institute for Brain Science: The Carney Institute for Brain Science (formerly the Brown Institute for Brain Science –BIBS) advances multidisciplinary research, technology development, and training in the brain sciences and works to establish Brown University as an internationally recognized leader in brain research. The Institute unites more than 100 faculty from a diverse group of departments at Brown, spanning basic and clinical departments, and physical and biological sciences. The Carney Institute provides a mechanism to advance interdisciplinary research efforts among this broad group and provides essential support to obtain and administer multi-investigator grants for research, infrastructure, and training. The Institute actively seeks new training funds to support interdisciplinary education that transcends that available in individual academic departments.

The Carney Institute community is united under the common theme of understanding how brain circuits generate and control complex behavior. Carney Institute faculty members have pioneered research to give paralyzed individuals the ability to move prosthetic limbs, move their own limbs, and to control devices through brain-computer interfaces; to develop new non-invasive tools to visualize and control brain function; to reveal the reward mechanisms in the brain that govern motivation and choice; to study and suppress diseases including ALS, spinal muscular atrophy, drug addiction, and epilepsy; to discover cells behind the retina in the eye that control the body's internal clock; and to discover mutations in genes that cause neurodevelopmental disorders including Christianson Syndrome. Carney Institute faculty are using computational and machine learning approaches for the diagnosis, assessment, and treatment of neurologic and psychiatric disorders including Parkinson's Disease, depression, chronic pain, and autism. Ongoing projects range from a single laboratory to multiple institutions, and from early-stage, high-risk high-reward projects to well-established research efforts. Centers within the Carney Institute include.

### **Center – Alzheimer's Disease Research**

<https://alz.carney.brown.edu/>

Brown University's Center for Alzheimer's Disease Research is committed to advancing early detection and individualized treatment for Alzheimer's disease and related dementias. Housed within the Carney Institute, the Center for Alzheimer's disease Research catalyzes collaborations across basic and clinical research groups toward uncovering when, where and how Alzheimer's disease first arises to advance the pace toward treatment. Our research projects integrate knowledge across biological systems in humans, including behavioral, neural, vascular and immune.

### **Center for Computational Brain Science**

<https://ccbs.carney.brown.edu/>

The Center for Computational Brain Science (CCBS) within the Carney Institute for Brain Science harnesses Brown University's expertise in computation, cognition and systems neuroscience toward new brain health solutions. To demystify how the brain accomplishes complex tasks with precision and speed, the CCBS fosters collaborations between basic brain science researchers and engineers, mathematicians and computer scientists, and brings computational neuroscience innovations to clinical applications and commercialization.

### **Center for the Neurobiology of Cells and Circuits**

<https://www.brown.edu/carney/research/centers-initiatives-core-facilities/center-neurobiology-cells-and-circuits>

The center advances the understanding of the function of neural circuits, building on a foundation of genetic, molecular, and cellular approaches. Center faculty produce vital knowledge to advance understanding and treatment of autism, neurodegeneration including Alzheimer's and ALS, chronic pain, psychiatric illness, migraine, addiction, and epilepsy.

### **Center for Translational Neuroscience**

<https://www.brown.edu/carney/ctn>

The Brown Center for Translational Neuroscience (CTN) synergizes the missions of the Robert J. and Nancy D. Carney Institute for Brain Science and the Brown Institute for Translational Science (BITS). The mission of the CTN is to advance knowledge of the pathogenesis of brain disease and to translate this

knowledge to improved clinical outcomes for families affected by brain disease. The mission has an emphasis in research and training related to deciphering disease pathogenesis, identification of new targets for molecular interventions, and development of improved diagnostics and biomarkers.

In establishing the first formal collaboration between the Carney Institute and BITS, the CTN is a bench-to bedside, “go-to” hub facilitating translational neuroscience research at Brown University and the clinical neuroscience departments in the Warren Alpert Medical School and affiliated hospitals. The CTN builds upon and complements current translational research strength and expertise at Brown, with a central focus on specific brain diseases. A key element of the CTN is multidisciplinary team science with a focus in molecular medicine. The science of the CTN starts with patients and takes the specific approach of genetically inspired translational neuroscience. To this end, an emphasis in the CTN is to follow the logic of genetics based in the approach of a translational neuroscience cycle of research. This cycle moves back and forth from fundamental basic research to clinical research — with each stage providing key information that can be integrated into clinically relevant solutions — and, thereby, serves families affected by brain disease.

### **Center for Vision Research**

<https://www.brown.edu/carney/centers-initiatives/center-vision-research>

The mission of the Center for Vision Research is to provide training in vision research, promote and facilitate research and unify vision research at Brown, by bringing together investigators from different departments. Faculty members affiliated with the center come from various Brown departments, including Philosophy, Visual Arts, Ophthalmology, Neuroscience and Cognitive, Linguistic, and Psychological Sciences.

### **Institute - Hassenfeld Child Health Innovation Institute (HCHII)**

<https://www.brown.edu/hassenfeld/Hassenfeld>

Hassenfeld Child Health Innovation Institute (HCHII): The Hassenfeld Institute seeks to integrate research, clinical practice, public health efforts, and educational programs to achieve the following four goals: 1) Improve the health of children, making the communities we serve among the world’s healthiest places for children and their families, 2) Address the issue of poverty and how it impacts child health, 3) Serve as a national and international model for what can be achieved in child health and 4) Train the next generation of child health leaders. The Institute aims to make a transformative impact on the lives of children and their families in Rhode Island, as well as around the world. Made stronger by its deep and far reaching collaborations, the Hassenfeld Institute is led by and partners with key organizations throughout Rhode Island. Its core leadership resides under the following four institutions: Brown University’s School of Public Health, Hasbro Children’s Hospital, the Warren Alpert Medical School of Brown University, and Women & Infants Hospital of Rhode Island. Researchers and child health professionals from other institutions, such as Bradley Hospital, The Miriam Hospital, and its community partners are also intricately involved.

The work of the Institute employs multidisciplinary research methods to address a broad range of child health issues. The Core Research and Evaluation Unit of the Hassenfeld Institute is tasked with providing the necessary research and evaluation infrastructure to support work on a broad range of health initiatives within the Institute as well as with the Institute partners. This includes extensive analysis and mapping of health data in Rhode Island, as well as launching a birth cohort study with long-term follow-up. Along with the work carried out by the Core Research and Evaluation Unit, the Hassenfeld Institute has assembled teams of experts to implement and assess innovative new approaches to address important child health issues. These teams will form the foundation of the Hassenfeld Initiatives. The Institute’s three initial initiatives are: 1) Healthy weight, nutrition and physical fitness, 2) Autism (a precision medicine approach) and 3) Childhood asthma research innovation.

### **Institute - Institute for Computational and Experimental Research in Mathematics (ICERM)**

<https://icerm.brown.edu/>

Institute for Computational and Experimental Research in Mathematics (ICERM): The Institute for Computational and Experimental Research in Mathematics (ICERM) was founded in 2010 through a major grant to Brown University from the National Science Foundation, Division of Mathematical Sciences. The mission of ICERM is

to support and broaden the relationship between mathematics and computation: specifically, to expand the use of computational and experimental methods in mathematics, to support theoretical advances related to computation, and address problems posed by the existence and use of the computer through mathematical tools, research and innovation. ICERM supports its mission by developing and hosting research programs and activities that 1) Encourage the creation of new computational methods to advance mathematical understanding, 2) Foster a deeper understanding of algorithms and computational tools, 3) Expose program participants to the use of simulation, visualization, experiments, or computer-assisted proofs, 4) Catalyze new directions of mathematical research through synergistic collaborations across disciplinary areas and research communities, 5) Advance the training and mentoring of graduate students and early-career postdoctoral researchers through exposure to new mathematical areas and computational methods. The Institute benefits from its strong ties to the mathematical sciences departments at Brown and from the vibrant educational community of colleges and universities across New England.

### **Institute – International Health (IHI)**

[https://www.brown.edu/academics/public-health/ihi/?utm\\_source=SPHResearch&utm\\_medium=accordion](https://www.brown.edu/academics/public-health/ihi/?utm_source=SPHResearch&utm_medium=accordion)

The International Health Institute (IHI) was established in 1988 to develop, promote, and coordinate the international health activities of Brown University faculty and students committed to global community engagement, IHI faculty have established research collaborations with institutions in low and middle-income countries and developed supervised research experiences for Brown University undergraduate, graduate and medical students with our foreign partners. The IHI is one of several academic units involved in strengthening global health research, training and service activities at Brown University. The IHI's mission is to apply interdisciplinary perspectives to research and training to improve the health of populations in developing countries.

### **Institute - Molecular and Nanoscale Innovation Research Facilities (IMNI)**

<https://www.brown.edu/research/institute-molecular-nanoscale-innovation/>

Institute for Molecular and Nanoscale Innovation Research Facilities (IMNI): The Institute for Molecular and Nanoscale Innovation (IMNI) fosters interdisciplinary, multi-investigator research and education. A state-of-the-art equipment infrastructure is essential to enable research topics of intellectual and technological importance and allow researchers the ability to engage in research problems of broad scope and complexity that cannot be addressed by a single investigator, rather requiring the advantage of a larger infrastructure and interdisciplinary expertise provided by a campus-based research center. The IMNI Core Research Facilities provide access to advanced instrumentation and various services as well as involvement in developing new technology or new applications of existing techniques. The IMNI Core Research Facilities are administered by IMNI and are available to researchers from all university departments, as well as outside users from local industry and academic institutions on a usage fee basis to recover operating costs. IMNI administers the Electron Microscopy, Microelectronics and NanoTools Facility.

### **Program - Biology**

<http://biology.brown.edu/>

Program in Biology: This Program promotes basic scientific research aimed at discovery of fundamental insights into living systems at all levels of complexity with a major emphasis on relevance to human health and disease mitigation. Faculty of the Program in Biology conduct research on all levels of biological organization: molecular, cellular, organismal and population, and concentration programs with varying degrees of multidisciplinary or specialty foci. The close administrative relationship with the Warren Alpert Medical School offers additional opportunities for blending fundamental biology and clinical sciences in research projects across the institutions. These multidisciplinary research opportunities are a hallmark of Brown University's biomedical programs. Campus-based faculty (127), with primary appointments in the life and biological sciences, collaborate regularly with hospital-based academic faculty members (626) pursuing research at area hospitals.

## Program - MD, PhD

<https://www.brown.edu/academics/biomed/md-phd-program/>

The MD, PhD Program was founded in 1979 by the inaugural Chair of the Department of Pathology, Dr. Nelson Fausto. Since its inception, the program has graduated over 60 MD/PhD students with the majority remaining in academic and research careers.

A distinguishing feature of the Brown MD/PhD program is its focus on translational research. Because translational research requires fluency across basic science and clinical medicine boundaries, a defining feature of Brown's program is its heavy integration across the MD and PhD transitions. Traditional MD/PhD programs are structured with two years of medical school followed by 4-5 years of graduate school, culminating with the final two years of medical school. Typically, there is little to no integration across these transitions.

At Brown, the curriculum is designed to inculcate scientific thinking into the MD years, while maintaining clinical perspective and skills during the PhD years. Specifically, MD/PhD students spend the summer after their first and second years of medical school with a research mentor. The students have the opportunity to select research mentors across the graduate programs within the Division of Biology and Medicine with the potential to explore programs within the School of Public Health in certain circumstances. The goal of this research integration during medical school is to enhance scientific thinking while simultaneously streamlining the process of selecting the best research environment for each student. After students matriculate into graduate school and complete their course requirements, they begin a longitudinal clinical clerkship in family medicine, seeing patients one afternoon every 2 weeks. This clinical experience serves to maintain student's clinical skills and confidence while encouraging them to apply their burgeoning scientific skills to clinical problems.

The Brown MD/PhD program has trained many physician-scientists who occupy leadership positions in translational medicine oriented departments throughout the country. Notable accomplishments of our graduates include developing highly successful NIH-funded research programs, promotion to Chairs of several national medical school departments, as well as founding disease specific, research oriented philanthropic foundations.

The mission and goals of Brown's MD/PhD program were significantly enhanced in 2017 with a 22 million dollar endowment which will allow a marked increase the number of training slots, enhance the programmatic offerings with a particular focus on career trajectories, and, most importantly, matriculate the strongest students.

## Programs - Medical Education

<https://www.brown.edu/academics/medical/education-programs>

Medical Education. The Warren Alpert Medical School has always reflected the ethos of Brown University, epitomizing the university's goal of training its graduates to lead lives of usefulness and reputation. While the Warren Alpert Medical School is traditionally thought of as a training ground for leaders in primary care, its graduates have gone on to roles across the spectrum, from small town doctors to deans of medical schools to physician-scientists to leaders at the National Institutes of Health. Each year, our graduates match to top-ranked residency programs in both primary care and a wide variety of specialties. This innovation in medical education is evidenced by hallmark initiatives such as:

- The Program in Liberal Medical Education, the eight-year combined undergraduate and medical degree program that allows undergraduates to pursue the breadth and depth of a liberal arts education before entering the Warren Alpert Medical School.
- The Scholarly Concentrations Program, which enables students to focus on individual areas of interest, engaging in intellectual pursuits beyond their core medical studies through intensive, cross-disciplinary research projects. The result is a scholarly product, typically one or more publications in a peer-reviewed journal.
- The Primary Care-Population Medicine Program that leads to both the MD degree and a master's in population medicine, preparing students for careers in medicine while providing comprehensive, longitudinal training in population-level health care. The program was selected as one of the American Medical Association's first 11 Accelerating Change in Medical Education initiatives, which provided a \$1 million grant for its launch.

- The two-year Doctoring course that provides students with patient contact within the first two months of medical school. Students work once a week in a community clinical setting with a physician-mentor who provides intensive grounding in medical ethics and professionalism as students master communication and cultural competencies and learn to take patient histories and other clinical skills.

### **School - Engineering**

<https://www.brown.edu/academics/engineering/>

School of Engineering: Dedicated in 2013 with a strong emphasis on biomedical research and biomedical engineering, the School emphasizes the power of interdisciplinary thought and recognizes that engineering is intertwined with every aspect of human lives. Brown Engineering is a unique place, which emphasizes the power of interdisciplinary thought and recognizes that engineering is intertwined with every aspect of human lives. The School is organized without the traditional departments or boundaries found at most schools; the School's model is focused on making unique connections between the various engineering disciplines. Along with associations with the other scholarly disciplines – biology, medicine, physics, chemistry, computer science, the humanities and the social sciences – Engineering's co-operations bring unique solutions to challenging problems. The School focuses on unique and innovative clustering of faculty; in terms of research groups, engineers of all types team together with non-engineers to tackle some of the biggest problems facing engineering and science today. The School's talents and expertise lie in the interdisciplinary domain where the seemingly diverse disciplines converge. Because of a unique structure and approach to engineering, for example, the lack of formal boundaries between engineering disciplines, research is highly interdisciplinary and often includes connections to other departments on campus outside of the School. In keeping with an interdisciplinary nature, the School of Engineering has no traditional departments and Brown does not award degrees based by specific research area. Areas of study in engineering include: Biomedical Engineering; Chemical and Biochemical Engineering; Electrical Sciences and Computer Engineering; Fluids and Thermal Sciences; Materials Science; Mechanics of Solids; Program in Innovation Management and Entrepreneurship (PRIME) (Master's only) and Executive Master in Science and Technology Leadership (EMSTL).

### **School - Professional Studies**

<https://professional.brown.edu/>

School of Professional Studies: The School of Professional Studies advances Brown University's commitment to executive education and its mission to develop reflective leaders, to effect change in the world, and to improve human welfare. The School offers outstanding educational programs for executives and professionals who are ready for the challenge.

IE Brown Executive MBA – The focus is for students to learn to lead in the complex, global business environment by integrating core business studies with social sciences and humanities.

Executive Master of Healthcare Leadership – The focus is for students to prepare to transform healthcare policy and delivery with clinicians, executives, advocates, payers and other professionals who will design and implement innovative, sustainable solutions across healthcare.

Executive Master in Cybersecurity – The goal is for students to become transformative cybersecurity leaders in this rapidly evolving field by understanding and applying technical, legal, policy and human factors essential for resilient, secure organizations.

Executive Master in Science and Technology Leadership – The focus is for students to build on existing technical expertise and develop leadership and communication skills with leading professors and accomplished practitioners from science, technology and engineering.

### **School - Public Health**

<https://www.brown.edu/academics/public-health/home>

Brown's School of Public Health currently occupies 80,000 square feet in an 11-story building owned by Brown University. SPH has 11 interdisciplinary research centers focused on (1) health services research and aging, (2) statistical sciences, (3) population health and clinical epidemiology, (4) evidence synthesis, (5) international

health, (6) alcohol and addiction studies (7) community health promotion, (8) AIDS research, (9) environmental health and technology, (10) behavioral medicine and prevention (11) primary care and prevention and. The co-location of multiple research centers in a single building presents opportunities to share resources.

The School has laboratory space at 70 Ship St Providence, Rhode Island, which is located approximately three blocks from the Public Health building. These two buildings are connected via the University shuttle system. The public health building also has access to the local area hospitals, including Rhode Island Hospital, Hasbro Children's Hospital, and Women & Infants Hospital, via university shuttle service. The scientific resources at Brown University are strong, and increasing in strength with program expansion and faculty recruitment for the new School of Public Health which opened on July 1, 2013. Led by new Dean Ashish Jha, SPH provides the administrative umbrella for both the affiliated research centers and the four Departments. Faculty and leadership across SPH are contributing significantly to Advance-CTR in mentorship and leadership roles.

### **School - Warren Alpert Medical School**

<https://www.brown.edu/academics/medical/>

Warren Alpert Medical School: Established in the early 1970s, the Warren Alpert Medical School of Brown University is the State of Rhode Island's only school of medicine. It was established with the goal of training new physicians who stay and practice in the state, and attracting leaders in research and clinical medicine who would care for citizens. Though it is among the nation's youngest medical schools, the Warren Alpert Medical School has developed into a robust research powerhouse and leader in innovative medical education, and is consistently ranked in the top quartile of medical schools in the U.S. News & World Report rankings.

Mission: To support and promote the health of individuals and communities through innovative medical education programs, research initiatives, and clinical excellence in service to society and to improve the health and wellness of all.

Vision: We envision attracting, training, and sustaining diverse individuals who will work together to lead locally, nationally and internationally renowned transformative and socially responsible medical education, research, clinical care, and advocacy. We will inspire and cultivate physician scholars and leaders who positively impact the health of people and society.

### Values

- Humanism and compassion
- Integrity, accountability, and collaboration
- Creativity, innovation, and discovery
- Inclusiveness, diversity, and equity
- Dedication to anti-racism
- Social responsibility, both locally and globally
- Community engagement and service
- Commitment to professional development

### **School - Warren Alpert Medical School – Alternative**

<https://www.brown.edu/academics/medical/about-us>

Warren Alpert Medical School: Founded as the Brown University School of Medicine in 1972, it is ranked in the top quartile of medical schools nationally. The Division's six basic biological science departments are closely integrated with other science departments and are actively involved in the academic and research activities of the University. Fourteen clinical departments are housed at Brown's eight affiliated hospital partners in the greater Providence area. In 2007, a \$100 million gift from the foundation named the Warren Alpert Medical School of Brown University. That investment continues to provide financial support for medical students, faculty members and research programs and played a major role in helping the school construct its flagship building. In 2011, Brown opened a 63,000sq. ft. renovated building in Providence's Jewelry District as the new home of the Warren Alpert Medical School. The building now anchors what has become a diversified, vibrant "knowledge district".

## **School and Affiliates - Warren Alpert Medical School and Affiliated Hospitals**

<https://www.brown.edu/academics/medical/about/hospitals>

Warren Alpert Medical School Affiliated Hospitals: The Alpert Medical School is affiliated with the Lifespan and Care New England Healthcare Systems and the VA Providence Healthcare System. The Care New England Healthcare System is comprised of Women and Infants Hospital, Butler Hospital and Kent Hospital. The Lifespan Healthcare System is comprised of Rhode Island Hospital, Hasbro Children's Hospital, The Miriam Hospital and Emma Pendleton Bradley Hospital.

## **CAREER DEVELOPMENT AND MENTORING ACTIVITIES**

### **BioMed Faculty Administration (BMFA)**

<https://www.brown.edu/about/administration/biomed/faculty-affairs/>

BioMed Faculty Administration supports more than 2,000 faculty in the Division of Biology and Medicine in their teaching, research, clinical, and administrative roles. BMFA facilitates the recruitment, appointment, retention, and promotion of faculty members across 6 campus-based departments and 14 clinical departments in 7 hospitals. BMFA sponsors educational and mentoring programs such as grant writing, promotion, and peer mentoring workshops. BMFA manages faculty data and provides reporting to both internal partners and external organizations and works collaboratively to insure that BioMed's policies and practices are consistent with University goals.

BioMed Faculty Administration supports more than 2,000 faculty in the Division of Biology and Medicine in their teaching, research, clinical, and administrative roles. BMFA facilitates the recruitment, appointment, retention, and promotion of faculty members across 6 campus-based departments and 15 clinical departments in 7 hospitals. We sponsor educational and mentoring programs such as grant writing, promotion, and peer mentoring workshops. BMFA manages faculty data and provides reporting to both internal partners and external organizations. We work collaboratively to insure that BioMed's policies and practices are consistent with University goals.

Our institutions have robust career development mentoring programs, junior faculty development opportunities, and internal pilot award programs for junior faculty across disciplines. Faculty mentoring includes detailed one-on-one interactions between junior and senior faculty with efforts at grant development as well as going through summary statements and addressing grant revisions. In addition, there are programs designed especially for women faculty, and various grant writing workshops. We have various programs in research integrity training and ethics in the conduct of research. Diversity and inclusiveness and unconscious bias training are additional features of our culture and training environment. Multiple mentoring opportunities are offered to accommodate a variety of junior faculty interests and schedules.

