Facilities and Other Resources

OVERVIEW OF THE UNIVERSITY AND SMHS

The George Washington University (GW) was created in 1821 through an Act of Congress, fulfilling George Washington's vision of an institution in the nation's capital. GW is a mid-sized, private comprehensive research university with 14 schools, including the **School of Medicine and Health Sciences** (**SMHS**; ranked #58 in 2021 Best Medical Schools: Research; US News and World Reports), the **School of Nursing** (**SN** ranked # 33 in Best Nursing Schools: Master's and #45 in Best Nursing Schools: Doctor of Nursing Practice), the Milken Institute **School of Public Health** (**SPH**, ranked #12 in 2021 Best Public Health Graduate Schools; US News and World Reports)**,** and the **School of Engineering and Applied Sciences** (**SEAS** ranked #67 in 2021 Best Engineering Schools; US News and World Reports). SMHS faculty with clinical activities also hold appointments at the Medical Faculty Associates (MFA) physician practice plan and **Children's National Hospital (CNH**; ranked #7 nationwide in 2021 Best Hospitals; US News and World Reports; CNH hosts the GW Department of Pediatrics that includes 41 divisions).

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Pamela R. Jeffries, PhD, RN, FAAN, ANEF, FSSH	Dean, School of Nursing
John Lach, MS, PhD	Dean, School of Engineering and Applied Science
Dayna B. Matthew, JD, PhD	Dean, GW Law
Anuj Mehrotra, PhD	Dean, School of Business

Children's National Hospital Leadership	
Mark Batshaw, MD	Executive Vice President, Physician-In-Chief & Chief Academic Officer; Director, Children's Research Institute

GW has more than 25,000 students from all 50 states, DC, and more than 130 countries studying toward a variety of degrees in disciplines ranging from forensic science and creative writing to international affairs and computer engineering, as well as medicine, public health, law, and public policy. GW consists of three campuses (Foggy Bottom and Mount Vernon in Washington, DC, and the GW Virginia Science and Technology Campus in Ashburn, Virginia). Having evolved into one of the nation's leading universities, GW recently completed a comprehensive strategic planning initiative captured in the new Vision 2021 report. With more than 100 centers and institutes and cutting-edge research in science and technology, health, public policy, global security, and the arts and humanities, research and innovation are driving forces at GW. At present, GW holds ~$158M in research funding. Major Research Buildings include:

The Science and Engineering Hall is an intellectual hub and positions GW to attract the world's best faculty and brightest students. This complex is located between 22nd, 23rd, H, and I Streets NW – literally 0.7 miles to the gates of the White House, includes the 8th floor committed to the GW Cancer Center, as well as functions from the School of Engineering and Applied Science, Columbian College of Arts and Sciences' Biological Sciences, Physics, Chemistry, and Hominid Paleobiology. Researchers from Milken Institute School of Public Health are located on the 7th floor of the building.

Milken Institute School of Public Health Building is located on Washington Circle at 24th Street and New Hampshire Avenue, the building features more than 115,000 square feet of floor space for state-of-the-art classrooms, research labs, departmental offices, and conference rooms at a cost of $75M, with platinum rating under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System of the US Green Building Council (USGBC).The building houses more than 200 full- and part-time faculty and staff, and the school's on-campus graduate and undergraduate students.

The George Washington University Hospital is owned and operated by a subsidiary of Universal Health Services (UHS) one of the largest healthcare management companies in the nation. The George Washington University Hospital has approximately 385 beds, 20+ operating suites and 1 hybrid operating room along with a level III neonatal intensive care unit. The GW Hospital is accredited by The Joint Commission and licensed by the District of Columbia Regulatory Affairs Department. In 2016 there were 19,937 admissions, 25,892 surgeries, 3,395 births, 74,680 emergency room visits and 125,995 outpatient visits.

George Washington University Medical Faculty Associates (MFA) is an independent multispecialty physician group practice encompassing more than 52 medical specialties. Committed to providing comprehensive, thorough and accessible patient care, MFA physicians see patients at the main campus as well as at the George Washington University Hospital and several other area hospitals and community-based medical practices. MFA physicians serve as full-time faculty of the GW School of Medicine and Health Sciences providing mentorship and teaching to medical students, residents and fellows. The MFA faculty is extensively involved in a wide variety of research activities including NIH-, foundation- and industry-sponsored studies. Research by MFA physicians include inpatient hospital-based studies as well as studies in the outpatient setting. These studies include investigations of new oral, parenteral agents and infusion-based agent. Among the many research activities include new treatments for cardiovascular diseases, infectious diseases including HIV infection, neurologic disorders among many others. MFA surgeons are examining new devices that improve cardiovascular, neurosurgical and orthopedic conditions.