Career development activities, described below, are categorized as 1) Research and Scholarship, 2) Career Mentoring, 3) Grant and Manuscript Writing, 4) Ethics and Responsible Conduct of Research, 5) Educational Faculty Development, and 6) Entrepreneurship and Biomedical Small Business Training.

### **Research and Scholarship Mentoring via Advance-CTR**

Many of the research career development activities available to junior faculty are available through the Rhode Island Center to Advance Clinical and Translational Research (Advance-CTR). Advance-CTR statewide partners were awarded an Institutional Development Award for Clinical and Translational Research (IDeA-CTR) grant by NIGMS in 2016 (Advance-CTR, U54GM115677). This grant established the Advance-CTR infrastructure, which is central to career development activities across Rhode Island universities and academic health centers. Advance-CTR serves to support and educate clinical and translational researchers in Rhode Island. The goal of Advance-CTR is to enhance collaboration and coordination of translational research in order to accelerate cross-disciplinary discoveries that improve health. Advance-CTR aims to: 1) Foster coordination between translational researchers at partner institutions, 2) Bring together the diverse clinical research resources to provide a home that facilitates new collaborations, 3) Eliminate obstacles that may prevent researchers from pursuing clinical



research initiatives, 4) Educate, mentor and encourage young investigators in clinical research professional development, 5) Facilitate research to gather preliminary data necessary for developing competitive research proposals and, 6) Sustain a clinical translational research environment by providing the necessary management and coordination of resources. Advance-CTR has three research service cores that are accessed through a central online portal.

## Career Development Mentoring

**Advance-K Scholar Career Development Program** This program is sponsored by the Brown University Division of Biology and Medicine and Advance-CTR. The Advance-K Scholar Career Development Program aims to train the next generation of clinical and translational researchers to conduct rigorous and reproducible science and to enhance innovation and discovery in health-related research. The goal of the program is for scholars to submit an application for individual funding (K01, K08, K23, or career development awards from the VA or foundations) within the year long program period.

Advance-K Faculty Scholars follow a common curriculum focused on grantsmanship, professional development, and clinical and translational research competencies, along with a customized set of activities to meet individual learning goals. Advance-K Scholars are expected to participate in two-hour bi-weekly training sessions. Attendance at these sessions is mandatory for participation in the program. Each Scholar will enhance the skills specific to their research and career development through an individualized learning plan. Each Scholar will meet with their Project Development Team, consisting of local technical and scientific expertise, for assistance with grant preparation and planning. Bi-weekly sessions focus on individual research presentations, grant preparation, budget development, responsible conduct of research, mentorship, and/or other professional development goals. Advance-K Scholars participate in appropriate 12 university and industry-sponsored workshops and courses and can use consultative services offered by Advance-CTR. Additionally, there are opportunities for individualized course work (e.g., Certificates or Masters). During the program's award period, Scholars are expected to pursue an individual extramural mentored career development award. An interim progress report, and final report, is required of participating Scholars. The Advance-K Scholar Career Development Program encourages applications with an emphasis on interdisciplinary team science.

**Advance-CTR Mentoring Training Program** is a statewide program that provides faculty with the skills to become more effective research mentors to early-career investigators. This 8.5-hour, peer-driven program is based on a published curriculum (Mentor Training for Clinical and Translational Researchers; Pfund et al., 2014), that has been successfully tested via a multi-site randomized controlled trial (RCT) led by the University of Wisconsin Madison. It is now being used as a framework for training across the NIH-funded National Research Mentoring Network (NRMN) and Center for Improvement of Mentored Experiences in Research (CIMER). The Advance-CTR Mentoring Training Program uses a case-based approach to explore an intellectual framework for research mentoring, providing opportunities for reflection on mentoring skills and an interactive forum to solve mentoring dilemmas and share strategies for success. The training covers themes that include: aligning expectations, maintaining effective communication, assessing understanding, addressing equity and inclusion, fostering independence, promoting professional development, and articulating your mentoring philosophy and plan. Each training session is co-facilitated by two faculty members who have been trained and certified by NRMN as Facilitators. They guide faculty participating in the program on how to develop customized curricula and prompt discussions of case studies and mentoring tools. The facilitation process is designed to expand participants' knowledge of mentoring through exposure to the experiences of all training participants, which enables attendees to engage with as many mentoring experiences as they would typically handle in a decade.

**Women in Medicine Mentoring Program** The Women in Medicine Mentor Program promotes connections between women medical students at Alpert Medical School early in their educational and professional studies with women physicians based at Brown affiliated hospitals and in the community. This program is also open to junior faculty and provides a mentoring network for investigators of various career levels. Through events such as the WIM Mentoring Night and WIM Specialty Night, students will explore different themes in mentoring groups led by women physician faculty and residents. This is also an opportunity for students to learn about a medical specialty and consider ways in shaping career goals in medicine from the perspectives of a woman

physician. An additional goal is to foster continued contact between students and physician mentors who connect at this event. Informal discussions at the WIM Mentoring Night will focus on career paths in medicine from the perspectives of women physicians, different approaches to work-life balance in shaping a career, women in academic medicine and leadership positions, and how to engage effectively with a mentor.

**Diversity and Inclusiveness** The Offices of Faculty Professional Development and of Diversity and Multicultural Affairs at the Alpert Medical School (AMS) offer workshop training sessions entitled “Everyday Bias for Healthcare Professionals” and “Better Together: Putting Team Science Theory into Practice to Enhance Your Research”. The unconscious bias training provides an overview of what unconscious bias is and how it works, its implications on diversity and inclusion goals, how it shows up in daily interactions, and how we can address and navigate unconscious bias. The team science workshop provides an overview of the theories behind team science, an assessment of personal readiness to engage in team science, and methods to apply the team science approach. Junior faculty are encouraged to attend these workshops to enhance their research programs.

### **Grant and Manuscript Writing**

**“Clear Writing for Grant Applications and Manuscripts” Workshop:** This annual workshop, presented by Kurt H. Albertine, PhD, is sponsored by the Rhode Island NIGMS funded Institutional Development Awards and Advance-CTR. The workshop is conducted over three consecutive 13 days and includes six hours of instruction each day. It includes both didactic and interactive learning modules and homework exercises. Topics covered include approaches to writing, ethics, crafting a specific aims page, writing a personal statement and contributions to science, the sections of a manuscript and a grant application, and interactive critiques of writing samples.

**“Planning and Writing Successful Grant Proposals” Seminars:** The AtKisson Training Group presents several grant writing seminars multiple times each year. Sponsored by the Brown University Office of BioMed Faculty Administration, the School of Public Health, and the Office of the Vice President for Research, these seminars offer full and half-day instruction in all phases of grant writing, from deciding to submit through how to write for peer review. Seminars offered include Planning and Writing Successful Grant Proposals, including K awards and NIH R01 Renewal Applications.

**Population Studies and Training Center Summer Grant Writing Workshop:** Sponsored by the Population Studies and Training Center (PTSC) at Brown University, this program is targeted to junior and mid-career PSTC faculty associates who have not yet received funding from the National Institutes of Health as a sole PI (R01, R03, R21). With a social science focus, this program features periodic one-on-one or group meetings, approximately every 2-3 weeks, where participants are advised by experienced NIH-funded researchers and share their drafts with other participants. Advice is provided on construction of effective application components such as Specific Aims and Research Strategy and assistance is provided with developing a budget and supporting documentation. Participants are expected to attend all sessions, share full proposal for internal review at least three weeks in advance of submission, and submit proposal through the PSTC.

### **Ethics and Responsible Conduct of Research**

**Research Integrity Series for Junior Faculty** (most appropriate for Advance-K Scholars!): The Division of Biology and Medicine (Biomed) at Brown University offers an advanced Responsible Conduct of Research (RCR) course customized for junior faculty, called the “Research Integrity Series for Faculty”. The in-person course consists of 2-hr core and elective modules, offered approximately monthly during the Fall and Spring, and faculty must take a total of 8 hrs to receive their certification. Most of the faculty that take the course currently have mentored career development (K) awards or are applying for K awards, thus materials, case studies, and discussions are targeted toward scientists who are transitioning to independence or have recently done so. It is the expectation that trainers on Brown University’s T32 programs, or those faculty who serve as mentors on NIH K and other career development awards, will participate as speakers and facilitators in the course. Records of faculty participation are kept by the Division’s Office of Graduate and Postdoctoral Studies as well as the Office of the Vice President for Research.

The course covers the scope and complexity of ethical situations that confront modern biomedical, clinical, and translational researchers, including the following topics: i) the role of the scientist in society; ii) the peer review process and its purpose; iii) data acquisition, storage, and privacy; iv) legal and ethical considerations in animal research; v) publication practices and responsible authorship; vi) practical and ethical issues in human-subjects research; vii) the mentoring relationship and associated responsibilities of mentors and trainees; viii) recognizing and navigating conflicts of interest and research misconduct; ix) electronic data management issues; x) copyright and intellectual property issues; xi) launching an independent research program; and xii) rigor and reproducibility of data. Discussion of the ethics of diversity is incorporated throughout to convey an appreciation for the fact that differences of race, culture, age, gender, (dis)ability, and religion can affect the conduct and interpretation of research.

Brown University BioMed also offers a refresher training that satisfies the National Institutes of Health (NIH) and National Science Foundation (NSF) RCR training requirements. The course comprises three in-person sessions lasting three hours each and is offered twice each academic year, once during the fall semester and once during the spring semester. To complete refresher training, trainees will attend all three sessions of a cycle or participate in 2 sessions and complete online Collaborative Institutional Training Initiative training.

While training courses fulfill the necessity of focusing on discipline-specific ethical issues, Brown University feels that it is critical to bring scholars of all disciplines into dialog with each other about ethics as a 14 academy-wide aspect of graduate education. This interdisciplinary programming places the ethics of biological research in a larger context. The Academy in Context series sponsored by the Graduate School and the Office of Student Life brings graduate students, postdoctoral fellows and faculty from across the University together to discuss ethical issues with faculty speakers and outside experts. The focus on ethics has allowed us to invite speakers on a very wide range of topics - from the way computer technology is altering human bodies, or the intersections between governmental policy making and the scientific community, to the ethical dimensions of negotiating ownership of the past in archaeological excavations. The large dinner-seminar is complemented by smaller group discussions that focus on specific ethical applications. These workshops synthesize questions, identify other readings on the topic, and make suggestions for aspects that can be woven into the curriculum of courses across the campus. Rather than being divided along disciplinary lines, participants are part of teams that include engineers, humanists, social scientists, and physical scientists. They not only learn about the issues, but they also see how people with different backgrounds think about the issues.

**Brown Ethics and Responsible Conduct Of Research Education (BEARCORE):** The BEARCORE program is designed to educate early-career researchers and trainees from a variety of academic fields on how to conduct their scientific investigations responsibly and with integrity. It is an in-person training program that may be supplemented by online instruction through the Collaborative Institutional Training Initiative (CITI). BEARCORE is held each spring, has mandatory and elective modules, and fulfills NIH and NSF requirements. While BEARCORE is used primarily by trainees and new researchers to fulfill NIH and NSF RCR requirements, it is open to anyone in the Brown community and affiliated academic health centers.

The BEARCORE course is conducted via three, two-hour Core (mandatory) sessions and additional one-hour Elective sessions. Sessions are co-taught by Brown faculty members and subject matter experts with in-depth topic area knowledge. The sessions are predominantly case-based, and include mixed-media presentations, panel discussions, and in-class discussions of hypothetical and real scenarios drawn from current literature and news media. Certificate of Completion course requirements for researchers and trainees with NIH and NSF grants include attendance of all in-person sessions/lectures, participation in class discussions, and completion of pre-work and homework assignments. BEARCORE training modules are focused on research misconduct, authorship, rigor, reproducibility, unconscious bias, conflict of interest, data stewardship, data management and sharing, and data use. Participants must attend at least two elective modules. Examples of electives include ethical considerations in animal research, ethical considerations in human subject's research, grants management, and intellectual property and commercialization in academia.

**BEARCORE Refresher Course:** BEARCORE can also be taken as a refresher course. NIH requires that RCR training be completed at least once during each career stage (i.e., undergraduate, graduate, postdoctoral, and faculty levels), and at a frequency of no less than once every four years. NSF defers to each institution to

determine the frequency of RCR training for its NSF-supported trainees, and Brown encourages NSF trainees to follow the same training frequency requirements as those enforced by NIH. Upon completion of the in-person course of instruction to satisfy the initial RCR training requirement, the participant may then complete refresher courses to comply with the career stage requirement and/or the requirement to complete re-training no less than once every four years. Faculty enrolled in the BEARCORE refresher course must attend at least eight hours of in-person teaching to receive the RCR Refresher certificate. However, they can choose what sessions to attend in order to fulfill the eight-hour training requirement. For example, faculty can attend two Core sessions (two hours each) and four one-hour Elective sessions or they can attend one Core session and six Elective sessions.

## **Educator Professional Development Program**

The Office of Faculty Professional Development at the Alpert Medical School recognizes and supports faculty in their role as educators. The Program strives to provide faculty educators with the knowledge and skills to best teach our medical students in the classroom and at the bedside. The array of programming provides both seasoned and novice educators with the tools they need to instruct, guide, train, facilitate, and mentor. The goal of the Program is to enhance student learning and thus impact the quality of patient care. The Program also seeks to provide faculty with a community of educators with, and from whom they can learn. The office utilizes internal resources in the form of our talented faculty educators who share their expertise with colleagues and provide a central infrastructure for faculty development across the Division of Biology and Medicine and the affiliated clinical departments at Brown. The Program's portal connects faculty to a range of offices, programs, and resources that foster personal and professional growth. Professional development opportunities are available for teaching and learning, diversity and inclusion, faculty wellness, leadership skill building, research and scholarship and career development. A sample of workshops that are available to all faculty include, Hypothesis Driven Research, Unconscious Bias Training, Presentation Basics, Crafting an Elevator Talk, Creating a Positive Learning Environment Across all Participants, and Facilitating Active Learning Across all Kinds of Teaching. Program participants can earn a Certificate and Advanced Medical Education Training status and can request services such as a Talk Review and Feedback session or Curriculum Consultation. Educators may also be eligible for funding to support their ongoing development in this area.

## **Entrepreneurship and Biomedical Small Business Training**

**Brown Biomedical Innovations to Impact (BBII):** Brown Biomedical Innovations to Impact (BBII): The Brown University Office of Technology Innovation provides and manages translational development capabilities to help solidify proof of technical feasibility and of commercial relevance, both of which can de-risk an idea or discovery and turn it into more concrete product opportunities that are attractive to potential industry partners or startup creators. The Brown Division of Biology and Medicine, in collaboration with Technology Innovations, has launched a translational commercial development program, Brown Biomedical Innovations to Impact (BBII). BBII manages an academic accelerator fund dedicated to supporting academic biomedical technologies - with potential for high impact - to become well-defined product opportunities that are attractive to industry partners and investors. BBII achieves its goals by funding translational research projects focused on validation of technical feasibility and commercial relevance. BBII offers: 1) advising and coaching of investigators by an independent panel of advisors with broad expertise in evaluation, investment, and commercialization of biomedical technologies, 2) partnering and managing with the investigator by retaining consultants and contract research organizations to leverage development expertise and to provide project management support to ensure focus and timely delivery on project milestones, and 3) exploring commercial development opportunities by working through established relationships with industry, venture capital, and entrepreneurial startup resources to find the best path for further development.

**Biomedical Innovation and Entrepreneurship Certificate Program:** The Institute for Biomedical Entrepreneurship (IBE) develops and delivers a variety of formal and informal educational programs for researchers and other innovators. The five-day Entrepreneurship Certificate Program provides an understanding of the execution processes involved in developing ideas into commercial successes. The format is designed for multiple audiences including faculty, researchers, and staff, with an interest in biomedical innovation and commercialization. The goal of the program is to: 1) prepare participants to readily analyze and validate commercial potential of their research, and to intelligently evaluate potential startup opportunities for

personal involvement, 2) leave participants capable of beginning the implementation process on ideas that merit development, and 3) provide participants access to resources for developing their ideas and pursuing validated opportunities into commercial development.

**Drug Discovery Bootcamp:** The Drug Discovery Bootcamp, offered by Speid & Associates, Inc., is a two-day, intensive training program designed for those that have relevant experience in the research and development of new chemical and biological entities. It is a unique and outstanding program recommended to any investigator interested in drug discovery, development, commercialization and anyone who is interested or needs to learn about the FDA approval process for new drugs or devices. The bootcamp provides an in-depth look at the drug discovery process. A mixture of large pharma, small pharma and expert panel members ensure that panel discussions are relevant, responsive and applicable to everyday situations that participants face. 16

**I-Trep Program:** The I-Trep program (NIGMS R25GM11670) at the University of Vermont provides training, mentoring, and networking resources to promote biomedical entrepreneurship. Full participation in the I-Trep program is open to faculty and postdoctoral fellows from Alaska, Delaware, Maine, New Hampshire, Puerto Rico, Rhode Island, and Vermont. Everyone has access to webinars and online resources through free registration at the I-Trep website. This program offers one-to-one expert consulting to assist in development of SBIR/STTR grants, webinars on discovery commercialization, a biomedical entrepreneurship summer course, and travel award opportunities to travel to meetings to aid in development of entrepreneurship.

**DRIVEN:** Accelerating Medical Entrepreneurship in the Northeast The DRIVEN Accelerator Hub is an NIH-funded (UT2GM130176) consortium led by Celdara Medical and includes partnerships with leading research institutions in the Northeast region (Brown, Dartmouth, Maine Medical Center, Mount Desert Island Biological Laboratory, Simbex, University of Delaware, University of New Hampshire, University of Rhode Island, and University of Vermont). The mission of the DRIVEN Accelerator Hub is to create quality-adjusted life years (QALYs) and save lives by: 1) Increasing the number of quality medical startups, 2) Decreasing their time to market, and 3) Increasing their probability of success. DRIVEN manages a Partnership Program, an Acceleration Fund, and an Ignition Fund. The Partnership Program provides specialized consulting and mentoring to entrepreneurs and startups on their company or technology. At the conclusion of this program, participants will prepare and present a slide deck to VC and industry members. Program finalists will also be eligible to apply for to the DRIVEN Acceleration Fund, which awards \$50,000 to early-stage companies to accomplish strategic goals. The Ignition Fund provides \$25,000 for innovations or discoveries that need additional experimentation before company formation or outlicensing is warranted. DRIVEN also maintains an online database where biomedical entrepreneurs can access resources. They can filter by location, web resource, date added to site, user type (e.g. undergrad, grad, postdoc, faculty), type of resource (e.g. expert/coach, networking, webinar, workshop), and the type of skills the resource provides (e.g. project management, leadership, accounting, regulatory, finance). DRIVEN sponsors forums for drug discovery education, networking, and industry analysis.

**New England Medical Innovation Center (NEMIC):** NEMIC and Advance-CTR have teamed up to bring early-stage Rhode Island academic entrepreneurs a one-on-one coaching program to teach them the various components of translating research into an eventual business plan and pitch deck with investors in mind. The Planning Pitch Deck & Business Plan Immersion Program supports two research entrepreneurs from Rhode Island Hospital and Brown University by providing an individualized strategy of how to take their specific research innovations to market. The program helps the entrepreneurs navigate strategic decisions and hone their business plans through individualized meetings with NEMIC staff and advisors. Faculty entrepreneurs meet with NEMIC's experts for two hours every two weeks based on their schedule over 10 weeks to refine each element of their business plan and pitch deck with investors in mind. Areas of focus include market and market size, financial projections, organizational structure, and more. At the end of the program, each company will present their final pitch deck to the group. The program culminates with each investigator delivering a final presentation or "pitch" of their innovation to NEMIC experts and the Advance-CTR investigator community, where they will receive feedback, discuss lessons learned, and preview next steps for taking their innovation from the ideation stage and into the market

**RI Bio Programming:** RI Bio is southeastern New England's life sciences industry group. They are dedicated to galvanizing collaboration and growth among life sciences companies, hospitals, universities, sources of capital and governmental partners. They convene, catalyze and advise. With the support of their partners, they work to secure resources to support the life sciences community and provide members with exclusive access to regional/industry news, events, materials and supplies, workspaces, growth partners, training, and more. They regularly convene workshops on such topics as "Protecting Your Ideas (Patents, Trademarks, Copyrights & Trade Secrets)" or "Turning Your Scientific Discovery into a Successful Enterprise".

## COLLABORATING INSTITUTIONS

### Rhode Island Department of Health (RIDOH)

[Rhode Island Department of Health \(RIDOH\)](#)

Rhode Island Department of Health (RIDOH): Rhode Island is unusual in having a single Department of Health for the entire state rather than one for each county or city. With the primary mission to prevent disease and to protect and promote the health and safety of the people of Rhode Island, RIDOH oversees the licensure, certification, registration, and discipline of more than 72,000 individuals in 65 health occupations and 2,600 facilities. RIDOH also oversees the administrative and regulatory functions of 35 licensing boards whose 325 members represent the various professions and consumers. These responsibilities give RIDOH unique access to licensed health professionals, facilities, and other health-related resources in the state – a function that recently took the form of a department-wide Public Health Directory. RIDOH also operates more than 180 different programs and services through its seven divisions. In addition to regulatory functions, many of these programs include funding and operational links with numerous health care providers, employers, and community-based organizations. Each of these relationships provides a potential linkage for the translation of clinical best practices into various components of the Rhode Island community. While communicable disease control, vital records, environmental health and other units carry out the traditional health department functions, newer and equally important functions include minority health, chronic disease prevention, health promotion, injury control, and public information. RIDOH also collects and manages large data sets used for surveillance and intervention research.

The Rhode Island Department of Health has established a population health framework, which includes three leading priorities, five strategies, and 23 population health goals. The framework is used as a road map for improving Rhode Island's health. Through the State Innovation Model (SIM) and its culture of collaboration, other state agencies are also looking at their goals and activities within this same framework. The leading priorities are 1) Address the Social and Environmental Determinants Health, 2) Eliminate the Disparities of Health and Promote Health Equity and 3) Ensure Access to Quality Health Services, Including Vulnerable Populations.

RIDOH Academic Center: The [RIDOH Academic Center](#) was created in 2015 to enhance RIDOH's capacity to integrate scholarly activities into public health policy and practice by establishing and facilitating collaborations with academic and research colleagues across the state, and building upon internal and external partnerships and synergy to establish the RIDOH Culture of Learning at the department. The RIDOH Academic Center supports two areas of engagement to achieve these goals: the Public Health Education and Research Academy (PHERA), and the Workforce and Career Development Network (WCDN).

*Public Health Education and Research Academy:* Through the work of the RIDOH Academic Center, RIDOH has become an Academic Health Department that looks forward to having formal affiliations with all of Rhode Island's colleges and universities. Formal affiliations currently exist with Brown University School of Public Health, University of Rhode Island, Rhode Island College, Community College of Rhode Island, Roger Williams University, and Johnson & Wales University. Collaboration between RIDOH programs and academic faculty is encouraged based on RIDOH's public health policy and practice, and similar research and teaching interests of academic faculty. These partnerships drive development of collaborative research ideas that create experiential learning opportunities for [RIDOH Public Health Scholars](#), who are undergraduate, graduate, professional or clinical students currently enrolled in courses of study that relate to public health. RIDOH's utilization of a health equity lens for public health program planning and policy development provides multidisciplinary opportunities for collaboration with faculty and students in programs of study such as public health, healthcare, communications, graphic design, technology, housing, finance, law, urban planning, architecture, etc. The

RIDOH Academic Center's PHERA also facilitates forums for collaborative state-academic partnerships to enhance statewide research and outcomes in public health-related topic areas. These research-based groups include multiple researchers from various academic institutions as well as state agencies and community partners.

*Workforce and Career Development Network:* The Workforce and Career Development Network works to enhance the knowledge, skills and abilities of RIDOH staff and healthcare and health-related professionals across Rhode Island through assessment of career planning and continuing education needs, development of initiatives, and utilization of collaborative and innovative methods to address Rhode Island's health workforce needs.

**RIDOH Health Equity Zones:** The Centers for Disease Control and Prevention and the Rhode Island Department of Health are collaborating with 10 Health Equity Zones (HEZs) throughout Rhode Island to support innovative approaches to prevent chronic diseases, improve birth outcomes, and improve the social and environmental conditions of neighborhoods across five counties statewide. Health Equity Zones are geographic areas designed to achieve health equity by eliminating health disparities using place-based strategies to promote healthy communities. Healthy communities are places where people live, work, play, and learn. These are neighborhoods consisting of social and physical environments that support healthy choices and safe living. All HEZs grantees conducted community needs assessments in year one. HEZ work plans, based on the needs identified and prioritized in year one, focus on the residents in neighborhoods that each Health Equity Zone serves. The HEZ work plans present ideas and approaches to invest in local communities and improve population health. Community engagement is a priority in reaching these public health goals.

**HealthFacts RI, Rhode Island's All-Payer Claims Database,** is a new and powerful dataset that can be used to examine the use, quality, and cost of healthcare provided to Rhode Islanders. HealthFacts RI is jointly managed by the Executive Office of Health and Human Services, the Department of Health, the Office of the Health Insurance Commissioner, and HealthSource RI. The mission of HealthFacts RI is to provide actionable data to support the study and comparison of healthcare data, to identify opportunities to improve healthcare quality and health outcomes, and reduce healthcare costs; and to help Rhode Islanders make informed decisions about their healthcare. HealthFacts RI:

- Sparks innovation across the healthcare system to improve patient care and health outcomes, and lower costs
- Collects data to support the study and comparison of healthcare utilization, cost, and trends for people living in Rhode Island insured by major health insurance companies
- Requires health insurers with more than 3000 members to submit enrollment and provider data, and medical and pharmacy claims for claims dating back to 2011
- Informs people about the costs for certain healthcare procedures
- Identifies opportunities to improve healthcare quality in Rhode Island
- Ensures patient privacy by removing identifying information (names, addresses and other personal information) from patient data
- Protects the integrity and security of the database and all data transactions
- Oversees access to the data while rigorously protecting patient privacy
- Measures progress on important healthcare benchmarks
- Advances clinical improvement strategies and academic research

### **Rhode Island Quality Institute (RIQI)**

<https://www.riqi.org/>

**Rhode Island Quality Institute (RIQI):** Founded in 2001, Rhode Island Quality Institute (RIQI) is a 501(c)(3) nonprofit center of collaborative innovation with a mission to significantly improve the quality, safety, and value of healthcare. RIQI exists to save lives at the speed of data, and capitalizes on Rhode Island's small size as "living laboratory" for ideation, development, testing, and scaling of innovative products and services. Few places in the nation can rival RIQI's leveraging of Rhode Island as a petri dish for rapid prototyping, discovery, and bringing innovative healthcare products and services into to being and facilitating research drawn from the rich database.

RIQI's unique value is created by aligning partnerships and leading-edge improvement strategies with needs and opportunities in healthcare, addressing problems that cannot be solved by single entities acting alone—no matter how large or powerful. By maintaining strong partnerships with healthcare leaders, government/industry organizations, leading researchers and academe, and forward-thinking community groups, RIQI facilitates consensus around innovative solutions to healthcare's challenges. As a catalyst for change, RIQI leverages deep expertise in health information exchange that enables clinical, person-supplied, and social determinates of health data to be collected, persisted, analyzed, and accessed in real-time where it's needed and by whom it's needed. RIQI applies skill in quality improvement science and analytics to drive system transformation and accelerate healthcare's transition to value-based payment models. RIQI facilitates improvements in health and healthcare through initiatives that improve care coordination; reduce medical errors and waste; leverage research, big data and machine learning; and engage with consumers, patients, and families to empower them for self-management.

RIQI operates CurrentCare, RI's statewide Health Information Exchange (HIE), a centralized data repository that collects, aggregates, normalizes, stores, and makes accessible data on more than 75% of Rhode Island residents from such entities hospitals and health systems, laboratories, pharmacies, long-term/post-acute care facilities, mental health and substance abuse treatment centers, community health centers, retail care delivery sites such as CVS Minute Clinic, community-based primary care and multispecialty care practices, the VA, and consumers statewide. CurrentCare is a secure electronic network that allows doctors and other care givers immediate access to a patient's up-to-date health information in order to provide the best possible and most comprehensive care. CurrentCare helps providers succeed in the transition to value-based payment systems, providing caregivers with clinical decision support tools, and opportunities to avoid unnecessary and expensive care, such as duplicate tests and avoidable ER and hospital admissions. RIQI's robust analytics capability supports HIT-enabled quality, cost and efficiency improvements, as well as population health improvements across RI. It offers providers feedback on their clinical outcomes compared to their peers, and enables quality reporting and sophisticated analytics to improve the outcomes of care. The system is a boon to researchers, given that Rhode Island is a microcosm of the nation, the population is extremely stable, and the database is quite unique as a result of very high levels of cooperation in the state.

### **Rhode Island Public Health Institute (RIPHI)**

<https://riphi.org/>

Rhode Island Public Health Institute (RIPHI): RIPHI's mission is to promote community health and to eliminate health disparities in Rhode Island and beyond. RIPHI partners with Brown University and the Rhode Island Department of Health to develop innovative public health programs, conduct translational and policy research, and train students and public health practitioners. RIPHI maintains over 200 community partnerships across Rhode Island and the United States. RIPHI's work is grounded in five key activities that advance public health and draw on the core competencies of Brown University and the Rhode Island Department of Public Health.

1. **Public Health Programs and Community Service:** Improving public health requires outreach to communities that have limited access to health services and those most heavily impacted by preventable and treatable diseases. RIPHI sponsors high-impact public health programs in community and clinical settings with a focus on community services and translating research into practice.
2. **Community Engagement in Programs and Research:** RIPHI is committed to engaging local stakeholders in dialog about improving public health in their communities. We work with policymakers, scholars, activists, and community residents to engage communities in our programmatic and research activities.
3. **Educational Training in Public Health:** RIPHI provides community service and educational opportunities for students, professionals, and community members. RIPHI offers training for students and public health professionals in didactic and community settings, with a focus on public health and community service.
4. **Translational Research:** RIPHI's research is diverse in scope and focuses on translating research into practice, reducing disparities, and promoting health equity. Much of our research focuses on evaluating the programs we develop to advance our goal of promoting public health.



5. Public Policy and Dissemination of Best Public Health Practices: Improving public health requires policy change. We make every effort to ensure that our research and programs have maximum impact on public policy. Policymakers are involved from the onset of each of our projects and throughout their duration. RIPHI makes every effort to disseminate lessons learned from our work in peer-reviewed articles, policy memos, community forums, and in the popular media.

RIPHI runs the Food on the Move mobile produce market. Food on the Move started as an NIH-funded clinical research trial has become one of the largest mobile markets in the U.S., with over 35 mobile markets per month. Our mobile markets provide a testing ground for innovative models to improve food access and affordability, and serve as a national model. The year-round mobile markets bring fresh, healthy produce to the people and places that need it most. Healthy food is made more accessible by bringing markets to senior housing sites and community locations, and more affordable by doubling the value of Supplemental Nutrition Assistance Program (SNAP) dollars spent on fruits and vegetables.

Published research shows that Food on the Move works – people who regularly shop at our markets significantly increase the amount of fruits and vegetables they eat, and research shows that eating ample fruits and vegetables is linked to a lower risk of obesity and chronic health conditions such as diabetes and heart disease. As a data-driven organization with a policy focus, RHPHI uses data to advance state and federal policies that make healthy foods accessible and affordable to everyone

## **COMMUNITY ENGAGEMENT ORGANIZATIONS**

### **Swearer Center**

<https://www.brown.edu/academics/college/swearer/>

The Swearer Center: The Howard R. Swearer Center of Brown University works with more than 1,200 Brown students, through and with 100+ community partners -- more than half of which are in the greater Providence area. In its 30-year history, the center has developed and nurtured many deep — and deeply rewarding — relationships with individuals and organizations in Providence. The center connects students, faculty and community partners through community engagement, engaged scholarship and social innovation -- three key perspectives that are the foundations of its work. Swearer Center programs and fellowships provide students with community engaged, cohort-based experiential learning opportunities. Through programs and fellowships, students link their passion for social justice and community engagement with their academic and career goals. The Swearer Center partners with a wide range of organizations (nonprofit, LEAs, state and local government agencies etc.) that wish to access the resources of the Swearer Center or the university to advance their mission and work. Partnering organizations work with Swearer Center and university staff as co-educators, co-developers and co-creators of knowledge in our community engagement and engaged scholarship work.

Swearer Center partnership practices are centered around the values of Community Agency and Reciprocity. Community-based organizations are best situated to design, create and deliver programs and services in their own communities and therefore our work is that of capacity building partner, technical assistance, and conduit to access other university resources like community-based research. We work to ensure that both partners realize the desired benefits of the partnership. The Swearer Center offers partner organizations a variety of supports, resources, scholarship, student time and effort, funding for social innovation projects and membership in the Community Partner Network. In turn, partner organizations provide essential learning and engagement opportunities for students, as well knowledge and expertise to Swearer Center and institutional staff as we seek to understand and better inform the field of higher education and community engagement.

### **Center for Prisoner Health and Human Rights**

<https://www.lifespan.org/centers-services/infectious-diseases/global-and-local-health-programs/center-prisoner-health-and>

Center for Prisoner Health and Human Rights was established in 2005 to act as a hub for the innovative correctional health research and programming occurring at The Miriam Hospital and other research hospitals in RI and around the country. The Center for Prisoner Health and Human Rights, based in the Division of Infectious Diseases, seeks to advance the health and human rights of prisoners and other populations through research,

education and advocacy. Infectious diseases, including HIV and other STDs, hepatitis B and C, and tuberculosis, as well as addiction, mental illness and many other diseases, are much more prevalent among prisoners and other individuals involved in the criminal justice system. The center collaborates with doctors and health care professionals, faculty, researchers, lawyers, community activists, and students. It is committed to educate health professionals, policy and opinion makers, and the public, and to translate world-class research into sound, evidence-based policies and practices that address the multiple dimensions of this public health and human rights crisis.

### **Rhode Island Foundation**

<https://www.rifoundation.org/>

**Rhode Island Foundation:** Founded in 1916, the Rhode Island Foundation is one of the nation's oldest and largest community foundations. Rhode Island Foundation is Rhode Island's only community foundation and the largest funder of Rhode Island's nonprofit sector. The Foundation is a proactive community and philanthropic leader dedicated to meeting the needs of the people of Rhode Island. The Rhode Island Foundation works with many partners to (1) Actively inspire philanthropy and increase permanent resources for the State of Rhode Island, (2) Invest in important community programs through grants, and (3) Provide leadership and a forum for dialog on critical community issues. In 2017, the Foundation award \$43M in grants to more than 1,700 nonprofit organizations, and we continued our commitment to address the state's most pressing issues and needs of diverse communities.

## **COMPUTING- OFFICE OF INFORMATION TECHNOLOGY (OIT)**

### **Office of Information Technology**

<https://it.brown.edu/>

Brown University's network infrastructure is comprised of a state-of-the-art fiber optic backbone connecting a majority of buildings on campus. Support is available through Computing & Information Services (CIS), a centralized computing department at Brown. OIT supports a secure computing environment (referred to as "Stronghold") for sensitive and protected data that adopts HIPAA security measures. OIT also provides a high performance computing platform through the Center for Computation and Visualization. The computing platform comprises a 8,000+ core computing cluster with 266 GPU's for accelerated computing. A GPFS parallel filesystem provides roughly 1 petabyte of disk storage, and 56/100 Gb/s Infiniband connectivity is used for all parallel applications messaging and I/O. The storage system is integrated with a 10 Petabyte Tivoli TSM backup/archival system. Redundant Internet connectivity provides high availability to the Internet and 12 research sites. Brown University utilizes Cisco networking equipment configured for high availability. An equipment renewal process is managed by the OIT organization to regularly refresh and upgrade network technology.

**Advanced Research Computing (ARC):** Advanced Research Computing (ARC) is a centralized group of data scientists within the Center for Computation and Visualization (CCV) in OIT that consolidates "big data" expertise to help researchers across campus apply new methods and derive insights from their data. By embedding these staff in research labs and groups and forming close partnerships with faculty, postdocs, and students, the ARC supports data-intensive projects across the physical, life and social sciences, and the humanities. In addition, the ARC builds analytic solutions with Brown's institutional data and supports data-driven decision making by senior administrators. Currently made up of thirteen full-time staff (with three more positions recently opened), the team's expertise spans machine learning, informatics, data exploration and visualization, databases and data management, and software engineering. Facilities include ~2,000 square feet of offices and conference rooms in OIT offices at 3 Davol Square.

**Stronghold Research Environment for Data Compliance.** Stronghold is a secure computing and storage environment that enables Brown researchers to analyze sensitive data, while complying with regulatory or contractual requirements. Stronghold is currently self-certified to meet the security requirements and controls for HIPAA (Health Insurance Portability and Accountability Act) and is undergoing the certification process for FISMA (Federal Information Security Management Act) and CJIS (Criminal Justice Information Security). This service is customized to the needs of individual users and their data use agreements. Each Principal Investigator (PI) is given a dedicated environment for their project to support their researchers, students, and collaborators.

Access to the internet is restricted except for required locations for data imports or necessary software downloads. Import and export controls are in place to limit who can perform data migration, where sensitive data can come from and where desensitized or anonymized data can be moved to. Sensitive data are subject to file system auditing, and real-time alerting is available at the request of the PI.

### **Unified Research Data Sharing and Access (URSA) Initiative**

<https://www.brown.edu/initiatives/translational-research/biomedical-informatics-services>

Unified Research Data Sharing and Access (URSA) Initiative: The overall goal of the Unified Research Data Sharing and Access (URSA) Initiative is to make data accessible and usable for research purposes by the clinical and translational research community through establishment of a shared technical infrastructure and common processes. This initiative is coordinated by the Brown Center for Biomedical Informatics (BCBI) that operates the Advance-CTR Biomedical Informatics Core in close collaboration with information services, compliance programs, and research offices at Brown and health data partners: Lifespan, Care New England, VA Providence Healthcare System, Rhode Island Quality Institute, and Rhode Island Department of Health. For sensitive data, URSA utilizes the Stronghold server system at Brown (URSA Stronghold), which offers a secure computing environment for storing and analyzing data

**Cybersecurity Program:** The cybersecurity program at Brown University is a collaborative initiative comprised of several internal teams brought together for the purpose of proactively managing security exposures or vulnerabilities, and reactively handling incidents that may arise in Brown's computing environment. The purpose of the cybersecurity program is to develop, coordinate, drive, and maintain the cross-functional efforts necessary for Brown University to effectively manage security exposures, critical vulnerabilities, or cybersecurity incidents that span Brown's various technology platforms. The program also aims to maintain capabilities in several procedural areas, including security awareness, readiness, detection, communication, remediation, incident root cause analysis, education, and process improvement. The program includes management and procedural guidelines, policies, and training and awareness opportunities to assist staff in recognizing, identifying, and coordinating an appropriate response to attacks on Brown University information assets.

Documentation and procedures are also an integral piece of the program, designed to reduce overall security event exposure for Brown University, initiate a more effective and efficient incident response, decrease total time to incident resolution, outline basic regulatory responsibilities, and promote the ethical obligations surrounding the handling of sensitive data or personal information. It is the mission of the Cybersecurity Incident Response Team (CIRT), a keystone of the program, to provide for the coordination of the response to, and investigation of, attacks on Brown University information assets. The CIRT also provides guidance on detecting, containing, and recovering from computer security incidents. Coordinated by the Information Security Group, the CIRT is responsible for managing responses to computer security events throughout the Brown infrastructure, including third-party-hosted systems. The degree of involvement of CIRT personnel in an event is dependent upon the event's severity or potential impact to University operations.

- **Security Awareness:** Any major enterprise that relies on heavy use of technology must stay aware of the vulnerabilities and emerging threats associated with those technologies. Protective techniques and safeguards must be consistently reviewed and updated using outside sources, vendors, partners, and other alliances that provide information about new technology threats.
- **Readiness:** Whether one's responsibilities are technological, operational, or professional, staff must understand clearly the security concerns that may exist within their realm of responsibility. Staff should be familiar with University policy, Computing and Information Services (CIS) and Information Security Group (ISG) policy, and the inherent security risks or responsibilities that exist within their job role. People, systems, policies, and processes need to remain organized to make the University computing environment suitable for effective management of threats.
- **Detection:** As a major computing enterprise, OIT must operate an array of monitoring systems suitable for the environment. Intrusion detection, monitoring of standard configurations, and early warnings of abnormal activity must be properly maintained to ensure that adverse events can be acted upon quickly.
- **Communication:** Effective communication among technology staff, professional staff, academic departments, strategic vendors, and sometimes the external community is critical when handling security incidents. Information must be communicated clearly and accurately to affected areas about any developing security crisis and the active management of an ongoing incident. Sound communications plans allow for the

expedient gathering of resources when emergency efforts are needed. It is also imperative that internal Brown technical and professional teams work together when wider communications to the University community is necessary.

- Remediation, Mitigation, Eradication, Containment and Control: In the event of a cybersecurity incident, prompt remediation of the situation includes one or more of the following actions: stopping the attack, applying vendor software patches, implementing creative solutions to eliminate the risk, or containing and controlling a propagation-based malware threat. Whatever the situation, plans and scenarios need to be discussed to ensure that short-term effective strategies can be implemented quickly to contain a problem.
- Root Cause Analysis: Identification of a problem's root cause is essential to making sure the same incident does not recur. Root cause analysis is also important for regulatory reporting requirements which may be necessary in some cases. Whatever exercises are necessary, teams must work to facilitate the analysis necessary to determine problem causes. Such exercises include forensic investigations where appropriate.
- Education and Process Improvement: Teams must study the root causes of incidents and how they are handled. Process improvement and implementation of lessons learned is essential to grow cybersecurity defense capabilities. After studying incidents and the effectiveness of response to them, team must work to implement new processes as necessary to ensure better protection in the future.

**Center for Computation and Visualization (CCV):** The mission of CCV is to provide the scientific and technical computing expertise required to advance computational research and support Brown's academic mission. The accelerated transformation of the pace and impact of computational approaches led to Brown University's recognition of the importance of high performance computing across all of its disciplines. As a result, Brown and IBM developed in 2009 a \$4M investment in a high performance computing platform, known as Oscar, that is available statewide to researchers. Through grant funding and University investment, this platform has undergone continual hardware enhancement, and now includes Intel Scalable Processors and nVIDIA GPUs of the Pascal and Volta architectures, as well as 100Gb/s EDR Infiniband. The equipment is maintained and operated by the staff of the Center for Computation and Visualization (CCV), who have extensive experience in operating shared computational clusters. CCV staff are responsible for scheduled maintenance, access control as needed, and integration with research specific hardware as required by NIH-funded researchers. CCV staff also take care of all financial aspects of operating and maintaining the facility.