CORES & FACILITIES:

Animal Behavior Core

The Animal Behavior Core is located in Ross Hall and is equipped to automatically record and analyze animal behavior. It allows trained users to perform various behavioral assays, including tests for motor activity (open field, ladder running), anxiety (elevated plus maze), social behavior, home cage behavior, and learning and memory (fear conditioning). The core has several rooms dedicated to different testing.

Animal Research Facility
The George Washington University Animal Research Facility (ARF) is the core or centralized laboratory animal support facility for the School of Medicine and Health Science (SMHS), other University teaching and research programs using animals and our collaborative institutions. The ARF is fully accredited by the Association for the Assessment and Accreditation of Laboratory Animal Care International (AAALAC) with continuous accreditation since April 1974. The 17,000 square foot facility is located primarily in Ross Hall and occupies facility housing and support space on five floors. The core is arranged in a vertical array with floors connected by a service elevator from the basement (B1) to floors 4, 5, 6 and 7. The facility also provides an examination and treatment room, quarantine, a diagnostic laboratory, isolation, cage sanitation, radiology, necropsy and a surgery suite. The highly experienced and qualified ARF veterinary and laboratory animal care staff maintain eight species of research animals as well as multiple breeding colonies and provide animal care and technical support for the animal research community throughout the DC area. The animal health care program is under the direction of a fully qualified veterinarian and managed by a facility manager who oversees the trained animal technicians. Animals in each room are observed daily for signs of illness by the animal technician responsible for husbandry. Routine veterinary medical care is provided to all animals by veterinary technicians under the direction of the attending veterinarian.

Bioinformatics Core
The McCormick Genomics and Proteomic Center (MGPC) provides wet laboratory, proteomics and computational genomics support to GW researchers. The center's focus is to harness emerging, in-house genomic, transcriptomic, proteomic, and bioinformatics knowledge to build and test new biologically relevant hypothesis. The Cancer Informatics Core pilot project (CIC-p) provides collaborative informatics support for cancer research, through guidance for software use and by acting as liaison for various NGS data services.

MGPC provides a rigorous, collaborative research environment that can be harnessed by the research community at GW to expand the horizons of genomic and proteomic knowledge, to open new avenues in basic and translational cancer research, and to train the next generation of bright minds in cancer genome research. The MGPC team has valid licenses for the following commercial software tools and databases:

- Geneious: A genome browser reference mapping and sequence assembly tool. Features include:
    - NGS Analysis and Genomics
    - Sequence and Chromatogram Analysis
    - Alignment and Tree Building
    - Molecular Cloning
    - Searching, Sharing, and Automation
- HGMD (Human Gene Mutation Database): A gold standard resource for comprehensive data on published human inherited disease mutations
- TRANSFAC (Transcription Factor Database): A tool that provides data on eukaryotic transcription factors, their experimentally proven binding sites, consensus binding sequences and regulated genes
- Oncomine: Compute gene expression signatures, clusters, and gene-set modules, for extracting biological insights from the data
- MetaCore: A high quality biological systems content in context, producing essential data and analytical tools to accelerate scientific research
- Ingenuity® Pathway Analysis (IPA®): IPA is a powerful analysis and search tool that uncovers the significance of 'omics data and identifies new targets or candidate biomarkers within the context of biological systems. IPA may be used for the analysis, integration, and interpretation of data derived from 'omics experiments, such as RNA-seq, small RNA-seq, microarrays including miRNA and SNP, metabolomics, and proteomics.
- OriginLab: Data analysis and graphics software to make technical charts for scientists and engineers displaying 2D and 3D plotting, statistics, curve fitting, and peak fitting

Biomarker Discovery and Analysis Facility
Services in the Biomarker discovery and Analysis facility include: 1) Quantitative PCR that allow analysis of transcripts in a 384 well platform and provide high quality cDNA from tissues; 2) In situ hybridization on

cryostat sections and access to a library of probes targeted to neural development and pathological conditions. Facilities include quantitative western blotting, luminescence and fluorescence microplate assays, primary cell culture and electroporation systems and a cell culture and ES cell facility.

Biorepository Core
Founded in 1994 and operating under National Cancer Institute's Best Practices for Biospecimen Resources, the GW Biorepository assists researchers in the medical school by housing samples in the secured repository staffed with experienced biobankers and under the direction of the director. With more than 22 years of experience, the Director and staff oversee the integrity of over 100,000 biospecimens and clinical data, comprised of specimens related to HIV malignancies, neurology and cancer cases at GW, as well as individual GW investigator specimens.

Flow Cytometry Core Facility
The Flow Cytometry Facility maintains 2 cytometers and a workstation for data analysis.

Library Facilities:

- Eckles Library
- Gelman Library
- Himmelfarb Health Sciences Library
- Jacob Burns Law Library
- Virginia Sciences and Technology libraries

The University has an extensive network of libraries, databases, computer facilities, and other resources located on and off campus that are available to researchers. Our network of on-campus libraries includes the Eckles (main) Gelman, Himmelfarb, joint Milken Institute SPH and the Medical School, plus Virginia Sciences and Technology libraries. Faculty, staff, and students also have access to eight additional branches located throughout the Washington, DC metropolitan area – including the Library of Congress, the libraries of the National Institute of Health, and the National Library of Medicine – that permit inter-library loans.

Nanofabrication Core
Lithography

- The Raith PIONEER combines ultra-high resolution electron beam lithography (EBL) and scanning electron microscopy (SEM). The PIONEER features 30kV column technology and a full rotation and tilt stage.
- The Raith VOYAGER is a high-performance electron beam lithography (EBL) instrument.
- The Neutronics NXQ4000 Series Semi-Automatic Mask Aligner combines innovative design with precision alignment and exposure features. The automatic sequencing makes the system very easy to learn and use.
- The Laurell Spin Coating Systems at GWNIC feature programmable push button recipe management which allows control of spin speed, acceleration, and duration. They feature a PTFE chamber and chuck for easy cleanup and will accommodate up to four-inch wafers.
- The FEI Helios NanoLabTM 660 DualBeamTM is a fully digital, Extreme High Resolution (XHR) Field Emission Scanning Electron Microscope (FE SEM) equipped with Focused Ion Beam (FIB) technology. It allows for fast characterization of nanometer details and analysis in 2D and 3D, very high-quality thin sample preparation and flexible nanoprototyping. The FIB SEM can be used for nanofabrication as well as 3-D reconstruction of biological structures.

Deposition & Etching

- The Versaline Deep Silicon Etch III (DSE III) system is designed to etch very high aspect ratio features while providing very smooth sidewall profiles. The DSE system is capable of etching silicon, SOI and oxides in the same chamber configuration.
- The Versaline Plasma Enhanced Chemical Vapor Deposition (PECVD) system features an isothermal chamber designed to deposit high-quality dielectric films such as SiO2 and SiNx.
- The Apex SLR is a very flexible system platform for both III/V semiconductor etches and dielectric etchings.

- The Cambridge NanoTech Fiji series Atomic Layer Deposition (ALD) system with Load Lock is a modular, high-vacuum ALD system that accommodates a wide range of deposition modes using a flexible architecture and multiple configurations of five precursor lines and various plasma gases.

Thermal

- The CHA Criterion Electron Beam (E-beam) Evaporator and Criterion Pulsed Vapor Deposition (PVD) system offers midrange sizing that incorporates both load lock and source isolation options.

Measurement, Characterization & Analysis

- The Micromanipulator Probe Station provides a highly accurate test environment for Capacitance-Voltage (C-V) measurement. The KLA-Tencor P-7 stylus profiler offers measurement repeatability for reliable measurement performance.
- The four-point probe system allows a wide variety of samples to be measured from glass slides with TCOs or metal layers, to wafers and even ingots up to 250mm deep. GWNIC provides access to the Kulicke & Soffa Model 4123 Manual Wedge Bonder and Kulicke & Soffa Model 4126 Ball Bonder.
- The F20-UV is a general-purpose film thickness measurement instrument that can measure films ranging from 1nm to 40um optically using a190-1100 nm light source.

Microscopy Core

Light Microscopy

- The Leica M80 Stereomicroscope is a dissecting microscope with a platform, lighting, excellent Leica M80 optics and digital camera.

Confocal Microscopy

- The Zeiss LSM 710 laser scanning confocal microscope can be used for long-term whole live-embryo, tissue slices and cell imaging at high resolution. This upright microscope with x/y/z scanning stage, controlled via Zen software to execute complex multipoint temporal acquisition patterns.
- A Zeiss Cell Observer Spinning Disk Confocal microscope is fully integrated for live-imaging at high resolution.
- The Leica TCS SP8 Multiphoton Flexible Supply Unit features White LASER and 2-photon excitation.

Electron Microscopy

- The FEI Teneo LV SEM instrument is a Field Emission Scanning Electron Microscope (FESEM) that combines high and low-voltage ultra high-resolution capabilities with the world's only low-vacuum, high-resolution imaging solution.)
- The FEI Helios NanoLab 660 DualBeam is a fully digital, Extreme High Resolution (XHR) Field Emission Scanning Electron Microscope (FE SEM) equipped with Focused Ion Beam (FIB) technology.
- The FEI Talos™ F200X is a 200 kV FEG Scanning Transmission Electron Microscope (S/TEM), which is designed for fast, precise and quantitative characterization of biological and materials samples.

Sample Preparation

- The Leica VT1000 S Fully Automatic Vibrating Blade Microtome is designed for special applications associated with the sectioning of fresh biological tissues.
- The Leica EM KMR3 Glassknife Maker is designed to produce consistent, perfect glass knives for microtomy from glass strips.
- The Leica Ultracut R Ultramicrotome provides ease of use for cutting resin embedded samples for microscopy. Automated thick and thin resin section cutting modes.
- The Leica EM UC7 Ultramicrotome is a fully configurable system used for preparation of semi and ultrathin sections, as well as the perfectly smooth surfaces required for LM, TEM, SEM, and AFM sample preparation.
- The Leica EM AFS2 Automatic Freeze Substitution System performs freeze substitution and progressive lowering of temperature (PLT) techniques along with low temperature embedding and polymerization of resins.
- The Tousimis 931 Critical Point Dryer offers automated precision process control for a wide array of samples.