The high performance computing resources at CCV equip the Brown research community to undertake complex numerical simulation, modeling, and data analysis. Oscar is the primary research computing cluster with several hundred multi-core nodes sharing a high performance interconnect and file system. Applications can be run interactively or scheduled as batch jobs. Several large memory nodes provide substantially more memory than is available on typical workstations and laptops. A large collection of software is available on CCV systems, including: python, perl, R, Matlab, Mathematica, Maple, optimized math and science libraries, and domain-specific applications. CCV staff can help acquire and install most applications upon request. The technical specifications of Oscar are:

- Two login nodes provide access for application development, debugging and batch job management
- About 400 compute nodes up to current specs of dual multi-core processors and 128 GB of memory and a total of more than 8,000 cores
- Specialized nodes containing GPU processors or 512 GB of memory
- High-bandwidth/low-latency Infiniband interconnects
- -A ll nodes are diskless with I/O provided by an IBM GPFS parallel file system
- 1 PB of usable disk space
- RHEL 7.3 Linux operating system
- SLURM workload manager

CCV provides storage for large research files connected to the HPC system. A default allocation of 256 GB (also called RData) is given to all faculty members at Brown, on a per request basis, with the option of purchasing additional storage as needed. Long-term storage and backups are available on a fee basis. Storage can be purchased in increments of terabytes for periods of up to 6 years. The cost for backups is included when storage is purchased. Data is incrementally backed up to tape on a daily basis. In addition, snapshots for the last 7 days are available online for quick restores. Long-term archiving of files to tape (one or two copies) can be purchased as needed. Tape libraries are housed at two separate locations to enable disaster/recovery scenarios. In

addition, a disaster recovery copy of the non-ephemeral data is kept on a lower-performance filesystem to permit immediate recovery and limited production computing in the unlikely event of the loss of the primary filesystem. These research storage allocations can be easily mounted to desktops or other computer systems to allow for easy access and sharing files. Details of HPC file storage at CCV:

- Rdata is accessible from all CCV systems (/gpfs/data)
- Can be mounted to all desktops on Brown's campus network
- Is backed up on a daily incremental basis
- Rdata allocations can be increased by purchasing additional storage
- Home directory on Oscar: All users will have access to a home (/gpfs/home) allocation of 10 GB. This allocation is backed up on a daily basis
- Group storage: Premium accounts will be entitled to an additional allocation of 256 Gb that may be merged with RData (for primary PI). Likewise, group premium accounts will be entitled to additional 25 GB per user
- Snapshots: Daily snapshots are available for both RData and Home file systems for seven consecutive days
- Scratch: Space for temporary files is available as (/gpfs/scratch). These files are not backed up and scratch space is strictly for temporary files. Files may be purged after 30 days or as the file system is being utilized
- This allocation will be managed by an application called xdisk (time versus space) (work in progress)
- Sharing data: Sharing files that are too big to be sent via email. There is a 10 GB quota and a limit of 2 GB per file
- Users can access RData from the CIFS share. This can be mapped as a drive in Windows and mounted in Mac OS X and Linux from any campus system (off-campus use requires a VPN connection to campus)
- Users can also access files by using a file transfer tool like Secure Copy (SCP), Secure FTP (SFTP), or rsync

A key benefit of using these computing resources is that CCV installs and maintains a large collection of computational research software. CCV can install most software packages upon request. A full range of statistical and other scientific software is available on the CSS system, including standard statistical packages (including SAS, Stata, S-plus), specialized statistical software (such as DBMSCopy, ROCKIT, nQuery, East), scientific programming languages and software (such as Fortran, C++, Matlab) and office software. All data stored on the CSS network is secure: access to the system from outside our network requires the use of a software client that employs a point-to-point encryption. The UNIX operating system also provides the mechanism to limit access of specific directory trees to specific groups of users. CSS will supplement the funded Administrative Coordinator for the Core with a modest amount of in-kind administrative support in the form of existing clerical and secretarial help, assistance with grant and subcontract preparation, access to conference rooms and office equipment. The Core will pay a nominal fee to CSS to offset the cost of maintaining multiple-user site licenses for statistical software and for maintaining updated operating systems, having full access to the computing network (including associated software and dedicated hardware), and software and systems support for core personnel.

**Center for Computation and Visualization (CCV):** The mission of CCV is to provide the scientific and technical computing expertise required to advance computational research and support Brown's academic mission. The accelerated transformation of the pace and impact of computational approaches led to Brown University's recognition of the importance of high performance computing across all of its disciplines. As a result, Brown and IBM developed in 2009 a \$4M investment in a high performance computing platform, known as Oscar, that is available statewide to researchers. Through grant funding and University investment, this platform has undergone continual hardware enhancement, and now includes Intel Scalable Processors and nVIDIA GPUs of the Pascal and Volta architectures, as well as 100Gb/s EDR Infiniband. The equipment is maintained and operated by the staff of the Center for Computation and Visualization (CCV), who have extensive experience in operating shared computational clusters. CCV staff are responsible for scheduled maintenance, access control as needed, and integration with research specific hardware as required by NIH-funded researchers. CCV staff also take care of all financial aspects of operating and maintaining the facility.

The high performance computing resources at CCV equip the Brown research community to undertake complex numerical simulation, modeling, and data analysis. Oscar is the primary research computing cluster with several hundred multi-core nodes sharing a high performance interconnect and file system. Applications can be run interactively or scheduled as batch jobs. Several large memory nodes provide substantially more memory than

is available on typical workstations and laptops. A large collection of software is available on CCV systems, including:python, perl, R, Matlab, Mathematica, Maple, optimized math and science libraries, and domain-specific applications. CCV staff can help acquire and install most applications upon request. The technical specifications of Oscar are:

- Two login nodes provide access for application development, debugging and batch job management
- About 400 compute nodes up to current specs of dual multi-core processors and 128 GB of memory and a total of more than 8,000 cores
- Specialized nodes containing GPU processors or 512 GB of memory
- High-bandwidth/low-latency Infiniband interconnects
- All nodes are diskless with I/O provided by an IBM GPFS parallel file system
- 1 PB of usable disk space
- RHEL 7.3 Linux operating system
- SLURM workload manager

CCV provides storage for large research files connected to the HPC system. A default allocation of 256 GB (also called RData) is given to all faculty members at Brown, on a per request basis, with the option of purchasing additional storage as needed. Long-term storage and backups are available on a fee basis. Storage can be purchased in increments of terabytes for periods of up to 6 years. The cost for backups is included when storage is purchased. Data is incrementally backed up to tape on a daily basis. In addition, snapshots for the last 7 days are available online for quick restores. Long-term archiving of files to tape (one or two copies) can be purchased as needed. Tape libraries are housed at two separate locations to enable disaster/recovery scenarios. In addition, a disaster recovery copy of the non-ephemeral data is kept on a lower-performance filesystem to permit immediate recovery and limited production computing in the unlikely event of the loss of the primary filesystem. These research storage allocations can be easily mounted to desktops or other computer systems to allow for easy access and sharing files. Details of HPC file storage at CCV:

- Rdata is accessible from all CCV systems (/gpfs/data)
- Can be mounted to all desktops on Brown's campus network
- Is backed up on a daily incremental basis
- Rdata allocations can be increased by purchasing additional storage
- Home directory on Oscar: All users will have access to a home (/gpfs/home) allocation of 10 GB. This allocation is backed up on a daily basis
- Group storage: Premium accounts will be entitled to an additional allocation of 256 Gb that may be merged with RData (for primary PI). Likewise, group premium accounts will be entitled to additional 25 GB per user.
- Snapshots: Daily snapshots are available for both RData and Home file systems for seven consecutive days.
- Scratch: Space for temporary files is available as (/gpfs/scratch). These files are not backed up and scratch space is strictly for temporary files. Files may be purged after 30 days or as the file system is being utilized. This allocation will be managed by an application called xdisk (time versus space) (work in progress).
- Sharing data: Sharing files that are too big to be sent via email. There is a 10 GB quota and a limit of 2 GB per file.
- Users can access RData from the CIFS share. This can be mapped as a drive in Windows and mounted in Mac OS X and Linux from any campus system (off-campus use requires a VPN connection to campus). Users can also access files by using a file transfer tool like Secure Copy (SCP), Secure FTP (SFTP), or rsync.

A key benefit of using these computing resources is that CCV installs and maintains a large collection of computational research software. CCV can install most software packages upon request. A full range of statistical and other scientific software is available on the CSS system, including standard statistical packages (including SAS, Stata, S-plus), specialized statistical software (such as DBMSCopy, ROCKIT, nQuery, East), scientific programming languages and software (such as Fortran, C++, Matlab) and office software. All data stored on the CSS network is secure: access to the system from outside our network requires the use of a software client that employs a point-to-point encryption. The UNIX operating system also provides the mechanism to limit access of specific directory trees to specific groups of users. CSS will supplement the funded Administrative Coordinator for the Core with a modest amount of in-kind administrative support in the form of

existing clerical and secretarial help, assistance with grant and subcontract preparation, access to conference rooms and office equipment. The Core will pay a nominal fee to CSS to offset the cost of maintaining multiple-user site licenses for statistical software and for maintaining updated operating systems, having full access to the computing network (including associated software and dedicated hardware), and software and systems support for core personnel.

## Virtual Reality Systems

### CCV - YURT

<https://it.brown.edu/services/type/virtual-reality-systems>

YURT: The YURT Ultimate Reality Theatre (YURT) is a state-of-the-art projection based VR theatre, with over 69 HD stereo projectors that display onto 145 mirrors, full 360° surround view, floor and ceiling, and camera based tracking system with submillimeter accuracy. The system is approximately 12x8x9 feet in size, and can accommodate groups up to 10 people. The YURT is coupled to the CCV High Performance computer system, allowing for even more flexibility when visualizing large and complex data sets. The YURT displays over 100 million stereo pixels and the HD projectors are driven by 20 nodes of the CCV HPC cluster. At normal viewing distances, the pixels are smaller than are resolvable by the human retina. The screen consists of translucent polycarbonate. The front wall is 25 feet long and 8 feet high and spans 180 degrees of view. The screens are suspended, along with half of the projectors, from an aluminum superstructure, with a catwalk for maintenance. The blending and warping that create one image from many projectors is proprietary, from the Scalable Display company, but this library has been licensed to be incorporated into many different applications and software libraries. Many of the applications that run in the YURT use vrg3d, a virtual reality graphics package developed and maintained in the Computer Science Department. Other scientific and analysis packages have already been successfully incorporated into the YURT, including Blender, a popular open-source 3D modeling game engine, and Paraview, a widely-used scientific graphics and analysis package.

### CCV - Cave

<https://it.brown.edu/services/type/virtual-reality-systems>

Cave: The Cave is the predecessor to the YURT, sharing many of the YURTs characteristics as well as applications. Arranged in an 8 foot cube, the Cave utilized 7 stereo projectors and a similar camera based tracking system. CrystalEyes LCD-shutter glasses provide stereo depth-perception, and a variety of Intersense and Polhemus tracking devices allow software to track the position of a user's hand, head, wand, etc. The Cave also has a multi-speaker sound system that provides positional audio. Some existing software that can be used in the system currently include volume visualization, molecular visualization, and simple 3d model manipulation.

## High-Bandwidth Fiber Connectivity

High-Bandwidth Optical Fiber Connectivity: An NSF-EPSCoR Infrastructure Improvement Award to Brown University (Dr. Edward Hawrot, PI) now provides 10Gbps per lambda (laser light wavelength) connection between Brown's Laboratory for Molecular Medicine at 70 Ship Street, the new Medical School building located in the heart of Providence's historic Jewelry District and the core campus. Similar high-bandwidth connectivity is provided to a nearby university branch building on the edge of the Jewelry District that is home for Statistical Sciences and the School in Public Health. Other nodes provide connection to the core Brown network on campus, the OSHEAN network terminus in the Foundry building located in downtown Providence, the University of Rhode Island Providence campus at 80 Washington Street where the URI's Providence Biotechnology Center is located. The lambda connection now connects us to other EPSCoR institutions in New England. OSHEAN access from the Foundry node provides 10 Gbps per lambda connectivity to Boston and New York and beyond.

### UFunds

<https://ithelp.brown.edu/kb/ufunds>

UFunds is a system developed at Brown to allow for custom applications and a standardized processing workflow. Despite the name, UFunds is not just for handling financial awards. It can support anything where a given office has some initiative or program for which they wish to accept applications. For example, it has been

used to support applications to participate in academic programs, as well as Brown's part in Fellowships applications for outside awards such as the Fulbright. Users can apply for various "opportunities" using UFunds. Opportunities in UFunds are managed by Brown faculty and staff. They may be available to the entire Brown community or restricted based on criteria such as student/faculty/staff or class year.

One key function UFunds provides is transparency. UFunds tracks everything that a user applies for, and by default that history is made available to approvers. This allows for more informed decisions in cases where a given applicant might have applied for funding from multiple sources. Approvers do have the ability to flag applications "private" so that they are not made visible to other approvers. Note that UFunds is not a place to publicize opportunities. UFunds only displays opportunities that are currently accepting applications, and there is no mechanism to show past or future opportunities. Because of this, you may still need an external site to provide details about your program(s), especially outside the application period.

## **CORE AND SHARED RESEARCH FACILITIES**

### **CoresRI.org.**

<http://www.coresri.org>

Rhode Island universities, colleges and academic medical centers across the state collaborated to develop the CoresRI.org website ([www.CoreRI.org](http://www.CoreRI.org)); a directory of core research facilities, services and instrumentation in Rhode Island. Development of CoresRI grew out of a need to maximize awareness and optimize utilization of these important core facility resources within the state. Besides encouraging equipment sharing and reducing duplication of services, CoresRI.org fosters collaborations and enables investigators to better assess future shared equipment needs. The CoresRI directory catalogs instruments (specific makes, models, and uses), services, resources, locations, and contact personnel. Through the directory, researchers can easily search for instruments and services and directly link to the core facility's website for more detailed information. The site currently lists over 953 instruments, services or resources located within 148 facilities at 19 institutions and 84 centers.

### **BioMed Core Research Facilities**

<https://biomedcorefacilities.brown.edu/>

BioMed Core Research Facilities. Graduate student education and research training at Brown University benefits from a wide range of [cutting](#)-edge facilities, instrumentation, and other resources to support these endeavors. Brown University's Shared Technology Resource (Core) Facilities function at the level of service, research, and teaching. Serving as centers of intellectual exchange and collaboration, each technology-focused core provides a broad spectrum of investigators access to innovative instrumentation, current technologies, and expert consultation. The facilities are financed by a mixed funding model that includes grant awards, user fees, and institutional support. Additional cost effectiveness and efficiency are achieved by decreased equipment duplication, economy of scale savings, improved quality control, and rapid turnaround times. Advanced technology platforms of similar scale and productivity would not be financially feasible for any individual lab to purchase, upgrade, and maintain. Each facility is staffed by highly trained personnel that provide exceptional customer service and resource management. The timely acquisition of new instrumentation in the core facilities and the frequent implementation of new technologies facilitate faculty recruitment, education, and training of students, and support research funding. Faculty oversight and facility user committees advise the core directors. The cores are supported by a Director of Research Operations, a Core Facility Program Manager and two Financial and Administrative Coordinators.

### **BioMed - The Center for Animal Resources and Education (CARE)**

<https://animal-care.brown.edu/>

The Center for Animal Resources and Education (CARE): Brown University shares a mission with other institutions of higher learning in the responsibility to advance the understanding of living organisms through studies of the behavioral and biological processes upon which their survival and well-being depends. Research involving laboratory animals has an essential role in this process. There are approximately 70 Brown-based or



Brown affiliated investigators who use vertebrate animals in their research and approximately 115 active IACUC protocols each year.

The CARE program at Brown University is accredited by the Association for the Assessment and Accreditation of Laboratory Animal Care, International, (AAALAC), and is registered with and inspected by the U.S Department of Agriculture (USDA). Brown's Assurance of compliance with the Public Health Service Policy on Humane Care and Use of Laboratory Animals has been reviewed and accepted by the Office of Laboratory Animal Welfare (OLAW) of the National Institutes of Health (NIH). All animals are maintained in accordance with the National Research Council Guide for the Care and Use of Laboratory Animals. The CARE program is directed by attending veterinarian Lara Helwig, D.V.M., a diplomat of the American College of Laboratory Animal, Medicine, (ACLAM). The facility is staffed by three full-time veterinarians, all ACLAM diplomats. The veterinary staff provides veterinary services to research investigators at three of the area hospitals affiliated with the Warren Alpert Medical School. They are responsible for the health care of all animals in the facilities, the review of all IACUC-approved animal care and use protocols, appropriate training/procedural oversight for investigators, and assisting investigators in any animal related queries. The veterinary staff is on site and a clinical veterinarian is available at all times. Animal care staff provides daily feeding, watering and cleaning to all species. Veterinary technicians provide health surveillance and technical assistance. Brown's animal facilities include specialized housing and equipment for a wide variety of species. Dedicated surgical suites are available as well as dedicated procedural areas. A radiological suite is available and an ethylene oxide (ETO) sterilization machine for items that cannot withstand pressures and or temperatures of steam autoclaving.

**Campus Facilities:** Brown's animal facilities include specialized housing and equipment for a wide variety of species. Dedicated surgical suites are available as well as dedicated procedural areas. A radiological suite is available and an ethylene oxide (ETO) sterilization machine for items that cannot withstand pressures and or temperatures of steam autoclaving. Brown University Animal Care maintains a steadfast commitment to supporting research to the highest contemporary standards. Please contact the Animal Care Office for consultation about or assistance with any planned or current research animal needs.

**Hospital Facilities:** All animals are housed at the Rhode Island Hospital Central Animal Care Facility (11,000 sq. ft., including four procedure rooms). The facilities are operated in full compliance with USPHS policy, with oversight by the animal welfare committee. The animal facility is AAALAC approved (7/1/96; Multiple Assurance no A 3922-01). The hospital-based animal care program is also directed by Lara Helwig, an ACLAM diplomat. The facility is staffed by 3 full-time veterinarians, all ACLAM diplomats.

### **BioMed - Bioimaging Facility Leduc**

<https://biomedcorefacilities.brown.edu/bioimaging-facility>

This facility has two separate building locations, one of them being at the Laboratories for Molecular Medicine and one at the Sidney Frank Hall for Life Sciences. The facility has a PhD-level director and an MS-level microscopist manager. Instrumentation includes a Thermo Apreo Volume Scope (VS) SEM for serial block-face imaging, a Philips 410 transmission electron microscope with a goniometer stage, low-dose imaging equipment, and ATM digital imaging system. The facility also houses an FV1000 Olympus multiphoton laser scanning microscope, an Olympus FV3000 confocal imaging microscope, Zeiss LSM880, LSM800, and LSM710 confocal laser scanning microscopes, two Nikon Ti2-E high-content analysis fluorescence microscopes, two Zeiss Axiovert 200M fluorescence microscopes with DIC, phase contrast, and a stage heater for live imaging, a Zeiss Lumar fluorescence stereomicroscope, and an Olympus VS200 Research Slide Scanner. The facility provides operational oversight of the Opera Phenix high-content screening system in the Center for Alternatives in Animal Testing at the Laboratories for Molecular Medicine. The facility also maintains equipment for sample preparation, including a critical point dryer, sputter coater, glow discharge unit, and a Leica EM UC7 ultrathin microtome. MetaMorph software is available for image analysis. Training in microscopy, image analysis, and ultrathin sectioning is provided at both sites.

**BioMed - Drosophila Media Facility**

<https://biomedcorefacilities.brown.edu/drosophila-media-facility>

This facility is located at the Biomedical Center and is overseen by the Director of the Multidisciplinary Teaching Laboratories and staffed by a full-time technical assistant. The Facility provides investigators with high-quality media for Drosophila research and genetic stock maintenance. To provide large and small quantities of media, this centralized kitchen is equipped with a food-service quality Cleveland Range Kettle MKET-12-T. Media is pumped into trays of vials or plastic bottles using a Gilson Fly Food Dispenser. Used glass vials are returned to the facility where they are sterilized in a Steris autoclave and washed in a Northwestern Systems G403 electric heat glassware washer.

**BioMed - Flow Cytometry and Sorting**

<https://biomedcorefacilities.brown.edu/flow-cytometry-cell-sorter-facility>

This facility, located at the Biomedical Center, is directed by a PhD-level investigator and staffed by a full-time manager. The primary instrument is a Becton Dickinson FACSAria III, a 5-laser, 20-parameter instrument with analytical and sorting capabilities for up to four populations, bead-based immunoassays, and DNA cell cycle analysis. The five lasers are blue 488nm, yellow/green 561nm, red 633nm, violet 407nm and UV 375nm. A fixed-alignment cuvette flow cell provides excellent fluorescence sensitivity. The facility houses a 3-laser, 15-parameter BD FACSCelesta with blue 488nm, violet 407nm, and yellow/green 561nm lasers and equipped with a high throughput system for analysis of samples from 96 well plates. The facility also houses a four laser Cytex Aurora with blue 488nm, red 640nm, violet 405nm and UV 355nm lasers. This instrument can analyze up to 54 channel, 57 parameters and is equipped with an auto sampler loader. Consultation is available. A computer workstation with FlowJo software is provided for facility users.

**BioMed - Genomics**

<https://biomedcorefacilities.brown.edu/genomics-facility>

This facility is located at the Laboratories of Molecular Medicine and staffed by a full-time PhD-level director. It provides investigators access to a variety of advanced instrumentation and training. DNA sequencing services are provided using an Illumina NextSeq 550 Sequencing System. Instrumentation housed in the facility includes a Nanostring nCounter® SPRINT™ Profiler, an Affymetrix Gene Chip Workstation, two ABI ViiA™ 7 Real-Time PCR Systems, a BIO-RAD QX200 Droplet Digital PCR, an Advanced Analytical Fragment Analyzer, a Cytation 5 Plate Reader, a Synergy H1 Hybrid Multimode (H1MM) Microplate Reader, a Covaris S220 Ultra-Sonicator, an Agilent 2100 Bioanalyzer, a LI-COR Odyssey Infrared Imaging System, a Countess Cell Counter, an AXON GenePix 4000B Scanner, a Beckman Optima Max Ultracentrifuge, and a Nanodrop ND 1000.