- The Cressington 208HR Sputter Coater is a versatile coater for a multi-user facility.

Data Analysis

- The Arivis Workstation runs Zen, LASX, Volocity and Arivis software for image analysis.
- The IMARIS Workstation.

Research Pathology Core

The Research Pathology Core Laboratory is a research core facility housed in the Department of Pathology. The facility is located in room 124 Ross Hall. The Pathology Core Laboratory is available to provide research services for both human and animal tissues, including tissue processing, embedding, sectioning, routine H&E and special stains, frozen sections, optimization and performance of immunohistochemistry, and electron microscopy. Pathology consultative services are also available.

Biomedical Engineering

Laboratory: The Biomedical Engineering (BME) department at the George Washington University, is located on the fifth floor of the Science and Engineering Hall (SEH). The new SEH is the largest academic building dedicated to science and engineering in the nation's capital. It is located next to GW Medical School (Ross Hall), which facilitates the multidisciplinary collaborations between two schools. The BME department is well equipped with a full set of biomedical engineering related equipment and facilities such as imaging, cell and tissue culture facilities, material synthesis, and characterization.

Other important facilities such as pathology core facility, biomechanical testers, AFM, a flow cytometry core facility, gel permeation chromatography, micro CT, 1H/13C NMR spectroscopy, mass spectrometry, elemental analysis, XRD, machine shop, and poster printing are in Science and Engineering Hall, Tompkins Hall, or Ross Hall at GW. They are easily accessible 24/7.

Auxiliary facilities (machine shop): The School of Engineering and Applied Science of the George Washington University has a Research Machine Shop housed in SEH. The shop has all of the standard machine tools, e.g. milling machines (CNC and manual), lathes (NC and manual), drill presses, grinders, etc. It is staffed by a full-time technician and can also be used by graduate students. SEH Hall also houses an advanced rapid-prototyping facility (*Stratasys Dimension*) that can be used for manufacturing 3D complicated design models.

Research Technology Services: The Research Technology Services at The George Washington University provide research computing services to the GW Community to enhance GW's research competitiveness and success. The following table highlights the main services they can provide.

Service	Key Components
Data Services / Data Management	General data hosting, data transfer, databases
Network	CAAREN, high speed data transfer, public / private, I2
Cloud Computing	AWS, Google Cloud, NIH STRIDES, Equinix
Identity	Affiliates, Federated, Certificates, Account Provisioning
Storage	BOX, StrongBox, Pegasus, Armor
Applications	REDCap, MDAP, Galaxy, Globus
Machine Learning	AWS Sagemaker, Google AI platform
System Administration and Support	Linux & Windows Workstations, StrongBox
High Performance Computing (HPC)	Pegasus, HTCondor/OpenScience Grid
Technology Consulting	Cloud environments, Architectures, Program Debugging
Analytics Support	Build / support efforts, tool selection
Training	LAI Carpentry workshops, AWS, Google programs

Biostatistics Center

The Biostatistics Center, within the Milken Institute School of Public Health, serves as the coordinating center for large-scale multi-center clinical trials and epidemiologic studies. Established in 1972, the Center participates in major medical research programs of national and international scope under the auspices of NIH and other Federal agencies, frequently leading to major medical advances. In addition, the Center participates in population-based epidemiologic studies, and conducts grant-supported research in biostatistical methods. The Biostatistics Center is staffed by masters and doctoral level statisticians and computer systems analysts. The staff has extensive experience and expertise in biostatistics, epidemiology, clinical trial study design and data management, and administration and coordination of multi-center research studies.

The Biostatistics Center aims to provide statistical leadership in the design, execution, and analysis of in vivo investigations and clinical trials, and to ensure that the results of such studies are of the highest scientific integrity and meet rigorous biostatistical standards. The total Center staff of over 120 employees includes 19 statisticians, 8 doctoral or professorial, 18 M.S., approximately 58 computer systems analysts, programmers, research staff plus data management and administrative personnel. The Center's staff provides extensive experience in biostatistics, epidemiology, clinical trials, case-control studies, and database management.

The Center's functions include statistical design of the study; development of data collection forms and manuals of procedures; all aspects of data management with emphasis on adherence to protocol and quality of data; training and certification of clinical personnel; generation of monitoring reports; development of new statistical methodology; statistical analysis of results; and preparation of statistical and scientific reports and publications.

Activities of the Biostatistics Center:

- Statistical methods: The Biostatistics Center is instrumental in the evaluation and development of new statistical methods to meet the unique needs of planned or ongoing investigations and the application of state-of-the-art statistical methods is required to ensure that collaborative clinical trials and epidemiologic studies meet rigorous scientific and biostatistical standards.
- Study design: The Biostatistics Center participates in the statistical design of all types of medical investigations.
- Data management: The Center has established procedures for all aspects of data management for the projects in which it participates to ensure that the data which is analyzed and reported in scientific publications is of the highest quality
- Statistical analysis and publications: The Center performs state-of-the-art statistical analyses of study results in order to address the scientific objectives of each study.

Biostatistics and Epidemiology Consulting Service (BECS)

The Biostatistics and Epidemiology Consulting Service (BECS) is embedded in the Milken Institute School of Public Health Department of Epidemiology and Biostatistics and provides biostatistical, epidemiological, and study design support for health-related research projects. The priority services of the BECS are: Pre-award consultation on best practices for biostatistical methods, sample size selection, and study design for health-related grant proposals; and Pre-award statistical analysis assistance (by faculty and/or graduate students in biostatistics and in epidemiology) of preliminary data to support a grant application.

Cancer Clinical Trials Office

The Clinical Trials Office (CTO) of the George Washington Cancer Center (GWCC) assists with the planning, conduct and compliance of any cancer-related clinical trials, including those using pharmacologic or radiation therapies or investigational devices, as well as non-interventional trials. The CTO is overseen by an Associate Center Director of Clinical Investigations and a Senior Administrative Director, and is staffed by nurses, regulatory personnel, data mangers and study coordinators. The CTO can provide protocol support regarding scientific review, HIPAA compliance, Human Subjects protection and IRB requirements and submissions, as well as ongoing regulatory and reporting requirements. The CTO can also assist in the design, implementation and execution of investigator-initiated clinical trials and correlative studies, including blood collection and processing and tissue procurement. A state-of-the-art software package for protocol and data management is being implemented.

Clinical Research Office
The Clinical Research Office (CRO) of the Medical Faculty Associates unifies clinical research operations for the clinical faculty practice to support research growth, streamline operations and ensure regulatory compliance, as well as to assure its practices conform with GWU requirements and processes. The CRO maintains responsibility for all aspects of administration and oversight of industry-designed, industry-sponsored multi-center clinical trials including contract negotiation, financial management, conduct and compliance functions. The CRO also provides education and mentoring for staff and faculty

DC Center for Aids Research (DC CFAR)
Supports inter-institutional research in HIV from molecular to community studies.

Human Research Office
The Office of Human Research (OHR) is the administrative support office for The George Washington University Institutional Review Boards (IRBs). The IRB is responsible for the review of all research activities that involve human subjects in accordance with federal regulations.

Institute for Biomedical Sciences (IBS)
PhD Programs in the School of Medicine are coordinated through the Institute for Biomedical Sciences (IBS). Established in 1996, the IBS has over a hundred faculty members who participate in the PhD programs focused on Genomics, Microbiology & Immunology, Cancer Biology, Neurosciences, and Pharmacology & Physiology. The IBS oversees a core curriculum and assists students in navigating the first year of graduate training and laboratory rotations with potential mentors. After the student has chosen a Ph.D. Program and has a program-specific academic advisor and research mentor, the role of the IBS becomes one of facilitation and integration. Together, the PhD programs currently include 73 students, of whom 56% are female and 11% from underrepresented groups. The percentage of PhD students from underrepresented groups is similar to the proportion nationwide who earn a PhD in Biology each year.

Laboratory Safety Office
OLS is a service organization within the Office for Vice President for Research with specialized knowledge and expertise in biological, chemical and radiological health and safety. OLS manages a broad range of regulatory obligations for George Washington University and works closely with allied departments (Office of Health & Safety, Police, Facilities Management, Risk Management, etc.) within the University and in our surrounding communities. OLS has an office on the Foggy Bottom campus.

The Office of the Vice President for Research (OVPR)
The OVPR provides grants management services from pre-award through post-award. They provide support and resources for researchers to successfully apply for grant funding. In addition to proposal development and financial oversight and compliance, the OVPR provides support for many of GW's core facilities. OVPR coordinates research salons designed to connect and engage GWU faculty from diverse disciplines in collaborative intellectual and scholarly exchange around research-themed issues, questions, and challenges. GW's Research Enhancement Unit (REU) is focused on increasing students' and faculty members' capacity to conduct research by providing the necessary training, environment, support, and information to enable them to further develop their skills and pursue research opportunities. With more than 100 centers and institutes and cutting-edge research in science and technology, health, public policy, global security, and the arts and humanities, research and innovation are driving forces at GW. REU helps GW investigators increase the competitiveness of their research proposals by:

- Providing consultative and scientific editing services
- Delivering professional development workshops, trainings and seminars
- Facilitating collaboration for large, complex, international and multi-/cross-disciplinary proposal