**BioMed - Herbarium**

<https://www.brown.edu/research/projects/herbarium/>

Herbarium: The Brown University Herbarium was founded in 1869 when the University acquired the collections of Stephen Thayer Olney. The collection includes around 100,000 plant specimens and is an important repository of Rhode Island and New England collections. We also have specimens from all 50 U.S. state (plus the District of Columbia) and the collection is rich in western and southern North American plants including sets of historically valuable specimens from 19th and early 20th century western U.S. expeditions. Among other important collections, the Herbarium also includes a set of Charles Wright's Cuban plants (1856-1867), Cyrus Pringles's plants of Mexico (1885-1909) and a unique and classic collection of Carex assembled by Stephen Olney. The Herbarium continues to be active and over the past few years we have added around 2,000 specimens to the collection. These include new collections made by faculty and students at Brown in addition to gifts from other herbaria.

## **BioMed - Informatics Services Brown Center for Bioinformatics (BCBI) - Advance-CTR**

<https://www.brown.edu/academics/medical/about-us/research/centers-institutes-and-programs/biomedical-informatics/research>

Informatics: Informatics services are provided by the Brown Institute for Biomedical Informatics (BCBI) and COBRE for Computational Biology of Human Disease (CBHD) and accessed through the Advance-CTR service portal. BCBI reviews the request for assistance and assigns it to the appropriate informatics or data analyst. The overarching research goals of BCBI are to develop, deploy, and evaluate computational and data science approaches to best use biomedical and health data for improving patient care. To this end, our research activities are a major application area for programs such as those within Brown's Data Science Initiative. Specific areas of core service are:

Computational Biology: The Computational Biology Service provides help for experimental design and data processing pipelines for high-throughput datasets generated in individual projects, particularly for DNA/RNA sequencing data. Our services are broadly categorized into:

- **Development: R/Python Packages** – The Core will provide help with packaging R, Python and Julia code and work with computational biologists to convert their code to make it easily shareable. The Core will help with the implementation and maintenance of web apps using the latest technologies for projects requiring web enabled interfaces.
- **Consulting** – A team of experienced computational biologists and biostatisticians are on-hand to help investigators design experiments.
- **Data Analysis:** The core provides assistance in experimental design and data processing pipelines for high-throughput datasets generated in individual projects, particularly for DNA/RNA sequencing data. Our assistance falls broadly into the categories outlined below.

Translational Bioinformatics: There is significant need for analytic approaches to advance understanding of the molecular underpinnings of disease and enable such insights to be used within clinical contexts. BCBI is developing translational bioinformatics approaches for incorporating deep biological knowledge into clinical practice. These efforts aim to complement synergistic research programs at Brown, including those being led by the Center for Computational Molecular Biology (CCMB).

Clinical Informatics: Concomitant with the widespread adoption of electronic health record (EHR) systems within the healthcare data ecosystem, there is an opportunity to transform the practice of medicine through effective use of digital data. Within BCBI, the Clinical Informatics Research and Discovery (CIRD) Laboratory is studying and using EHR data from clinical partners (focusing initially on partnerships with Care New England and Lifespan Health System, with plans to also partner with the VA Providence Healthcare System) for supporting clinical practice as well as research programs.

Public Health Informatics: The emergence of health information exchanges and population-level monitoring systems presents an unprecedented opportunity to develop computational approaches for studying healthcare delivery and quantifying the impact of healthcare reform initiatives. In partnership with the Brown University School of Public Health, Rhode Island Quality Institute (RIQI), and Rhode Island Department of Health (RIDOH), informatics approaches are being developed to support research motivated by state needs.

## **BioMed – Informatics Services - Computational Biology Core (CBC), COBRE CBHD**

<https://cbc.brown.edu/>

The primary mission of the CBC core of the COBRE for Computational Biology of Human Disease (CBHD) is to support junior Investigators in the analysis and interpretation of high-throughput DNA/RNA sequencing datasets, including data generated in their laboratories and large, publicly available datasets. The Core also facilitates scientific interactions among the projects in the COBRE. The long-term goal of the CBC is to provide a sustainable resource to support data analysis challenges faced by genomic studies across Brown University and our affiliated hospitals. The Core also provides training for the broad research community to ensure the sustainability of the next cohort of junior investigators.

### **BioMed - Magnetic Resonance Imaging**

<https://www.brown.edu/carney/mri/>

The Brown University MRI Research Facility, located at Sidney Frank Hall, occupies a 3,000-square-foot research suite. This facility is directed by a PhD-level investigator, managed by two PhD-level Associate Directors, and staffed by a registered radiography technologist specialized in magnetic resonance imaging. The facility provides infrastructure and support to facilitate research and educational activities using magnetic resonance imaging technology. The centerpiece of the facility is a state-of-the-art Siemens 3 Tesla PRISMA scanner. The scanner is equipped with 64 receiver channels for significant gains in signal-to-noise ratio and acquisition speed. The MRF is affiliated with the University's Robert J. and Nancy D. Carney Institute for Brain Science and is a resource available to Brown researchers and those at Brown affiliated hospitals. Ongoing research includes studies of brain structure and function in normal and clinical populations as well as studies of other body systems, non-invasive animal imaging and materials science.

### **BioMed - Molecular Pathology Core Research Laboratory**

<https://biomedcorefacilities.brown.edu/molecular-pathology-core>

Molecular Pathology Core Research Laboratory. This facility, located at the Laboratories for Molecular Medicine, is supervised by an MD-PhD-level pathologist and staffed by a full-time manager and research assistant. The facility provides access to histopathological, immunohistochemical and immunocytological technologies. Processing, embedding, sectioning, and staining of specimens is provided. The instrumentation includes a Leica EG1160 embedding center, a Leica CM3050S cryostat, a Micron HM355 rotary microtome for paraffin sections, a Leica RM2265 rotary microtome for thick and semi-thin plastic sections and paraffin sections, a Leica ASP300 S Automated Vacuum Tissue Processor, a ScanScope CS digital slide scanning system from Aperio Technologies, a Fujix Bas 1000 phosphor imager, a Nikon Eclipse TS100 inverted fluorescence microscope, a Nikon E800 microscope with a digital camera, a Leica VT1000S Vibratome for soft tissue sectioning, and an Arcturus PixCell II laser capture microdissection system.

### **BioMed - Transgenic and Gene Targeting Facility**

<https://biomedcorefacilities.brown.edu/transgenic-gene-targeting-facility>

Mouse Transgenics and Gene Targeting. This facility, located at the Laboratories for Molecular Medicine, is directed by a PhD-level research investigator and employs a full-time facility manager and research technician. Services include provision of CRISPR technologies for genome modification and editing, pronuclear injection of DNA into fertilized eggs, injection of gene targeted embryonic stem cells into blastocysts, and embryo cryopreservation. The facility provides genotyping services and individual investigators are responsible husbandry and breeding of generated mouse strains. Facility instrumentation includes a Nikon SMZ1500 dissection microscope, a Nikon Eclipse TE200 inverted microscope equipped with Eppendorf Transferman NK2 micromanipulators and an Eppendorf FemtoJet microinjector, a Nikon Eclipse TS100 inverted microscope, a Nikon SMZ800 surgical microscope, a Neon Transfection System MPK5000S, a Bio-Cool Controlled Rate Freezer, a Piezo Impact Drive, a NanoDrop Lite UV-Vis Spectrophotometer with printer, and a CBS V1500AB isothermal liquid nitrogen storage system.

### **BioMed - Plant Environmental Center**

<https://www.brown.edu/academics/ecology-and-evolutionary-biology/about-us/facilities/plant-environmental-center>

The Plant Environmental Center at Brown University is located atop the IBES building at 85 Waterman Street. The facility is comprised of six computer controlled research greenhouses totaling approximately 5,000 square feet. These greenhouses are used for research experiments, as well as to house various plant collections used to support biological science classes. In addition, this rooftop space includes an 1800 square-foot conservatory open year around. The collection in the conservatory includes many plant families, including a diverse collection of Cycads, Orchids, Aroids, and many plants from the Amazon region. Many of these plants have medicinal and ceremonial uses and are part of our Ethnobotanical collection. The greenhouse facility also consists of a head house, classroom, and plant growth chamber laboratory. The plant growth laboratory consists of eight E7/2 Conviron plant growth chamber units, as well as two eighty square-foot walk-in chambers and one eighty square-

foot cold room. These units are primarily used by graduate students and faculty performing research with very specific cultural requirements that cannot be maintained in the greenhouses

### **BioMed - Proteomics**

<https://biomedcorefacilities.brown.edu/proteomics-facility>

The Proteomics facility, located at the Laboratories for Molecular Medicine, is directed and staffed by a PhD-level scientist. Facility instrumentation includes a Thermo Scientific Q Exactive™ Hybrid Quadrupole-Orbitrap Mass Spectrometer, a Jasco J-815 Circular Dichroism Spectropolarimeter, MicroCal VP Differential Scanning Calorimeter, a MicroCal Isothermal Titration Calorimetry (iTC) 200, HORIBA Jobin Yvon FluoroMax-4 Spectrofluorometer, a GE AktaPrime Plus Protein Purifier, an Eksigent 2D+ ultra-high-pressure liquid chromatography system (UHPLC), an Agilent 1200 HPLC, and a Minifors fermentor.

### **BioMed – Rhode Island Biobank**

<https://biomedcorefacilities.brown.edu/rhode-island-biobank>

The Rhode Island Biobank, located in the Biomedical Center and Laboratories for Molecular Medicine, is a human tissue and fluid sample cryogenic storage facility for investigators located at Brown University and the affiliated hospitals of the Warren Alpert Medical School. This facility, staffed by a research technician, provides a secure, state-of-the-art biorepository to store human biological samples. Facility equipment includes four (4) -80°C freezers, three (3) 4°C refrigerators, and two (2) Taylor Warton liquid nitrogen freezers each capable of holding 40,000 1ml samples. The facility offers consultation regarding best practices in biobanking and biospecimen inventory management.

### **BioMed - Water Flume**

<https://engineering.brown.edu/fluid-dynamics-testing-facilities-fdtf>

The Department of Ecology and Evolutionary Biology was awarded a grant from the NSF to establish a core research facility for a 3,500-gallon water flume. Measuring 80 cm in width, 60 cm in height, and 440 cm in length, the flume is based on a recirculating design with the flow loop arranged in a horizontal configuration. With its ability to regulate flow rate patterns up to 1 m/s, the flume offers researchers a wide array of simulated conditions. Principal investigators use the flume to replicate situations normally found in the field.

### **BioMed- Structural Biology**

<https://biomedcorefacilities.brown.edu/structural-biology-facility>

Structural Biology Facility. The facility, located at the Laboratories for Molecular Medicine, is directed and managed by two PhD-level scientists. The facility houses instruments for NMR spectroscopy and X-ray crystallography. The facility instrumentation includes Bruker AVANCE III HD 850 MHz, Bruker NEO 600MHz NEO, and Bruker AVANCE II 500 MHz spectrometers. The 850 and 600 MHz spectrometers are equipped with TCI cryoprobes and have nitrogen liquefiers. The 500 is currently equipped with a TXI HCN room-temperature probe. Room-temperature probes are also available for the 850 and 600 MHz spectrometers. All spectrometers are operated by Linux workstations running Bruker TopSpin software. For protein crystallographic research, the facility instrumentation includes a Rigaku MicroMax-003 microfocus sealed tube X-ray generator and Saturn 944HG detector. The setup is equipped with ACTOR crystal mounting robot that can be operated using the J Director software from a Linux workstation.

### **BioMed - X-ray Reconstruction of Moving Morphology (XROMM)**

<https://biomedcorefacilities.brown.edu/xromm-facility>

The XROMM facility, located at the Biomedical Center, is directed by a PhD-level scientist and staffed by a research technician. XROMM is a 3D imaging technology for visualizing rapid skeletal movement in vivo. XROMM combines 3D models of bone morphology with movement data from biplanar X-ray video to create highly accurate re-animations of the 3D bones moving in 3D space. Rapid bone motion, such as during bird flight, frog jumping and human running, can be visualized and quantified with XROMM. Facility instrumentation includes mobile C-arm OEC 9400 Fluoroscopes and a biplanar X-ray room containing two Varian model G-1086 X-ray tubes, 2 EMD Technologies model EPS 45-80 pulsed X-ray generators, two Dunlee model

TH9447QQXH590 image intensifiers (16 diameter), and 2 Phantom v10 high-speed digital video cameras. The facility also has a veterinary Animage Fidex CT Scanner, a CT scanner designed for animals in the size range from rats to dogs and a SKYSCAN 1276 in vivo micro-CT system for scanning small laboratory animals and biological samples.

### **Chemistry - Electronics Shop**

<https://www.brown.edu/academics/chemistry/about/facilities-services/electronics-shop>

Chemistry Electronics Shop: The Electronics Workshop is utilized for repairing small electronic equipment and for custom design related to the department's research instrumentation.

### **Chemistry - Machine Shop**

<https://www.brown.edu/academics/chemistry/about/facilities-services/machine-shop>

Chemistry Machine Shop: The Department of Chemistry offers a full-service fabrication Machine Shop in which two full-time machinists—with a combined industrial and academic experience of more than 60 years—fabricate specialized tools and equipment that support the department's cutting-edge chemistry research. Utilizing the latest in computer aided design and precision manufacturing, staff work side-by-side with faculty and students to develop prototypes and custom-made parts. In addition to the fabrication of new equipment, the Machine Shop repairs and maintains scientific research equipment. There are over 15 machines available; for milling: one Birmingham 4-axis CNC bed mill, two Bridgeport 42 2-axis knee mills, and one Acra 55 2-axis knee mill. For lathing: one Clausing 17 swing, one Clark 14 swing, one Hendey 13 swing, one Clausing 11 swing. For grinding: one Okamoto surface grinder. For cutting: one Doall cutoff saw and one Doall 13 bandsaw. For drilling: one Deltra drill press. For welding: one Heliwelder 251 Tig welder, one Millermatic 212 Mig welder, and one Acetylene torch for brazing.

### **Chemistry - Mass Spectrometry Facility**

<https://www.brown.edu/academics/chemistry/about/facilities-services/mass-spectrometry-facility>

Chemistry Mass Spectrometry Facility: The Mass Spectrometry Facility in the Chemistry Department provides support for the analysis of a wide range of molecules using mass spectrometry based techniques, including a suite of modern instrumentation. The facility maintains two GC-MS (Agilent 5973N and Agilent 5977A), three LC-MS (Agilent 6530, Thermo LCQ Deca XP Max, Thermo LXQ linear ion trap), Bruker autoflex MALDI-TOF Bruker autoflex MALDI-TOF, and a stand-alone HPLC system (Agilent 1260 Infinite LC). The mass spectrometers offer electron impact (EI), electrospray (ESI), atmospheric chemical ionization (APCI), and matrix assisted laser desorption ionization (MALDI) ionization modes that cover a variety of analytes of interest. Available software resources include instrument control and data analysis programs Xcalibur, MassHunter, ChemStation, SpectrumMill, Bioworks/Sequest. Routine mass spectrometric measurements performed in the facility include HRMS molecular formula confirmation, structural elucidation by MS<sup>n</sup> tandem mass spectrometry, qualitative as well as quantitative analysis of small molecules: synthetic intermediates, natural products, metabolites, and organometallics. For macromolecules, we offer mass analysis of synthetic polymers, peptides and purified intact recombinant proteins and synthetic oligonucleotides.

### **Chemistry - NMR Facility**

<https://www.brown.edu/academics/chemistry/about/facilities-services/nmr-facility>

Chemistry NMR Facility: The Chemistry NMR facility has two locations: the GeoChem Building, 156 George St, and the MacMillan Building, 167 Thayer St. These two locations contain four Bruker high field NMR spectrometers and two Bruker data processing stations: a ZEUS GC410 - 400 MHz with z-BBO probe; an ARTEMIS GC410 - 400 MHz with z-BBFO probe; a CRONUS GC410 - 600 MHz with z-BBFO probe; an ARIES MM315 - 300 MHz with z-BBi probe; a HELIOS GC410 Processing Station; and a Caerus GC410 Processing Station. In addition, a 10ul Capillary NMR Probe and a 5mm z-TXI are available for the 400MHz spectrometers and can be installed upon request. A 600 MHz z-BBO that can lock on 19F on the 1H channel, and observe 2H on the BB channel, as well as a z-TXI probe are available for the 600 MHz Spectrometer.

### **Chemistry - Research Facilities**

<https://www.brown.edu/academics/chemistry/about/facilities-services>

Chemistry Research Facilities: The Chemistry Department is located in the Geology-Chemistry Research Building (GeoChem), housing both the Departments of Chemistry and Earth, Environmental, and Planetary Sciences. The Chemistry Department facilities include fully equipped research laboratories, dedicated laboratories for NMR and Mass Spectrometry, radioisotope use, fully staffed chemistry stockroom, machine shop, and an electronics workshop, as well as classrooms and office space. W. Duncan MacMillan Hall, directly attached to the GeoChem research facility, houses state-of-the-art teaching labs for chemistry, geology, and environmental sciences, as well as two lecture auditoriums.

### **DEEPS - Climate& Environmental Facilities**

<https://www.brown.edu/academics/earth-environmental-planetary-sciences/research-areas/earth-systems-history-esh/esh-facilities-data-and-software>

DEEPS Climate & Environment Facilities: Analytical facilities of the Climate & Environment group include top-notch facilities for mass spectrometry, organic and inorganic geochemistry, and sedimentology. Instrumentation and facilities include: Mass Spectrometry, field and laboratory equipment for lake sediment and soil sampling, coring and analysis; Brown Global Foraminifer and North American pollen databases; gas isotope ratio mass spectrometers for carbonate and organic samples; gas chromatograph-mass spectrometers; accelerated solvent extractors for organic samples; CHNS analyzers; X-ray fluorescence analysis facility; Jobin ICP-ES; particle size counter, estuarine oceanography equipment. Planetary studies: RELAB spectroscopy database of spectra of lunar and meteoritic materials; visible to mid-IR spectroscopy (multiuser facility supported by NASA); NASA Planetary Data Center, including image data from all major planetary missions; image-processing laboratories. Data and Software include the Arand Software Package, Brown Foraminiferal Database, Match 2.3.1 - Dynamic Programming Software, Bermuda Forum Data, Modern Analog Technique (MAT) package, NEMPID database NEMPID database James W. Bradley, editor, version 1.1, April, 2001), fr: Newby et al., QSR 24 (2005).

### **DEEPS - Geochemistry/Mineralogy/Petrology Facilities**

<https://www.brown.edu/academics/earth-environmental-planetary-sciences/research-areas/geochemistrymineralogypetrology-gmp/gmp-facilities>

DEEPS Geochemistry/Mineralogy/Petrology (GMP) Facilities: The geochemistry laboratories are well equipped for the application of chemical and particularly isotopic techniques to the solution of geologic problems. Equipment includes: automated mass spectrometers capable of analyzing both light and heavy elements, including O, C, Rb-Sr, Sm-Nd and U-Th-Pb, and all the necessary chemical and vacuum equipment to support mass spectrometer operations; a clean laboratory for the preparation of samples for isotopic analysis, including bombs and abraders for U-Pb zircon, monazite and sphene analyses; pressure vessels for experimental research, capable of operating continuously up to 1200°C and 3000 bars pressure; modern petrographic and binocular microscopes with conventional and digital photographic attachments; the usual ancillary gear used in mineral separation and sample preparation.

The thermal ionization mass spectrometer is an automated Finnigan-MAT 261 multicollector with 6 Faraday cups and an axial secondary electron multiplier (SEM), permitting simultaneous SEM/Faraday analysis of radiogenic Pb. There is also ready access to a Cameca electron microprobe and an XRF spectrometer for major and minor element analysis, both housed in the Department, and Cameca IMS-3f and Cameca 1270 ion microprobe microanalyzers housed at the Woods Hole Oceanographic Institution.

The facilities used by the experimental petrology/volcanology group include two experimental laboratories with numerous hydrothermal pressure vessels (Cold seal Rene and TZM), a 14 kb internally heated pressure vessel, two piston-cylinder vessels, and sample preparation equipment. Analytical facilities include a CAMECA SX-100 electron microprobe, an XRF spectrometer for analysis of major and trace elements. There is a new FTIR spectrometer in the Department.

## DEEPS - Geophysics Facilities

<https://www.brown.edu/academics/earth-environmental-planetary-sciences/research-areas/solid-earth-dynamics-research/solid-earth-dynamics-facilities>

DEEPS Geophysics Facilities: Brown is well equipped for experimental studies. The high-pressure, high-temperature experimental rock deformation laboratory has three Griggs-type piston-cylinder apparatus designed for conducting experiments at temperatures up to 1200°C, pressures up to 1500 MPa, and time durations up to several months. This allows study of the deformation mechanisms and rheology of rock samples at conditions including those of the entire crust and upper mantle.

The lab also has a unique high-pressure rotary-shear apparatus capable of doing rock friction experiments to arbitrarily high displacements and torsion of solid samples to arbitrarily high shear strains. This machine uses gas as the confining medium, has a flow-through pore-pressure system, features internal measurement of displacement, torque, and axial load, and is interfaced to a UNIX computer for digital data acquisition and control. It can measure the mechanical properties of rocks and minerals with unusually high precision. The laboratory also has facilities for coring, sawing and grinding of experimental samples and for petrographic examination of the deformed samples. The Department has a thin-section lab and technician, a machine shop and machinist. A nearby central facility houses modern scanning and transmission electron microscopes.

Brown is also well equipped for theoretical and field studies. Computer facilities include many high-end workstations, a departmental parallel computing facility, a variety of printers and access to the powerful campus parallel computing and visualization resources. All the computers are networked for high-speed communication as well as internet connection with supercomputer centers across the country. Equipment for field studies includes surveying equipment and both a portable rock saw with diamond blade and a portable diamond core drill.