PROGRAMS

Health Sciences
Uniquely positioned within the George Washington University School of Medicine and Health Sciences, the Health Sciences programs provide a training ground for the nation's experts in patient care, health care quality, medical laboratory sciences, clinical management and leadership, and numerous other disciplines. Health

Sciences offers four entry-level clinical training programs (Emergency Medical Services, Medical Laboratory Sciences, Physical Therapy, and Physician Assistant) in addition to professional programs for advanced training in a wide range of health fields including clinical research administration, regulatory affairs, clinical management and leadership, clinical and translational research, translational health sciences, biomedical informatics, integrative medicine and health, health care quality, disaster response, and occupational therapy. The GW Physician Assistant program is ranked 3rd out of more than 225 accredited programs nationally. Health Sciences is active in continuing education and professional development activities, operates numerous military affiliated programs, and jointly operates a health sciences academy with Alexandria City Public Schools. Health Sciences is a global leader in online and blended education, with national experts in curriculum development, instructional design, and program evaluation.

International Medicine Programs
For over 23 years, the Office of International Medicine Programs (IMP) at the GW School of Medicine and Health Sciences (SMHS) has cultivated global partnerships to develop and facilitate transformational mutual exchange in medical education, training, and research. IMP's goal is to provide transformational learning opportunities to build the human healthcare workforce capacity of other countries and share the latest advances in medicine and healthcare. As a pioneer in international medical education, training, and research, IMP has developed, coordinated, and completed over 150 projects in over 50 countries, touching the lives of more than 15,000 healthcare professionals, students, and patients around the globe. IMP promotes international research partnerships by convening SMHS and international researchers at scientific summits, where they can share the latest advances in their fields and identify opportunities for collaboration. In addition, IMP partners with GW faculty to design and implement medical and research training programs both at GW and abroad. IMP further serves the SMHS community by facilitating strategic international partnerships, providing safety and security resources for SMHS faculty and student travelers, and supporting incoming international students and visiting scholars.

Research Workforce Development
The Office of Research Workforce Development led by Associate Dean Alison K Hall PhD enhances research professional skill development at all career levels including undergraduate, medical student, postdoctoral fellow, and faculty. Created searchable faculty researcher database, blog and funding announcements for faculty, graduate students and postdoctoral trainees. Assist in development of NIH F, K, T and related mentored training activities and applications. Produces researcher on-boarding and scientific and professional development workshops, grant writing courses.

Responsible Conduct of Research

The George Washington University encourages all of its faculty and students to become familiar with professional and ethical standards in academia in general as well as in their chosen fields. In fulfilling its responsibility to prepare the next generation of responsible researchers, GW offers the following assistance:

- **Responsible Conduct of Research Training**
  All faculty and students participating in research are required to complete the Responsible Conduct of Research training provided at GW. Discussion of the issues raised by this training among faculty and students is an important element of professional development in all of our research and graduate programs.
- **NIH RCR Training Plan:**
  Students, faculty and other researchers supported on certain NIH training, career development, research education, and dissertation research grants 1 are also required to take RCR training. For the NIH RCR Training Plan, eight (8) hours of live RCR training must be undertaken at least once during each career stage throughout a scientist's career: i.e., at the undergraduate, post-baccalaureate, predoctoral, postdoctoral, and faculty levels. This training is required at a frequency of no less than once every four years. GW provides this training through lectures, workshops, and courses provided each year, including lecture series offered by the Office of the Vice President for Research that are qualified for RCR live RCR Training credit.

- **NSF RCR Training Plan:**
  Completion of RCR Training is mandatory for all undergraduate students, graduate students, and post-

doctoral researchers supported on a full-time or part-time basis on any National Science Foundation award resulting from a proposal due after January 4th, 2010. The RCR program must be completed in accordance with GW's NSF RCR Training Plan within the first budgetary period (usually the first year) of the date you begin charging such a new NSF award. This Training Plan requires completion of the online RCR course offered through GW's arrangement with the Collaborative Institutional Training Initiative (CITI).

Students and post-doctoral researchers also have the option of taking additional RCR courses that are available in lecture/classroom settings. For those students who wish to take in-person lecture/classroom training in lieu of the taking the NSF RCR Training Plan Online, students and post-doctoral researchers on NSF awards also have the option of documenting that they have taken a minimum of eight (8) hours of approved in-person RCR coursework from the schedule of such courses offered by semester.

Translational Health Sciences PhD
This online program enrolls 15-20 students per year, preparing candidates with the knowledge and skills needed to facilitate and lead innovation in health care. This program prepares early career professionals to take leadership roles as change agents in rapidly evolving health care environments. Students develop expertise in complexity theory, organizational analysis, mixed methods research design, program theory and evaluation. As a low residency program, most learning occurs online. Students are on campus at VTSC two weekends per semester to participate in collaborative, interactive workshops that integrate material across courses in that semester.

OTHER RESOURCES

Anti-Racism Coalition (ARC)
In recognition of the ethnic and cultural diversity of the varied learners in our medical enterprise and their subsequent interaction with and care for an internationally heterogeneous patient population, we the faculty and staff of the George Washington University School of Medicine and Health Sciences, The George Washington University Hospital, Children's National Hospital and the George Washington Medical Faculty Associates hereby commit to the development and active implementation of an antiracist academic community to identify and eradicate all forms of racism and ethnic oppression. We purposefully commit to identify, discuss and challenge the impact that race and ethnicity have on influencing our didactic training; subsequent patient interactions; institutional policies, culture and climate; and interactions with one another.

The intentional redirection of our academic environment will include strategies and best practices to dismantle racism and ethnic oppression as evidenced by our daily interactions with one another, patients, organizationally and to external institutions and partnerships.

Given the enormity of this task, we commit to:

- Develop a multidisciplinary team of executives, faculty and staff who will be responsible for the development, implementation and monitoring of the effectiveness of this program.
- Develop quantifiable outcomes in didactic and clinical courses of instruction and discussion groups, accountable on all levels of leadership, faculty, and staff.
- Identify specific resources needed to accomplish not only the work of the coalition, but to effect downstream, meaningful and sustainable change throughout the GWU medical enterprise.
- Commit to a continual process of self-examination and improvement of the program individually and organizationally.

Initiatives to Enhance Diversity
The GW SMHS Office of Diversity and Inclusion (established 2013) is led by Yolanda Haywood, MD as the founding Associate Dean for Diversity and Inclusion. In response to concerns about faculty diversity, GW SMHS envisions a community distinguished by the depth of its diversity and the value placed on it. GW SMHS identified four target groups that have been traditionally underrepresented: Black/African-American, Hispanic/Latino, the economically disadvantaged, and first-generation students. Increasing underrepresented student recruitment, improving retention, and promoting a culture of inclusion are integral to the GW SMHS

vision. As we strive for preeminence, each strategic initiative and its related goals and activities must be woven through all work and learning conducted at GW. Please feel free to reach out to the SMHS Office of Diversity & Inclusion as a resource as you establish your activities for each strategic initiative.

Appointments, Promotions, and Tenure
Active Status faculty appointments are of four types:

- Regular
- Limited Service
- Visiting or Research
- Faculty are reviewed annually by the Department Chair for promotion and/or tenure consideration. This is done through the annual report process in conjunction with the faculty member. It is important that faculty on the tenure track stay on point in their academic progress; meeting with the Chair every year is critical to helping make sure there are no surprises when it's time for a promotion or a tenure decision.

Classroom Resources
Academic Technologies supports over 200 technology-enhanced classrooms and labs on the Foggy Bottom, Mount Vernon, and Virginia Science and Technology campuses. These learning spaces are equipped with innovative technology, which enhances the teaching and learning experience at GW.

- Foggy Bottom Campus
  - The School of Medicine and Health Sciences (SMHS) Classroom Services supports the technological and educational needs of the faculty, staff, and students through 35 different classrooms, with seating sizes ranging from 8 to 180. They provide a multitude of services structured to support the teaching, learning and research needs of the SMHS community. Videoconferencing, an equipment loan service, and on-site technical support are just a few of the services available. They coordinate scheduling, AV and technical support for learning spaces.
  - The rest of the Foggy Bottom campus has 14 locations with classrooms. Number of classrooms ranges from 3 – 19, with seating capacity ranging from 15 - 293.
- Mount Vernon Campus has 7 buildings with between 1 and 10 classrooms
- Virginia Science and Technology Campus has 4 buildings with between 6 and 9 classrooms

Colonial One (Division of IT)

- Software and Business Apps
- Research Computing
- Web and Collaboration

Colonial One is a high-performance computing cluster available to support research needs that use high-performance computing for data analysis Colonial One is implemented and managed by the Research Services Group within the Division of Information Technology, assisted by GW-sponsored computational staff in the Computational Biology Institute and the Columbian College of Arts and Sciences. Access to Colonial One is open to the GW community. Located on the Virginia Science and Technology Campus in one of GW's two enterprise-class data centers, Colonial One is housed in an optimal facility featuring:

- Professional IT management by the Division of IT, including 24-hour on premise and remote environment monitoring with hourly staff walkthroughs.
- Redundant power distribution, including UPS (battery) and generator backup.
- Redundant cooling systems using a dedicated chilled water plant and a glycol refrigeration system.
- Direct network connectivity to GW's robust 100-Gigabit fiber optic network.

The Colonial One cluster has both a primary storage system and a high-speed scratch storage system connected to the Infiniband network fabric. Both are accessible throughout the entire cluster, and remote file transfer services are provided through dedicated login nodes.