## DEEPS - Mass Spectrometer Analytical Facility

<https://www.brown.edu/research/facilities/mass-spectrometer/>

Mass Spectrometer Analytical Facility: The Mass Spectrometer Analytical Facility is a part of the Department of Earth, Environmental and Planetary Sciences, Brown University and is located in GeoChem building room GC-040 and GC-015. The facility houses a Thermo Scientific Neptune Plus multicollector ICP-MS, a Thermo Scientific X-series-2 ICP-MS, a Photon-Machines Analyte G2 laser ablation, a trace-metal free clean lab built by Pico Trace, and a Cameca SX-100 electron microprobe. This state-of-the-art facility invites users from around the globe who have diverse research interests. The mission of this facility is to help scientists with their cutting-edge research. Our goal is to provide most precise and accurate isotopic compositions and trace element abundances for geological, biological, environmental and material research, as well as other related research fields. This facility could be available to establish and develop new analytical method as well as routine analysis through possible collaboration.

## IMNI - Electron Microscopy

<https://www.brown.edu/research/institute-molecular-nanoscale-innovation/CoreFacilities/ElectronMicroscopyFacility>

Electron Microscopy Facility: The Electron Microscopy Facility occupies more than 3,000 square feet of space and was designed to house a suite of electron microscopes and, as such, each room has the power, cooling water supply, and HVAC necessary to run a modern microscope. These rooms have been mapped for stray fields and, being in the basement, are well isolated from vibration. The laboratory currently consists of five instruments. The FEI CM20 is available for applications that require high tilt, moderate resolution (0.23 nm). The FEI Helios - FIB is fully equipped for (near) simultaneous ion/electron beam imaging and patterning of specimens. The JSM-845 is a tungsten filament SEM, with a specimen chamber that can accept larger samples and is capable of 4.0 nm resolution at 25 kV. The 2100F is a 200 kV, field emission source, high resolution/analytical S(TEM) capable of 0.10 nm lattice resolution. The LEO 1530 VP ultra-high resolution field emitter SEM that allows for a resolution of 1 nm at a voltage of 20 kV in high vacuum and 2 nm at 30 kV in the variable pressure mode.



**IMNI - Nanofabrication Central Facility (NCF)**

<https://www.brown.edu/research/institute-molecular-nanoscale-innovation/CoreFacilities/MicroelectronicsFacility>

Nanofabrication Central Facility: The NCF is housed in approximately 1000 square feet of Class 1000 cleanroom with an additional Class 100 cleanroom for photolithography, and it provides the necessary fabrication and characterization resources for research into modern device technologies, including electronics, microfluidics, and photonics. It contains the varied pieces of equipment required for a complete fabrication sequence of devices such as transistors and lasers, and includes tools for lithography, etching, metal and dielectric deposition, and various thermal treatments. The NCF provides the primary fabrication support for faculty and students in Engineering and Physics studying nanostructures and advanced devices and provides technological services for departments, including Biology and Medicine, Chemistry, and Geological Sciences. Additionally, this facility supports graduate and undergraduate instruction, including an undergraduate Design of Semiconductor Devices experimental course that is entirely run on Nanofabrication Central Facility equipment.

Run on a user fee basis, it provides the primary fabrication support for faculty and students in Engineering and Physics studying nanostructures and advanced devices, as well as technological services to colleagues in other departments at Brown, to local industry and to researchers from other academic institutions. The laboratory currently consists of over 16 instruments. Lithography equipment: Karl Suss MJB-3 Mask Aligner, Newport-Oriel flexible Mylar-Mask Lithography System, Photoresist Spinner, Wet Chemistry Hoods. Thin Film Deposition equipment: Electron Beam Evaporator, Atomic Layer Deposition System, Lesker Lab 18, LPCVD Tool, PlasmaTherm. Plasma Etching equipment: Trion Technology Minilock II, PlasmaTherm, SPTS LPX (Inductively Coupled Plasma RIE System). Furnaces: Dopant, LPCVD Si Deposition Furnaces for 2 Substrates, Wet Oxide and Dry Oxide. Characterization tools: Dektak Profilometer, Rudolph Ellipsometer. Other tools: Wet Chemistry Workbenches, Wire Bonder.

**IMNI - NanoTools Facility (NTF)**

<https://www.brown.edu/research/institute-molecular-nanoscale-innovation/CoreFacilities/nanotools-facility>

NanoTools Facility: The NanoTools Facility comprises sophisticated characterization instrumentation, and it serves the research and teaching needs of faculty, researchers, and students in the physical and biological sciences at Brown University. It is also available for use by outside academic and industry users. The current NanoTools laboratory currently features six state-of-the-art instruments. Bruker D8 Discovery 2D X-ray Diffractometer, with Vantec 500 2D area detector and LinxEye (0D, 1D) detectors for analysis; Bruker D8 Discovery High resolution X-ray Diffractometer, which includes a line source configuration system with a LinxEye (0D, 1D) detector and a Scintillator detector; Asylum MFP-3D Origin Atomic Force Microscope; Witec Alpha 300 Confocal Raman Microscope with additional Ray Shield coupler; Bruker EMX Premium-X Electron Paramagnetic Resonance (EPR) Spectrometer; Park Scientific XE-Bio Atomic Force Microscopy (AFM) and Scanning Ion Conductance Microscopy (SICM).

**Joint Engineering and Physics Instrument Shop (JEPIS)**

<https://www.brown.edu/research/institute-molecular-nanoscale-innovation/node/255>

Joint Engineering and Physics Instrument Shop (JEPIS) The purpose of JEPIS is to assist the scientific departments at Brown University in the development of experiments, research projects and instructional classes. JEPIS offers all the basic machine shop capabilities with the addition of CNC design consultation. JEPIS also offers hands-on training and instruction through a non-credit basic machine shop course, as well as, an advanced course geared toward Graduate Students. Recent renovations and enhancements to the JEPIS Student Shop will provide students with a stronger base for their experimental studies.

JEPIS is available to all Brown University departments, and the JEPIS staff is also available to provide general advice and assistance to staff, faculty, and students in finding sources for materials and devices required for their projects or instructional classes. JEPIS operates as a nonprofit cost center, charging an hourly fee for labor plus materials used to defer operational expenses. Major technological improvements and capital expenses are not included in the hourly rate.

## Physics - Ladd Observatory

<http://www.brown.edu/Departments/Physics/Ladd/>

Ladd Observatory: The historic Ladd Observatory opened in 1891 under the direction of Professor Winslow Upton, and a regular program of transit observations and timekeeping was started in 1893. The Observatory is open to the public for telescope viewing on Tuesday evenings, weather permitting. The Ladd Observatory houses a 12 refracting telescope with a lens made by John A. Brashear of Pittsburgh following the lens design of Prof. Charles S. Hastings of Yale University. The equatorial mounting and mechanical clock drive were made by George N. Saegmüller of Washington D.C. The telescope is equipped with a filar micrometer, spectroscope, and other attachments. There are also transit telescopes, precision pendulum clocks, chronometers, and various minor instruments with historic value located at the Observatory. Today, in addition to the main telescope, the Observatory features a Boltek StormTracker, a Unihedron SQM-LE Sky Brightness Meter, and a nighttime Sky Camera. The Sky Camera camera system used at the Ladd Observatory was manufactured by Santa Barbara Instrument Group. It includes a weatherproof housing with a window that is heated to prevent condensation. The window is an optical filter that transmits light from 630 - 1000 nm (red to near infrared) and is used to block light pollution. Inside is an ST-402ME digital imaging camera which uses a monochrome 16 bit per pixel Kodak KAF-0402ME CCD chip with 9 micron pixel size. The camera body is mated to a Computar fisheye lens that gives a wide-angle view of the sky. It has a 2.6mm focal length and a 1.6 focal ratio. The field of view is about 140 x 90 degrees.

## DIVERSITY PROGRAMS

### Brown Graduate School Diversity Commitment

<https://www.brown.edu/academics/gradschool/diversity-0>

Graduate School Diversity Commitment: The Graduate School is committed to fostering a welcoming and inclusive academic community and educating and training a distinguished and diverse cohort of master's and doctoral students, as well as postdoctoral researchers. Exposure to a broad range of perspectives, views, and outlooks is key to fostering both breadth and depth in intellectual knowledge. At Brown, the term diversity is used in the broadest sense to encompass many things such as race, color, religion, age, national and ethnicity origin, disability, status as a veteran, language, socio-economic background, sex, sexual orientation, gender identity, gender expression, political ideology, theoretical approach, and the list can go on. It is through the interaction among individuals from a diverse set of experiences, histories, and backgrounds that true intellectual diversity is achieved. The University's Office of Institutional Diversity and Inclusion provides leadership for the formulation and oversight of University policies related to pluralism and equity, and initiates programs and practices that promote diversity, inclusion, and fair treatment of all members of the community. The University designates officers who are responsible for issues of compliance and who are available to answer questions and provide advice.

Diversity Fellowships were created in early 2017, as part of the University and Graduate School Diversity and Inclusion Action Plans (DIAPs), for admission beginning in 2017-18. These fellowships are intended to diversify doctoral programs, with priority given to students from historically underrepresented groups. Diversity Fellowships are for top admitted doctoral candidates from across the disciplines, who receive enhanced stipends for three years and a one-time \$1,000 research account.

The Graduate School works closely with the Leadership Alliance to identify potential graduate program applicants among the pool of undergraduate students who are conducting research at Brown for eight weeks during the summer. Similarly, the Graduate School works in close partnership with students from Tougaloo College who spend time at Brown throughout the year while participating in various aspects of Brown-Tougaloo Partnership programming. The Graduate School also recruits at various annual meetings and conferences around the country.

Recruiting and Admission: The Graduate School actively recruits students who are and have been traditionally underrepresented in graduate education, including but not limited to underrepresented racial and ethnic minorities, women, and people with disabilities. The associate dean for diversity initiatives works in partnership with individual departments and programs at Brown and cultivates relationships with Historically Black Colleges

and Universities (HBCUs) and other Minority-Serving Institutions (MSIs). The Graduate School works closely with the Leadership Alliance to identify potential graduate program applicants among the pool of undergraduate students who are conducting research at Brown for eight weeks during the summer. Similarly, the Graduate School works in close partnership with students from Tougaloo College who spend time at Brown throughout the year while participating in various aspects of Brown-Tougaloo Partnership programming. The Graduate School also recruits at various annual meetings and conferences around the country.

Every spring, the Graduate School invites newly admitted underrepresented minority students to attend a one-day campus visit called Super Monday. Throughout the day, students are exposed to various aspects of graduate student life at Brown through interaction with faculty, staff and students from their prospective departments, deans of the Graduate School, and representatives from various centers and offices on campus. The day ends with a reception and dinner, which is attended by matriculating graduate students, faculty, and staff of color from across the campus. The Graduate School covers the costs associated with prospective students' transportation to and from Providence and overnight accommodations for this event.

**Retention and Advancement:** The Graduate School sponsors Multicultural Graduate Student (MGS) events for underrepresented minority students, including dinners with invited guest speakers, academic achievement and cultural celebrations, and social-networking activities. The Graduate School provides assistance to a variety of student associations and clubs that represent Brown's diverse graduate student population. In addition, the University offers individual and group support to students who identify as Lesbian, Gay, Bisexual, Transgender, and Queer/Questioning (LGBTQ).

**Program Review:** Diversity is one of several criteria used by the Graduate School to assess the performance of graduate programs.

### **Office of Institutional Equity and Diversity (OIED)**

<https://www.brown.edu/about/administration/institutional-diversity/>

The Office of Institutional Equity and Diversity (OIED) serves as a critical leader, resource, and support in sponsoring programs and events related to diversity and inclusion at Brown University. OIED helps lead inclusion efforts across campus through:

- **Accountability:** OIED monitors and measures progress of [Brown University's Diversity and Inclusion Action Plan](#) (DIAP) and the Departmental DIAPs, produces an Annual Report for the DIAP, and supports the activities of the Diversity and Inclusion Oversight Board and the President's Advisory Council on Diversity.
- **Compliance:** OIED oversees compliance with University policies and procedures, as well as with federal, state and local laws related to discrimination and harassment, sexual and gender-based harassment and violence (Title IX), equal employment opportunity and affirmative action (EEO/AA), and disabilities resources and accommodations (ADA/504).
- **Fostering Academic Diversity:** OIED supports academic and administrative units with their efforts to recruit a diverse faculty and staff by providing training and assistance to search committees as they develop diverse pools of candidates. OIED also supports the development, implementation, and assessment of professional development and mentoring initiatives for faculty, staff and students from historically underrepresented groups.
- **Promoting Diversity and Inclusion:** OIED collaborates with offices across Brown to design, implement and promote programs and events related to diversity and inclusion.

### **Brown Pathways to Diversity and Inclusion: An Action Plan (DIAP)**

<https://www.brown.edu/about/administration/institutional-diversity/pathways>

**Brown Pathways to Diversity and Inclusion: An Action Plan (DIAP).** Brown University is engaged in the work of creating a more diverse and inclusive academic community, as evidenced by Pathways to Diversity and Inclusion: An Action Plan for Brown University. This plan formalizes and expands upon diversity and inclusion efforts articulated in Brown's Building on Distinction strategic plan. The Graduate School is represented on the Diversity and Inclusion Action Plan (DIAP) Implementation Working Group.

## **Initiative to Maximize Student Development (IMSD)**

<https://www.brown.edu/initiatives/maximize-student-development/>

Initiative to Maximize Student Development (IMSD): Brown University is dedicated to ensuring a diverse and inclusive scholarly community. Brown's IMSD is a research training initiative funded by a grant R25GM083270 from the National Institute of General Medical Sciences of the National Institutes of Health from April 2008 – March 2022. The program has significantly increased the diversity of doctoral students in the life sciences and supported enhanced academic achievement among the students it serves. This recently renewed \$3.3 million award will extend IMSD's reach to the physical sciences, engineering and mathematics departments. The program will now support up to 20 doctoral students a year in 21 programs instead of just eight students in the Division of Biology and Medicine and the School of Public Health. The goal of the IMSD is to increase the number of underrepresented students who complete PhD degrees in biomedical research. Participants are identified from matriculants in the PhD programs. Participants receive a generous 12-month stipend and benefits, full tuition, health insurance and health fee. In addition, trainees are eligible to receive travel funding support to present their research at scientific meetings.

The program strives for Excellence, Community and Collaboration. IMSD provides a personalized, multi-dimensional training experience that features 1) Continuous-to-degree advising, 2) Cutting-edge research experience 3) Skill-based training modules to complement curriculum 4) Strong peer network and mentoring 5) Professional development and career planning. IMSD Workshop topics include: Demystifying the PhD Experience: Strategies for Academic & Personal Success in Graduate School ; Reading Scientific Publications ; Managing and Sharing Your Research Data ; Essential Laboratory Calculations ; Navigating a Successful Graduate Career: Professionalism & Etiquette ; Professionalism & Career Development: Preparing for the Postdoc Experience Graphic Presentation of Scientific Data ; Beyond the Hypothesis: Experimental Design and Critical Analysis, Designing and Delivering Scientific Presentations; Defending Your Research Proposal and Critiquing Those of Others ; Resources, Tools and Basic Techniques in Molecular Biology ; Scientific Writing: Key Principles ; and Introduction to Statistical Analysis of Data.

## **Leadership Alliance**

<https://www.brown.edu/initiatives/summer-research-early-identification-program/>

The Leadership Alliance was founded by Brown University in 1992, to address the shortage of underrepresented students in competitive graduate programs and academic careers and the professoriate. The Leadership Alliance's members include predominantly white institutions working closely with historically Black colleges and universities, minority-serving institutions, and industry partners who are committed to developing underrepresented students into outstanding leaders and role models in academia, business, and the public sector. Brown's participation in the Leadership Alliance through its Summer Research – Early Identification Program helps guide outstanding students to Brown graduate programs. Departments/institutions that are actively working with the Leadership Alliance include Alpert Medical School, Biomedical Sciences, Chemistry, Computer Science, the Department of Earth, Environmental and Planetary Sciences (DEEPS), Institute at Brown for Environment and Society (IBES), the Population Studies and Training Center (PSTC) and others. We also offer opportunities in multiple Humanities and Social Sciences departments.

The Brown Leadership Alliance Summer Research Early Identification Program (SR-EIP) offers up to 35 undergraduates each summer a paid research internship with a faculty mentor. Research opportunities are available in the following areas: life sciences, physical sciences, humanities and social sciences, engineering, computer science, and applied mathematics. Immersed in an intellectually stimulating and challenging environment, students work closely with a faculty advisor on the university's main campus or in one of the hospitals affiliated with the Warren Alpert Medical School at Brown University. In addition to this one-on-one collaboration, all participants present their research at the annual Leadership Alliance National Symposium and learn about the graduate school experience through conversations with Brown graduate students, postdocs and the Graduate School deans. Participants in the Brown SR-EIP receive a competitive stipend, a single room in an apartment in a Brown residence hall, and reimbursement for round-trip travel to Brown. There is a common kitchen in the residence hall. All Brown SR-EIP students live together in a building within a short walking distance of the main campus green, and easily accessible to shopping and transportation services.

## EDUCATION PROGRAMS

### Graduate Programs - Biology and Medicine

<https://www.brown.edu/graduateprograms/biomed-biology-phd>

Biology and Medicine Graduate Programs: Graduate study at Brown comprises more than 15 degree programs and varied opportunities in postdoctoral scholarship. Programs offer comprehensive course work leading to the Master of Science (ScM) and doctor of philosophy (PhD) degrees. There is also a joint MD/PhD program offered in conjunction with Alpert Medical School.

#### Master's Programs

Biomedical Engineering

Biotechnology

Fifth-Year Master's Program - for current Brown undergrads.

Brown/Pfizer Master of Arts Program

#### Doctoral Programs

Biology

Biomedical Engineering

Biotechnology

Computational Biology

Ecology and Evolutionary Biology

Molecular Biology, Cell Biology, and Biochemistry

Molecular Pharmacology and Physiology

Neuroscience

Pathobiology

**Academic Support Services for Graduate Students in the Division of Biology and Medicine:** Training faculty in general have primary appointments in the Division of Biology and Medicine, in the University at-large, and in clinical departments. The Division's Graduate Program is administered by the Associate Dean of Graduate and Postdoctoral Studies. All predoctoral students offered admission to graduate programs are guaranteed five years of financial support contingent upon making satisfactory progress toward the PhD degree. This support includes stipend, health insurance, and remission of tuition and fees. Support comes from a combination of resources including Division Fellowships, BIBS fellowships, Predoctoral Training Grants, Research Grants, Institutional Startup Funds, Teaching Assistantships and Individual Fellowships. About 25% of PhD students currently receive support from faculty generated research grants. A criteria of eligibility for more senior faculty to serve as a research mentor is available or pending external research funding.

**Office of Graduate and Postdoctoral Studies within the Division of Biology and Medicine:** Created in January 2006, the office focuses on and enhancing the training environment for the ~250 graduate students and 100 postdocs within the Division of Biology and Medicine. In creating this office, the Dean of Medicine and Biological Sciences committed to growth in the overall number of trainees and to increase the diversity of this group while enriching trainee preparation as scholars within the university setting and in their future career paths. The Associate Dean for Graduate and Postdoctoral Studies oversees admissions, recruitment, tracking, support, and professional development for students in all graduate programs. Graduate Programs within the Division of Biology and Medicine are primarily interdepartmental in structure. Predoctoral students benefit from this multidisciplinary training environment and strong extramural research-funding base. Each Division Graduate Program has its own administrative offices, support staff, and dedicated space for students along with computer and internet access nearby faculty research laboratories. There are further student computer clusters and associated hardware (printers and scanners) and fully supported software at the Libraries and Computing and Information Services (CIS) center. Each student is assigned office space or desk space.

## Graduate Programs - Brown University

<https://www.brown.edu/academics/gradschool/about>

Graduate School offers 51 doctoral programs and 28 master's programs, including those of the School of Engineering, the School of Public Health, and the School of Professional Studies.

Brown has a friendly scale and collaborative culture. With 2,600 graduate students and more than 700 full-time faculty members, Brown offers excellent academic training and mentoring within a supportive environment. The University is committed to creating a more diverse and inclusive academic community.

Graduate students may choose from a range of development opportunities, including:

1. Open Graduate Education program, providing flexibility for select doctoral students to define their academic journey and earn a secondary master's degree of their choosing.
2. Doctoral certificates as well as Sheridan Center for Teaching and Learning certificates.
3. Global Mobility grants and Graduate School travel research funds, supporting graduate student scholarship.
4. Deans' Faculty Fellowship Program, enabling advanced doctoral students to strengthen their teaching portfolios.
5. Interdisciplinary Opportunities for advanced doctoral students, allowing engagement in scholarly life at participating Centers and Institutes.
6. Both the Brown-Wheaton Faculty Fellowships and the Brown-Tougaloo Faculty Fellowships provide advanced teaching opportunities at a liberal arts and a rural college, respectively.
7. Brown Executive Scholars Training Program, preparing advanced master's students and doctoral candidates for careers in higher education administration.
8. Effective Performance workshops, improving capacity as communicators for research and teaching

## Graduate Programs - Public Health

<https://www.brown.edu/academics/public-health/academics>

### Master of Science Degrees (MSc)

Biostatistics

Clinical and Translational Research

NextGen Scholars Program in Biostatistics

### Master's of Public Health (MPH) Program Concentrations

Generalist

Addictions

Epidemiology

Global Health

Health Behavior

Health Services

Maternal and Child Health

Mindfulness

### Doctoral Programs

Behavioral and Social Health Sciences

Biostatistics

Epidemiology

Health Services Research

## Program - Biological Sciences

<https://www.brown.edu/academics/biology/undergraduate-education/>

Brown's program in Undergraduate Biology arms students with the knowledge, skills, and collaborative spirit required to tackle some of society's more pressing issues – from disease prevention to preserving Earth's natural heritage.

Undergraduates in the biological sciences can choose from more than nine concentrations. Biology students take courses and pursue research with faculty spanning six departments within the Division of Biology and Medicine. Partnerships with departments outside of the Division support interdisciplinary concentrations in Applied Mathematics-Biology, Computational Biology, Biochemistry, Biophysics, and Biomedical Engineering.

The Program in Biology strives to place students in the role of the scientist. A growing number of first-year and sophomore seminars, lab-based, and field courses in Biology allow students to engage with learning material in innovative ways that promote independent thinking.

With support from the Howard Hughes Medical Institute, Biology is working with other programs on campus to use well-established teaching methods that broaden participation and increase retention in science, technology, engineering and math disciplines. Our goals are to bring authentic research projects into STEM courses, facilitate collaborative problem-solving in large introductory courses such as Genetics, and build learning communities within courses. Learn more about the Brown-HHMI Gateway STEM Course Initiative here.

More than half of students in Biology pursue independent research. Over one-third complete a senior thesis and graduate with honors. Many students study abroad, pursue internships off-campus, and work with clinical faculty in the Medical School. Over 50 percent of students in Biology pursue careers in the health sciences and work with Health Careers Advising to meet their goals. More than 20 percent of students in Biology pursue graduate studies, and others go into business, education, government and nonprofit sectors.

### **Program - Liberal Medical Education**

<https://www.brown.edu/academics/medical/plme/prospective-students/prospective-students>

Program in Liberal Medical Education: For approximately 50 strongly motivated freshmen, the Program in Liberal Medical Education (PLME) offers a unique opportunity to combine undergraduate education and professional studies in medicine into an eight-year program.

The PLME is an application of the Open Curriculum concept that has been so successful at the undergraduate level at Brown. It encourages students of medicine to pursue their varied interests (in humanities, social sciences, or natural sciences) in-depth even as they prepare for careers as physicians or medical scholars.

As undergraduates, PLME students may choose to work toward an AB or ScB degree in the sciences, or toward an AB in the humanities, social sciences or behavioral sciences. PLME students may choose any one of the nearly 100 departmental and interdepartmental concentration programs offered at the university.

Undergraduate years: The undergraduate experience is designed to best prepare students for the last four years of the program, which constitute the Medical School years and culminate in the MD degree.

During the undergraduate portion of the program, the summer period is free but may be used for independent study, elective coursework, or laboratory research. During the Medical School years, students may pursue, in parallel with the MD degree, an advanced degree in their area of interest (e.g., MPH, MD/PhD) or other professional development such as a Scholarly Concentration (See Advanced Scholarship).

The expected duration of the PLME is eight years. However, students may choose to take advantage of the Flex Plan and extend their program by one or two years. The Flex Plan offers undergraduates the option to defer their entry to the Medical School while they pursue opportunities in other fields such as education, research, public service, government, health care, and business.

### **Program - Program in Innovation, Management and Entrepreneurship (PRIME)**

<https://www.brown.edu/academics/engineering/prime/>

Program in Innovation, Management and Entrepreneurship (PRIME). PRIME students learn to use emerging science and technology as a basis for the creation of commercial value and new ventures. The program offers students a strong grounding in how to start and grow a technology-based business in a dynamic, competitive

marketplace. PRIME students earn a ScM degree, a Masters of Science. Students from other PhD programs at Brown can earn a PRIME Master's degree alongside their program's PhD.

### **Programs - Computational Biology**

<https://www.brown.edu/academics/computational-molecular-biology/courses-study>

Computational biology involves the analysis and discovery of biological phenomena using computational tools, and the algorithmic design and analysis of such tools. The field is widely defined and includes foundations in computer science, applied mathematics, statistics, biochemistry, molecular biology, genetics, ecology, evolution, anatomy, neuroscience, and visualization.

The Ph.D. program is interdepartmental and the result of a collaboration between the four academic units that comprise the CCMB: Applied Mathematics, Computer Science, Ecology & Evolutionary Biology, and Molecular Biology, Cell Biology & Biochemistry.

The Undergraduate program offers three possible specializations in Computational Biology: Computer Sciences, Biological Sciences, and Applied Mathematics & Statistics. The program requires a senior capstone experience that pairs students and faculty in creative research collaborations.

## **EDUCATION TECHNOLOGY RESOURCES**

### **Center - Digital Scholarship**

<https://library.brown.edu/create/cds/>

The Center for Digital Scholarship (CDS) performs and promotes the use of digital technology in a scholarly context. Their areas of expertise consist of the following: data management, retention and sharing, data visualization, digital research consulting, design and implementation, GIS and mapping, textual and quantitative analysis, visual design and user-interface development, digitization of objects in 2 and 3 dimensions, and digital publications.

### **Digital Scholarship Lab (DSL)**

<https://library.brown.edu/dsl/>

Scholarship Lab (DSL). The DSL is a digital space in the Brown Rockefeller Library, designed specifically for collaboration, flexibility, and ease of use for scholars working on data-rich and visually-mediated research. It offers a collaborative, flexible, and easy-to-use space for digital projects and allows access to large LED display with multiple inputs for presenting data-rich and visually-mediated research. The lab features:

**A 7×16-foot display wall:** One side of the lab is occupied by a beautiful large-scale, high resolution video wall comprised of twelve 55-inch high resolution LED screens. The total size is 7,680 pixels across by 3,240 pixels down for a total of over 24 million pixels. This display is perfect for viewing high resolution images in detail, or viewing many images side-by-side for comparison.

**Multiple video inputs:** There are 14 video inputs throughout the room. Anywhere between one and 12 of those inputs can be displayed on the wall simultaneously, in a variety of configurations. Being able to easily change the layout of the wall means that the room is conducive to a variety of presentation styles, and that one can seamlessly move between modes of use: from a single input for presenting one person's work to an audience, to 2 inputs for visual comparison, or many more inputs to collectively and collaboratively look at a team's work.

**Portable touch-enabled 50-inch monitors:** two large portable monitors on carts that can be moved around the room. The portable monitors allow for small group breakouts.

**Videoconferencing:** The lab contains two high-definition wall-mounted cameras that can be panned and zoomed by remote control. The DSL has full videoconferencing capabilities for bringing in remote speakers or teleconferencing.



Completely reconfigurable furniture: The lab is equipped with seating and tables, and all furniture is on wheels. Table seating accommodates up to 20, with additional seating for up to 45. The DSL can be converted from a lecture hall to a team project room to a seminar room within minutes.

### **Digital Learning and Design**

<https://dld.brown.edu/>

Digital Learning & Design's mission is to collaborate with instructors to create engaging learning experiences and foster innovative teaching at Brown University. Consisting of instructional designers, technologists, and media professionals, this group helps instructors design engaging online, residential, and blended courses. This office inspires instructors to innovate, experiment, take risks, explore, and pilot instructional platforms. Flexible digital solutions and classroom spaces are available.

### **Multimedia Labs (MMLs)**

<https://sites.google.com/brown.edu/multimedia-labs-new-site/home>

The Multimedia Labs provide the Brown community with inclusive, adaptive, and experimental spaces across campus that are equipped with the technological and innovative support needed to inspire creative digital production and facilitate the vision of our community. This office provides students with access to a variety of creative technologies such as video production, podcasting, large-format art printing, 3D printing, and virtual reality. This group provides training and workshops with the goal of lowering the barrier of entry to these technologies. In addition, they manage computer labs filled with creative software for digital production for our community to use.

### **Sidney E Frank Digital Studio**

<https://library.brown.edu/create/digitalstudio/>

The Sidney E. Frank Digital Studio provides a unique and exciting intellectual hub for digitally enhanced scholarship at Brown University. The Digital Studio facilitates both short-term and extended engagements with academic questions that benefit from the infusion of technology and new methodologies in research and learning. This 4,500-square-foot space in the Rockefeller Library welcomes scholars at all levels into conversations and result-driven actions, whether they have come to consult on the content and design of digital projects, model or analyze data, create prototyped or finished multimedia presentations, learn a new tool, or explore the integration of traditional resources into novel forms of research and scholarship. Expert staff from Center for Digital Scholarship and around the Library assist students and researchers across the disciplines in digital imaging, iterative project design and implementation, copyright and fair use, data curation and management, archiving and repository services, digital scholarship methodologies and practices, as well as the delivery and dissemination of digital content.

## **LIBRARY RESOURCES**

### **Library - Brown**

<https://library.brown.edu/>

**Brown University Library:** The Brown University Library comprises five on-campus libraries and off-campus facilities that contain over 4.8 million items and adds 110,000 more each year. The Library subscribes to well over 500,000 electronic books in many subjects. Most are available in large collections that can be searched through the publisher's interface; all are individually cataloged. In addition to the collections to which the Library subscribes, several publicly available e-book collections are listed. The Sciences Library contains biological and medical serials. The library system is a member of the Center for Research Libraries and the Research Libraries Group, which provides scholars with free interlibrary loan services, including photocopying of articles as needed, and access to any of the cooperating research libraries at major universities.

Among its services, the Brown University Library manages the VIVO research networking system for faculty, offers practical training on essential tools for supporting research, and dedicates staff for supporting the clinical and translational research community. The Library also maintains a Fedora-based repository

(<https://repository.library.brown.edu/>) that provides core infrastructure for supporting the archiving and dissemination needs of research projects.

Within the Library, Health and Biomedical Library Services (HBL) supports the research and education needs of students, faculty, and researchers across Brown University, with focus on the Division of Biology and Medicine, the School of Public Health, and clinical and community-based partners. HBL provides expert searching and critical appraisal of the scientific literature in support of systematic reviews and other research. We also promote compliance with the NIH Public Access policy through educational sessions, resource guides, and consultations, and have training and experience in the evaluation, assessment, and enhancement of research impact. Librarians provide services and teach workshops on literature search, data management, and data sharing in support of clinical and translational research projects.

**Researchers at Brown (VIVO):** The Library, along with colleagues in Computing and Information Services (CIS) and the offices of the Dean of the Faculty and the Vice President for Research, launched a campuswide service that offers Brown faculty an online platform for sharing their research, publications, and professional work with the Brown community and the world at-large. The service, called Researchers@Brown, is derived from VIVO software, which was developed in recent years by Cornell University, the University of Florida, and a number of other academic partners. VIVO is based on semantic web technology, which provides capabilities for linking concepts, subjects, people, and organizations across institutional boundaries. The VIVO platform positions the work of Brown researchers to be discoverable and accessible in a variety of new ways and helps highlight the unique expertise of Brown faculty in the broader academic landscape. Researchers@Brown profiles have been created for all regular faculty at the University. Their profiles include biographies, research interests, educational background, publications, and professional activity. Faculty members can manage their own profiles or can assign a delegate to update them. The potential of Researchers@Brown to highlight and share Brown's intellectual productivity will be most effectively realized by linking researchers' profiles to related resources on the web. To help with that, the Library has subscribed to ORCID (Open Researcher and Contributor ID). ORCID allows researchers to create unique, personal semantic web identifiers that they can embed within their journal submissions, web sites, and social media profiles as well as within the Researchers@Brown system. By establishing links between these outlets, Researchers@Brown can offer a more comprehensive view of a researcher's work and can leverage the power of the web to enhance Brown's visibility and impact. Peers and other institutions are rolling out VIVO and pursuing similar semantic web initiatives that bring their work into conversation with the broader web of data. By being part of this movement, Brown is poised to have a significant impact on the way learners, researchers, and institutions discover and disseminate scholarship.

**Scientific Data Management:** A Scientific Data Management Specialist is available to work with students and faculty researchers in the sciences interested in writing and carrying out data management and sharing plans for sponsored research. The Specialist can serve as a partner to plan for the management and curation of the data throughout the research lifecycle, including for the long-term retention and sharing of data post-project. The Library's Data Management Services include consultation on data management issues, depositing data and supplementary files in a repository, and citing and publishing research data. The Brown Digital Repository (BDR) Open Data Collection was developed by Brown University for the long-term preservation of data integrity, and discovery and access to data generated by publicly sponsored research at Brown. The BDR offers an open application-programming interface (API) for programmatically retrieving both structured metadata and digital content in public collections. It includes an Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) server for exposing metadata about collections to external search engines and crawlers. The BDR provides each data set with Digital Object Identifiers (DOIs) via DataCite as persistent identifiers and is searchable using an Apache Solr index and via a public search API. Objects in the BDR's Open Data Collection in Dataverse have machine-readable Data Document Initiative (DDI) metadata and are also searchable in the NIH Data Discovery Index. Files in the BDR are stored redundantly in off-site storage and audit trails are maintained for each file to document changes and deletions, and older versions of files are retrievable in the event of unintentional modification. Files also receive a checksum value to allow for periodic auditing of data integrity. The BDR uses Globus for the transfer and sharing of large data sets. Lastly, The Division of Biology and the Library make available the electronic laboratory notebook software LabArchives to Brown and affiliated researchers (<https://library.brown.edu/info/labarchives>) to aid researchers in the documentation, organization, and preservation of their data as well as their collaboration within their team and with other research teams.

**Health Sciences Library Resources:** The Health Science Librarian can assist researchers in research planning, conducting research, publishing research and sharing data. Services include assistance with finding funding, writing a data management plan, sourcing data, conducting a literature review, organizing citations, analyzing and visualizing data, compliance with funders' public access policies, depositing research products into a repository, obtaining a Digital Object Identifier (DOI) and measuring the impact of the research. Regularly scheduled workshops are offered on citing and publishing research data, using data tools, building a better poster, and understanding public access policies and the NIH public access policy. .

## **MULTISPECIALTY PRACTICE GROUPS**

### **Brown Physicians Inc. (BPI)**

<https://brownphysicians.org/>

Brown Physicians Inc. (BPI): Brown Physicians Inc. is a nonprofit federation of six physician practice foundations formed in partnership with the Warren Alpert Medical School of Brown University. BPI is composed of six foundations, which include Brown Dermatology, Brown Emergency Medicine, Brown Medicine, Brown Neurology, Brown Urology, and University Surgical Associates. All are dedicated to fueling advances in health care in the state and the region. Together, the six foundations employ more than 500 doctors, all of whom are also members of the Warren Alpert Medical School faculty, and many of whom work side-by-side in local hospitals with physicians and other health care providers employed by the hospitals. By working closely together, the physicians, the medical school and the hospitals are better equipped to collaborate on educational initiatives and opportunities, to pool resources to support research and to coordinate clinical care and administrative functions. BPI patients can opt-in to be informed about potential clinical trials.

### **Southeastern New England Primary Care Practice-Based Research Network (PBRN)**

Background The Southeastern New England Practice-based Research Network (PBRN) was founded in 1998 with grants from the Academy of Family Physicians. This network, led by CEO Co-Lead, Dr. Charles Eaton has over 120 family physicians and general internists and over 90 practices both large and small, including private practices, safety net practices including hospital-based ambulatory care sites, and multiple community health centers participating in multiple practice-based research initiatives. Over the years, the PBRN has supported multiple NIH, AHRQ, and foundation related grants since its inception. Over 62 practices and 10,000 patients have participated in these studies, including the Robert Wood Johnson Quality Allies Diabetes Project, the NHLBI funded Cholesterol Management, the AHRQ funded e-Blood Study, the NIDDK funded Weight Loss and Physical Activity trial in Obese Primary Care Patients and the NHLBI funded COPD management study. Additional studies supported in part by the PBRN include several NIMH funded studies on depression, anxiety and DHHS funded studies regarding patient centered medical home. Additionally, the network has supported several junior investigators, including one funded by the National Cancer Institute to improve colorectal cancer screening in the Latinx community. More recently, Dr. Eaton has worked with the Brown Physicians Inc. internal medicine practices to pilot a Diabetes Care initiative.

## **RESEARCH ADMINISTRATION**

### **BioMed - Research Administration (BMRA)**

<https://www.brown.edu/academics/biomed/offices-and-services/research-administration/>

Brown Research Administration Support: The Biomedical Research Administration (BMRA) and the Brown University Office of Sponsored Projects (OSP) serve as a central resource to faculty, staff, and students in the Division of Biology and Medicine in their pursuit of research, training, and other scholarly activities while insuring compliance with University, federal, and private sponsor regulations, terms, and conditions. BMRA directly contributes to the academic mission of the Division of Biology and Medicine by providing support for obtaining sponsored research funds and managing sponsored research activity. The BMRA office is comprehensive in its scope and mission, handling both pre-award and post-award services. The primary functions of this office include:

Pre-Award – Providing information on sources of support, assisting principal investigators in identifying research funding opportunities, providing advice & assistance for completing application form pages, budget development, assisting faculty in the submission of applications, assuring compliance with the university and sponsors' policies and requirements, interpreting regulations of federal agencies and private sponsors, clarifying university policies and procedures for faculty and sponsors.

Post-Award – Overseeing the financial management of sponsored programs, maintaining accounts and records, preparing and submitting financial reports, administering the expenditures of funds, monitoring compliance with university and sponsor's financial provisions, assisting in audit resolution. 8

Property Management – Recording and tracking asset records, managing and maintaining campuswide inventory of all University and sponsor-funded property, identifying the availability of equipment for research use, issuing property reports to management and external sponsors, liaising with University and sponsor property auditors, and providing guidance to departments, faculty, and staff regarding issues related to property administration and inventory.

### **BioMed – Evaluation**

<https://biomedcorefacilities.brown.edu/biomed-evaluation-services>

BioMed Evaluation: The Evaluation Office provides evaluation consultation, guidance, and oversight for research programs and projects. Services include evaluation tool development such as questionnaires, focus group and individual interviewee scripts, and assessments. Logic and conceptual model development, with effective goals and SMART objectives, is available. This office can advise on qualitative and quantitative data collection, management, and analysis and help with verbal and written results reporting.

### **BioMed – Brown Biomedical Innovations to Impact (BBII)**

[https://www.brown.edu/research/conducting-research-brown/tech\\_innovations/bbii](https://www.brown.edu/research/conducting-research-brown/tech_innovations/bbii)

Brown Biomedical Innovations to Impact (BBII): The Brown University Office of Technology Innovation provides and manages translational development capabilities to help solidify proof of technical feasibility and of commercial relevance, both of which can de-risk an idea or discovery and turn it into more concrete product opportunities that are attractive to potential industry partners or startup creators. The Brown Division of Biology and Medicine, in collaboration with Technology Innovations, has launched a translational commercial development program, Brown Biomedical Innovations to Impact (BBII). BBII manages an academic accelerator fund dedicated to supporting academic biomedical technologies - with potential for high impact - to become well-defined product opportunities that are attractive to industry partners and investors. BBII achieves its goals by funding translational research projects focused on validation of technical feasibility and commercial relevance. BBII offers: 1) advising and coaching of investigators by an independent panel of advisors with broad expertise in evaluation, investment, and commercialization of biomedical technologies, 2) partnering and managing with the investigator by retaining consultants and contract research organizations to leverage development expertise and to provide project management support to ensure focus and timely delivery on project milestones, and 3) exploring commercial development opportunities by working through established relationships with industry, venture capital, and entrepreneurial startup resources to find the best path for further development.

### **Brown University Oncology Group (BrUOG)**

<https://bruog.med.brown.edu/>

Brown University Oncology Group (BrUOG): BrUOG was established in 1994. BrUOG has become a highly respected cancer research group because of its history of innovative clinical trials. These investigations evaluate early, cutting-edge applications of chemotherapy, biologic agents, and other cancer treatments in both Phase I (which determine the optimally tolerated dose of an anticancer treatment regimen) and Phase II trials (which assesses the potential therapeutic effectiveness). BrUOG has provided essential preliminary data for definitive Phase III trials, which are being conducted nationwide, often under the auspices of the National Cancer Institute.

BrUOG teaches the fundamental of clinical cancer research and provides outstanding research opportunities for physicians in training. In addition to protocols coordinated by BrUOG, patients at the affiliated hospitals also have

access to a large variety of other clinical trials through national cooperative groups such as Cancer and Leukemia Group B (CALGB), the National Surgical Adjuvant Breast and Bowel Project (NSABP) and the Radiation Treatment Oncology Group (RTOG). Only through the resources of such large organizations can such randomized trials of cancer therapy take place. Pharmaceutical industry-sponsored trials of novel agents are also available. Sponsorship for clinical trials is derived from the National Cancer Institute and from numerous pharmaceutical industry sponsors.

### **BioMed - Research Operations**

<https://biomedcorefacilities.brown.edu/biomed-research-operations-office>

The office of Research Operations oversees a portfolio of core research facilities in the Division of Biology and Medicine at Brown University. Serving as centers of intellectual exchange and collaboration, each technology-focused facility provides a broad spectrum of investigators access to state-of-the-art instrumentation, current technology services, and expert consultation. Each of these facilities has special capabilities. They are directed and managed by scientific experts that provide exceptional customer service, training, and resource management. A variety of classroom, workshop, and individual training initiatives are sponsored by many of the facilities. These high technology facilities are sustainably financed by a mixed funding model that includes grant awards, user fees, and institutional support. Cost effectiveness and efficiency are achieved by centralization of equipment, economy of scale savings, improved quality control, and rapid turnaround times. Advanced technology platforms of similar scale and productivity would not be financially feasible for any individual lab to purchase, upgrade, and maintain.

### **Office - Vice President for Research**

<https://www.brown.edu/research/conducting-research-brown>

The Office of the Vice President for Research (OVPR) fosters an environment conducive to research and the creation of knowledge by developing and supporting major research programs; providing effective infrastructure for technology innovations, research integrity, sponsored research administration and information systems, and research strategy and development.

### **Office – Technology Innovations**

<https://www.brown.edu/research/tech-innovations>

Technology Innovations: With its responsibilities to manage the university's patent portfolio, the Brown University technology transfer office, called Brown Technology Innovations is first focused on commercialization. By virtue of that role, we serve two customers: the faculty members who provide invention disclosures for patenting and commercialization; and the investors, entrepreneurs and companies that develop university technology. The faculty customer engages with our office concerning technology – specifically the evaluation of invention disclosures, the technology's patenting and its licensing. The technology investor customer works with our office because they wish to obtain or support technology. Any other mission or initiative by our office that is not focused on technology is extraneous. For Brown Technology Innovations, the focus is on Technology First.