Computing (Hardware and Software)

GWU is well connected to research and education communities. The wireless access service, Eduroam, is a secure, worldwide roaming access service developed for the international research and education community. It allows users from member institutions to connect to the Internet when visiting other participating institutions. GWU is also part of the Internet2Network, which is a computer networking consortium led by members from research and education communities, industry and government. It gives our researchers the ability to use ultra-high-speed networking speeds when working with large dataset transfers that are used in much of our current research.

The SMHS has a fully staffed IT unit that includes a director, network, and technical support staff to assist users with all projects and support requests. The software offerings are also comprehensive. Our capabilities will allow for any required references retrieval, any other data retrieval or exchange, and online databases access. All faculty, staff, and students have access to electronic mail and collaboration software. SMHS faculty and staff members also have access to licenses that include an extensive range of word processing, analytic, graphics, mapping, and presentation software such as, SPSS, Stata, SAS, Atlas.Ti, MPlus, Adobe Creative Suite, Nvivo, Qualtics, and ArcGIS.

Impact Initiative and SMART Lab
The SMART Lab (Supported Media for Administration, Research, and Teaching) provides assistance related to the technical design and development of course materials and any technology issues. The team provides hardware, software, and personal assistance to support faculty in the use of technology for the Health Sciences Programs. The SMART Lab support faculty and staff in producing and using media, technology, and novel instructional methods in order to create state-of-the-art learning experiences and curricula.

Internet2
GW has made significant investments to support advanced research in the Washington DC metro region by establishing the nation's newest regional research network Capital Area Advanced Research and Education Network (CAAREN). CAAREN connects to Internet2's Advanced Layer 2 Service, a nation-wide 100G software defined network (SDN). GW is part of the Internet2Network, which is a computer networking consortium led by members from research and education communities, industry and government. It gives our researchers the ability to use ultra-high-speed networking speeds when working with large dataset transfers that are used in much of our current research.

Writing Resources
GW also offers a variety of resources to assist students and faculty in academic writing. RefWorks is an online tool supported by Gelman Library that helps writers organize their research and create bibliographies. The WID Studio offers a range of resources and references on writing.

GW Milken Institute School of Public Health Faculty Development Resources

At the SPH we have various sources of faculty development opportunities in the areas of teaching and research.

Faculty Workshop Series: Successful Practices and Current Challenges for Remote Instruction

These sessions are intended to be instructor needs driven and are designed for faculty who have already taught a residential course in an online/remote format. During the session, attendees will have an opportunity to share good practices and persistent challenges with colleagues.

Children's National Hospital (CNH)
CNH is the only exclusive provider of pediatric care in the metropolitan Washington, DC area and is the only freestanding children's hospital between Philadelphia, Pittsburgh, Norfolk, and Atlanta. Serving the nation's children for more than 140 years, CNH is a proven leader in the development and application of innovative new treatments for childhood illness and injury. CNH is consistently ranked among the best pediatric hospitals in America by the US News and World Report. There is a particular clinical focus on NDDs, with the DC- Intellectual and Developmental Disabilities Research Center (DC-IDDRC), an integrated Center for Neuroscience and Behavioral Medicine, an Institute of Fetal Medicine, and the Cerebral Palsy Center. The NDD focus includes the

divisions of developmental pediatrics, physical medicine and rehabilitation,genetics, neurology, neurosurgery, neonatology, fetal medicine, psychiatry, psychology, speech language pathology, occupational therapy and physical therapy. There are a number of interdisciplinaryclinics that focus on NDDs, including the Children's Autism Spectrum Disorders Clinic, the Spina Bifidaclinic, the Epilepsy clinic, the Fetal Medicine Clinic, the White Matter Disorders Clinic, the Genetics Clinicand others. The majority of our DC-IDDRC clinical research projects reside in the Center itself, where there is opportunity for much interchange of ideas in a multidisciplinary NDD research setting. Founded in 1870, CNH is the nation's third oldest children's hospital. It includes a 310-bed hospital, five community-based health centers in the District of Columbia, and seven regional outpatient facilities in Marylandand Virginia. In addition to over 700 full-time faculty members affiliated with the George Washington University (GW) School of Medicine and Health Sciences. There are more than 600 community pediatricians affiliated withCNH through its Children's National Health Care Network, many of whom share a common electronic medical record with the hospital.

Some of the major resources and facilities available at CNH include:

- Children's National Research Institute (CNRI)
- Clinical and Translational Science Institute at Children's National (CTSI-CN) A partnership with GW
- Clinical Studies Resource
- Institutional Review Board (IRB) and Office for the Protection of Human Subjects (OPHS
- REDCap
- DC-IDDR
- Research Animal Facility
- Both CTMC locations - CNMC and GWU - offer their own housing facility for animals to be used for imaging.
- Advanced Pediatric Brain Imaging Laboratory
- Cellular Therapy Laboratory (CTL) at Children's National
- Fluorescence Activated Cell Sorting (FACS)
- Proteomics