### **Office - Research Integrity (ORI)**

<https://www.brown.edu/research/ori>

The Office of Research Integrity supports the Brown University research community by providing administrative support and regulatory advisement to the University's Institutional Review Board (IRB), Institutional Animal Care and Use Committee (IACUC), and Conflict of Interest Review Board. ORI also facilitates the University's Export Control compliance program and the conduct of ethical research.

The Office of Research Integrity (ORI) supports the Brown University research community by providing guidance, education and resources to facilitate the conduct of ethical research in accordance with governing federal and state regulations and University policies. The ORI's multidisciplinary team:

- Provides administrative support and regulatory advisement to the University's Institutional Review Board (IRB), Institutional Animal Care and Use Committee (IACUC), Conflict of Interest Review Board, and Embryonic Stem Cell Research Oversight (ESCRO) Committee;
- Assists researchers with adhering to requirements associated with international research collaborations, including running the University's Export Control Compliance Program;
- Manages the intake, review and approval of Data Use Agreements for research;
- Promotes integrity in research by providing training in the ethical and responsible conduct of research;
- Handles allegations of research misconduct;
- Through its Quality Assurance / Quality Improvement program, conducts outreach and education to researchers and staff regarding best practices to facilitate regulatory compliance and required institutional approvals, and performs post-approval monitoring and investigations of potential research-related non-compliance.

### **Office - Research Integrity and IRB**

<https://www.brown.edu/research/ori>

Office of Research Integrity and IRB: Reporting to the Associate Vice President for Research, the Office of Research Integrity (ORI) supports the Brown University research community by providing guidance, education and resources to facilitate the conduct of ethical research in accordance with governing federal and state regulations and University policies. The ORI's multidisciplinary team:

- Provides administrative support and regulatory advisement to the University's Institutional Review Board (IRB), Institutional Animal Care and Use Committee (IACUC), Conflict of Interest Review Board, Institutional Biosafety Committee (IBC), and Embryonic Stem Cell Research Oversight (ESCRO) Committee;
- Assists researchers with adhering to requirements associated with international research collaborations, including running the University's Export Control Compliance Program;
- Promotes integrity in research by providing training in the ethical and responsible conduct of research;
- Handles allegations of research misconduct; and
- Through its Quality Assurance / Quality Improvement program, conducts outreach and education to researchers and staff regarding best practices to facilitate regulatory compliance and required institutional approvals, and performs post-approval monitoring and investigations of potential research-related non-compliance.

Brown IRB: The Brown IRB reviews a diverse portfolio of human-subjects research protocols, including social, behavioral, and educational research, FDA-regulated research involving drugs and devices, research involving vulnerable populations, and clinical trials. The Brown IRB meets once per month and is currently comprised of 17 primary members and ten alternate members, including three physician/clinician members, two prisoner representatives and unaffiliated members, among others. Two staff members of the ORI's Human Research Protection Program (HRPP) are appointed as full IRB members to facilitate expeditious review and approval of expedited protocols. There is a high-level of commitment to continuing education for the Brown IRB and HRPP staff members that extends well beyond CITI certification. HRPP staff are expected and financially supported to achieve professional CIP certification and attend Public Responsibility in Medicine and Research (PRIM&R) and other professional conferences and webinars. IRB members are provided continued education via timely presentations pertaining to regulatory changes and the ethical conduct of research, including presentations provided by external subject matter experts. The HRPP team has one person fully dedicated to managing processes for single IRB review and clinical trial registration and results reporting. Brown is also a participating member of SMART IRB and leverages the Online Reliance System to request, track and document reliance arrangements on a study-by-study basis.

Brown's HRPP demonstrates its continuous commitment to exceptional quality and excellence through its internal Quality Assurance / Quality Improvement program (QA/QI program), completion of the Office of Human Research Protection (OHRP) QA Self-Assessment Tool, routine reviews by internal auditing services, and solicitation of expert, independent consulting reviews by subject matter experts. Brown's QA/QI program (i) routinely conducts outreach and education visits to research labs engaged in human-subjects research to enhance understanding of relevant regulations and ensure compliance with IRB-approved protocols; (ii)

assesses the HRPP's and IRB's compliance with applicable laws, regulations, codes and guidance; (iii) assesses the quality, effectiveness and efficiency of the HRPP; and (iv) assures the integrity of processes and procedures pertaining to identifying, managing, minimizing and/or eliminating financial.

### **Office - Sponsored Projects (OSP)**

<https://www.brown.edu/research/conducting-research-brown/sponsored-projects-osp>

The Office of Sponsored Projects (OSP) supports Brown University faculty and staff in the acquisition, performance, and administration of projects and programs funded from external sources. The office services include: compliance with governmental and private funding agency standards; review and submission of proposals for administrative and regulatory compliance; award negotiation and acceptance on behalf of Brown University; dissemination of research policy information to campus; establishment of subaward agreements and conduct of subrecipient monitoring; oversight and advising on financial management of sponsored projects, including financial reporting, cash management, effort reporting, and monitoring of cost-share arrangements; addressing financial and administrative issues that arise during the life of a sponsored project; coordination of award close-out process; and providing education and professional development opportunities in research administration for the campus community.

### **Office - Research Administration Information Services (RAIS)**

<https://www.brown.edu/research/conducting-research-brown/research-administration-information-systems>

Research Administration Information Systems & Reporting Services (RAIS): The RAIS team provides services to the research community for all electronic systems and data overseen by OVPR and Workday Grants. This includes: proposal creation in Brown's electronic grants management system (Coeus) and external electronic systems such as eRA Commons, Research.gov, and Grants.gov; Conflict of Interest disclosures and IACUC protocol development in InfoEd; as well as IRB protocol management in Coeus.

RAIS delivers in-depth business intelligence solutions to the Brown community through reporting, visualizations, and workflow notifications for departments and senior management. In addition, this group is leading the development and implementation of a new integrated electronic system managing grant development, submission and management and IRB protocol development and management. We currently support two systems Coeus and InfoEd, and Sponsored Reporting.

### **Office - Research Strategy and Development**

<https://www.brown.edu/research/conducting-research-brown/research-strategy-and-development>

The Research Strategy and Development office identifies and disseminates funding opportunities, supports development of research teams and submission of large proposals, manages internal research funding programs and limited submission opportunities, and supports smaller departments on pre- and post-award financial management.

## **RESEARCH BUILDINGS**

### **Brown Research Buildings**

<https://www.brown.edu/academics/biomed/campus>

**121 South Main St:** The School of Public Health research and training is located in this building. The facility includes 64,040 square feet of usable space devoted to research, administration and instruction, and houses the Center for Statistical Sciences, as well as nine other nationally renowned public health research centers. The academic and research goals for the Public Health Program are focused in the Department of Community Health. Offering multidisciplinary, comprehensive programs in population-based medicine and health, the department's educational mission encompasses undergraduate, graduate, and medical education, and fellowship training. Education and research activities are structured into four sections: Behavioral and Social Sciences, Biostatistics, Epidemiology, and Health Services, Policy and Practice.

**Applied Mathematics Building:** Opened in the fall of 2015, this three-story, 13,000-square-foot structure, provides office space for applied mathematics faculty, graduate students, postdoctoral researchers, and visitors, as well as meeting and seminar rooms. The building is equipped with flexible office space, open spaces with blackboard-painted walls to stimulate informal discussions, meeting space for research groups, and a large seminar room that can be used for presentations but will also serve as a common room for students and faculty alike at 170 Hope St.

**Barus and Holley:** located at 184 Hope St., is a seven-story, 187,035 sq. ft. building that was constructed in 1965. This building serves as the location for the faculty of the Institute for Molecular Nanoscale Innovation, the Physics Department and the School of Engineering and includes laboratories, classrooms, lecture rooms, and offices.

**Watson Center for Information Technology,** located at 115 Waterman St., is one of the premier University computing facilities in the world. The 110,559 sq. ft. facility is used for computer research labs, classrooms and offices and is the location of the Center for Computational Molecular Biology (CCMB), Computer Science and the Office of Information Technology (OIT).

**Biomedical Center (BMC):** This seven-story complex of offices, labs, and classrooms is used by departments across the Division of Biology and Medicine. Located at 171 Meeting St, this seven-story building consists of 67,118 square feet of usable space, 37% of which is devoted to research. It is part of the BioMed Complex, housing a total of 47,107 square feet of research space. The building is also located immediately adjacent to the Sidney Frank Life Sciences Building. This building houses research laboratories and the Flow Cytometry Facility, Herbarium, Drosophila Media Facility, Multidisciplinary Teaching Labs and faculty in the departments of Microbiology and Immunology, Ecology and Evolutionary Biology, and Molecular and Cell Biology and Biochemistry.

**Building for Environmental Research and Teaching (BERT):** The newly renovated BERT is a center of research and education in environmental science and the School of Engineering. Its rooftop is home to the Plant Environmental Center (PEC), a state-of-the-art facility that includes a greenhouse, classroom laboratories, and a 2,000 square-foot public conservatory - all maintained by the Department of Ecology and Evolutionary Biology.

**Plant Environmental Center:** Located at 91 Waterman St, the Plant Environmental Center, supported by the Department of Ecology and Evolutionary Biology, is a growing facility devoted to plant biology research. Spread out over three research greenhouses encompassing 5,000 square feet, the space includes a teaching plant collection, a classroom laboratory, and research facilities. There is also a 2,000 square-foot Conservatory, housing many different plant families. In addition to this space there are five E7/2 Conviron plant growth chambers, and a 180-sq-ft. walk-in growth chamber, used by grad students and faculty.

**Sidney E. Frank Hall for Life Sciences:** The Sidney E. Frank Hall is a five-story 169,000-square-foot facility is home to 60 laboratories and provides access to the Biomedical Center - forming a hub of life sciences research and teaching on College Hill. It houses the Departments of Neuroscience, Molecular Biology, Cell Biology, and Biochemistry, as well as the Leduc Bioimaging Facility and Magnetic Resonance Imaging Facility.

### **Buildings in the Jewelry District of Providence**

**Laboratories for Molecular Medicine (LMM):** The LMM is a focal point of interdisciplinary research activity and expertise for the Division. It supports core facilities that provide state-of-the-art research equipment and training to life sciences researchers at Brown and at partner institutions across Rhode Island. Located at 70 Ship St, this building has 69,002 square feet of usable space, 63% of which is devoted to research in genetics, genomics, proteomics, structural biology, and pathology. The open floor plan of the facility promotes collaboration among scientists and benefits trainees. These partnerships provide the context in which biomedical research will ultimately translate into the tools for clinical care. The facility is within a few blocks of the Warren Alpert Medical School building, as well as the major research buildings of Woman & Infants Hospital and Rhode Island Hospital, which house other Brown faculty and research centers affiliated with the Division. The LMM building houses the Genomics, Transgenics, Proteomics, Structural Biology, Bioimaging, and Molecular Pathology Core Facilities.



Faculty in Molecular Pathology and Laboratory Medicine, Molecular and Cellular Biology and Biochemistry are located in the Laboratories for Molecular Medicine.

Warren Alpert Medical School: The Medical School's 134,000 sq ft home at 222 Richmond Street features the latest innovations in medical education, including exam rooms where students can practice realistic patient interactions, a fully equipped anatomy lab, and a digital medical library.

### **233 Richmond Street**

Just across from the Medical School, 233 Richmond Street houses administrative offices as well as two key research centers the Brown Center for Biomedical Informatics (BCBI) and the Advance-Center for Clinical and Translational Research (Advance-CTR).

## **RHODE ISLAND & RESEARCH ENVIRONMENT**

**The State of Rhode Island (RI)** has a population just over 1 million. The state demographics are 81.4% white, 5.7% Black or African American, 2.9% Asian, 0.6% Native American, 0.1% Hawaiian or Pacific Islander. Approximately 12.8% of the state's population is Hispanic or Latino in origin and 13.3% of the population are immigrants. Rhode Island covers 1214 sq. miles and is 37 miles wide by 48 miles long.

**Rhode Island Clinical Environment:** The clinical environment within Rhode Island is highly conducive to further development of clinical research. Factors supporting clinical and epidemiological research in Rhode Island include: 1) One medical school training physicians who stay and serve the entire region; 2) one dominant adult medical-surgical hospital system with 80% of the medical school faculty; 3) one pediatric hospital with 95% of statewide pediatric hospitalizations; 4) one level 1 trauma center with adult and pediatric capabilities, the Nation's 5th busiest; 5) one large women's hospital with 75% of births in the state and 90% of the deliveries in Providence; 6) one large inpatient, academic psychiatry facility; 7) one academic VA hospital; 8) Outstanding colleges of Pharmacy and Nursing at the State's single land grant University; 9) one Department of Health serving the entire state with oversight over multiple datasets; and 10) CurrentCare, Rhode Island's official statewide health information exchange, which includes comprehensive, longitudinal records on 50% of the state's population, growing monthly. Combined, these factors make Rhode Island an ideal location to initiate population-based health programs, to advance clinical and epidemiological research, and to quickly implement improvements in clinical practice.

Large cohorts of patients can be assembled and our highly regionalized, non-duplicative clinical environment, with very low egress from the state, allows robust, population-based studies. As a reflection of the veracity of our current clinical, demographic and epidemiologic environment, Brown University was awarded two National Children's Study Vanguard sites. One was in Providence County and the other was in Bristol County Massachusetts. Women and Infants Hospital has a significant community base for clinical activities and well-established patterns of referral for regionalized high-risk perinatal obstetrical and neonatal services. A similar situation prevails in other specialties. Rhode Island Hospital and The Miriam Hospital host large postgraduate medical training programs in all the specialties and provide the bulk of inpatient adult medical and surgical care. Butler hospital is a large psychiatric hospital with a robust academic infrastructure. Hasbro Children's Hospital provides 95% of all inpatient pediatric care.

**Rhode Island Collaborative Culture:** Rhode Island research groups have formed a strong, collaborative clinical and translational network. The Universities, Hospitals and Community Organizations in Rhode Island have a rich culture of collaboration that is enhanced by having a single Medical School; an integrated academic medical center and health system composed of seven hospitals, closely affiliated with the Medical School; little program duplication and long-standing cooperation between the hospitals; a single children's hospital with the majority of inpatient pediatric care; a single birthing hospital where ~75% of births in the state take place; one Department of Health for the entire state. This 'Culture' is further evidenced by the success of the NIH and NSF funded BRIN, COBRE, CTR, EPSCoR and INBRE, and collaborative programs in RI. These inter-institutional programs share common goals to positively impact biomedical research by catalyzing activity, expanding capacity, augmenting capabilities, enhancing faculty development, strengthening infrastructure, disseminating knowledge, promoting community outreach, and facilitating regional collaborations among diverse stakeholders. The administrative cooperation and scientific progress made through these cross-institutional awards is a strong indicator for collaborative success of future programs.

## RHODE ISLAND STATEWIDE COLLABORATIVE PROGRAMS – NIH IDeA, NSF-EPSCoR

### Rhode Island Statewide Collaborative Programs

Rhode Island Academic and Healthcare institutions have a long history of collaborating on funded research programs. Most of these collaboratives are funded by the NIH Institutional Development (IDeA) Program. The IDeA Program builds research capacities in states that historically have had low levels of NIH funding by supporting basic, clinical and translational research; faculty development, and infrastructure improvements. Rhode Island qualifies as an IDeA state. Rhode Island's actively funded IDeA programs include one IDeA Network for Excellence in Biomedical Research (INBRE) award, eleven Centers of Biomedical Research Excellence (COBRE), and one Program Infrastructure for Clinical and Translational Research (IDeA-CTR) and two Environmental Child Health Outcomes (ECHO) programs.

### Centers of Biomedical Research Excellence (COBRE) Programs in Rhode Island

The COBRE programs support thematic, multidisciplinary centers that augment and strengthen institutional biomedical research capacity. This is accomplished by expanding and developing biomedical faculty research capability and enhancing research infrastructure, including the establishment of core facilities needed to carry out the objectives of a multidisciplinary, collaborative program. COBRE support comes in three sequential 5-year phases: Phase I focuses on developing research infrastructure and providing junior investigators with formal mentoring and research project funding to help them acquire preliminary data and successfully compete for independent research grant support; Phase II seeks to strengthen each center through further improvements in research infrastructure and continuing development and support of a critical mass of investigators with shared scientific interests, Phase III transitional centers provide support for maintaining COBRE research cores developed during Phases I and II, and sustain a collaborative, multidisciplinary research environment with pilot project programs and mentoring and training components.

1. P20GM139743 – COBRE Center for Sleep and Circadian Rhythms in Child and Adolescent Mental Health, PI Mary A Carskadon, Emma Pendleton Bradley Hospital (April 6, 2021 – February 28, 2026)
2. P20GM139767 – COBRE for Stress, Trauma, and Resilience (STAR), Laura R. Stroud, Miriam Hospital (Sept 15, 2021 – July 31, 2026)
3. P20GM130452 – COBRE Center for Neuromodulation (CNN), PI Benjamin Greenberg, Butler Hospital (March 2019 – January 2024)
4. P20GM121298 - COBRE for Reproductive Health, PI Surendra Sharma, Women and Infants Hospital (April 2017 – February 2022)
5. P20GM130414 - COBRE Center for Addiction and Disease Risk Exacerbation (CADRE), PI Peter Monti, School of Public Health, Brown University (August 1, 2019 – July 22, 2022)
6. P20GM125507 - COBRE Center on Opioids and Overdose, PI Josiah Rich, Rhode Island Hospital (September 1, 2018 – August 31, 2022)
7. P20 (newly awarded) - COBRE Center for Antimicrobial Resistance and Therapeutic Discovery (CARTD), PI Eleftherios Mylonakis, The Miriam Hospital (September 18, 2018 – July 31, 2023)
8. P20 GM109035 - COBRE: Center for Computational Biology of Human Disease, PI: David Rand, Brown University (June 1, 2016 – July 31, 2022)
9. P20GM103652 - Endothelial Injury and Repair: Cardiopulmonary Vascular Biology COBRE, PI Gaurav Choudhary, Ocean State Research Institute (September 2013 – May 2023)
10. P20GM103645 - COBRE Center for Central Nervous System Function, PI: Jerome Sanes, Brown University (August 15, 2013 – July 31, 2022)
11. P20GM119943 - COBRE for Stem Cells and Aging, PI: Peter Quesenberry, Rhode Island Hospital (July 1, 2017 – July 1, 2022)
12. P30GM104937 - COBRE for Skeletal Health and Repair, PI Qian Chen, Rhode Island Hospital (September 1, 2017 – August 31, 2022)
13. P30GM114750 - COBRE for Perinatal Biology, PI Sunil Shaw, Women and Infants Hospital (NCE)

### **Clinical and Translational Research (IDeA-CTR)**

Clinical and Translational Research Program (IDeA-CTR): Another activity is the IDeA Program Infrastructure for Clinical and Translational Research (IDeA-CTR) initiative. The IDeA-CTR encourages consortium applications from IDeA states to develop regional infrastructure and capacity to conduct clinical and translational research on diseases that affect medically underserved populations and/or diseases prevalent in IDeA states. IDeA-CTR awards support mentoring and career development activities in clinical and translational research and facilitate collaboration with clinical researchers in non-IDeA states.

U54GM115677 Advance Clinical and Translational Research (Advance-CTR), PI Sharon Rounds, Brown University (July 1, 2016 – July 31, 2026)

### **Environmental Influences on Child Health Outcomes (ECHO) Program**

Environmental Influences on Child Health Outcomes (ECHO) Program: The ECHO program at Hasbro Children's Hospital, the pediatric division of Rhode Island Hospital, is part of a national research project to study the effects of environmental exposures on the health and development of children. The Hasbro Children's Hospital research project is led by Phyllis Dennerly, MD, pediatrician-in-chief at Hasbro Children's Hospital. Dennerly along with Thomas Chun, MD, a pediatric emergency medicine physician at Hasbro Children's Hospital, and Abbot Laptook, MD, medical director of the Neonatal Intensive Care Unit at Women & Infants Hospital. The Hasbro Hospital-based ECHO program will focus on four key pediatric outcomes: upper and lower airway; obesity; pre, peri and postnatal outcomes; and neurodevelopment. The funding will allow Rhode Island Hospital to build an IDeA States Pediatric Clinical Trials Network (ISPCTN), which will support a four-year project entitled "Rhode Island Child Clinical Trials Collaborative" (RICCTC), enabling Hasbro Children's Hospital, Women and Infants Hospital, and Brown University to develop a pediatric clinical trials network as well as participate in the national NIH network.

UG1OD024951 Rhode Island Clinical Trials Collaborative, Rhode Island Hospital, PI Thomas Chun, (September 23, 2016 – August 31, 2025)

### **IDeA Network for Excellence in Biomedical Research (INBRE)**

IDeA Network for Excellence in Biomedical Research (INBRE) Program: The INBRE Program promotes the development, coordination and sharing of research resources and expertise that will expand the research opportunities and increase the number of competitive investigators in the IDeA-eligible states. INBRE grants are intended to enhance the caliber of scientific faculty at research institutions and undergraduate schools, thereby attracting more promising students to these organizations.

P20GM103430 Rhode Island IDeA Network of Biomedical Research Excellence. PI Bongsup Cho, University of Rhode Island, (September 30, 2001 – April 30, 2024)

### **RI NSF Established Program to Stimulate Competitive Research (EPSCoR)**

RI NSF Established Program to Stimulate Competitive Research (EPSCoR): Funded by a \$19 million National Science Foundation grant and a \$3.8 million state match, RI Coastal Ecology, Assessment, Innovation and Modeling (C-AIM) is a collaboration of engineers, scientists, designers and communicators from eight higher education institutions across R. RI C-AIM is developing new approaches to assess, predict and respond to the effects of climate change on coastal ecosystems. Working together with government, industry and communities, RI C-AIM is positioning Rhode Island as a 'center of excellence' for research on Narragansett Bay and beyond.

#OIA-1655221 RI Coastal Ecology Assessment Innovation & Modeling (RI-C-AIM), PI Geoffrey Bothun, University of Rhode Island (Sept. 2017-Aug. 2022)