

Office of Research

The Office of Research reviews and monitors all matters dealing with research at the university. These functions include identification of potential funding sources, pre-award administration, post-award administration, grant award and receipt, administration of the Human Research Protections Program and the Animal Care and Use Program, and monitoring of compliance with all federal regulations regarding the conduct of research.

Thus, the research office staff members serve three communities: faculty and student investigators, the university, and the approximately 80 funding organizations that support university research.

The roughly 800 active research protocols at USU cover a variety of scientific areas, including basic biomedical areas central to the mission of the Military Health System, such as the following:

- Mechanisms and control of a wide range of infectious diseases
- Molecular mechanisms of disease
- Topics in combat casualty care, operational medicine, and psychological health
- Women's health and minority health issues
- Warfighter performance factors
- Responses to the various stresses of military life

The USU intramural grant program is administered by the Office of Research, including staffing support for the University's Research Merit Review Committee (MRC), which reviews faculty applications for intramural funds. Intramural research awards include militarily relevant basic science, clinical, and educational research conducted by billeted faculty and students. Student research awards support the work of medical and nursing students as well as master's and doctorate graduate candidates. Student applications are reviewed by faculty in the students' division and by the appropriate dean and are administered jointly by the research office and the graduate program offices.

The Office of Research's home page (<http://www.usuhs.edu/research>) provides pertinent, up-to-date, user-friendly information on both intramural and extramural grant opportunities as well as a range of downloadable application and regulatory assurance forms. Through the Office of Program Development, the Office of Research supports the development of both new and established faculty by assisting in the search of new funding opportunities, assistance with grant writing, and contact with other USU investigators with similar interests. The Office of Program Development also provides access to PIVOT®, a database listing hundreds of global funding opportunities available to faculty, postdoctoral fellows, clinical fellows, students and staff. PIVOT also identifies researcher expertise from within or outside of USU from millions of profiles from leading research organizations worldwide which fosters collaboration by cultivating essential partnerships and alliances.

Many of the university's workshops and symposiums on research-related issues are offered through the Office of Research.. The office also sponsors quarterly lectures and small-group workshops for investigators who perform research involving human volunteers. Other workshops, panels, and speakers sponsored by the office have addressed topics in military research, effective communication of scientific hypotheses and results, technology transfer, military medicine, and emerging issues regarding the protection of the human participants in research.

USU Research Days promotes research by faculty, staff and students at the Armed Forces Radiobiology Research Institute (AFRRI), Graduate School of Nursing, School of Medicine, Postgraduate Dental School and their affiliate institutions. This annual event is coordinated through the Office of Research and formally encompasses four events: Graduate School of Nursing (GSN) Research Colloquium, School of Medicine Graduate Student Colloquium, Postdoctoral Fellows Colloquium, and the Faculty Senate Research Day. More than 240 faculty and student poster presentations, several keynote and distinguished lectures featuring nationally and internationally prominent speakers participate in Research Days.

Research Program

The university's research program is administered through the Office of Research, in conjunction with the Henry M. Jackson Foundation and other not-for-profit foundations. It covers a range of clinical, basic and other research topics important to both the military and public health. Infectious diseases, traumatic brain injury, preventive medicine and cancer are areas of particular strength. Researchers also are making important new efforts in state-of-the-art fields that cut across disciplines, such as genomics, proteomics, and drug delivery mechanisms.

Infectious Diseases

USU researchers conduct projects on infectious diseases in the United States and across the globe, developing effective treatments, vaccines, and other preventive measures to contend with an array of pathogens. Technological advances by university researchers have made possible the accurate prediction of mosquito population level and transmission risk for a wide variety of mosquito-borne diseases. By using satellite imaging and remote sensing devices, these researchers assist health-related government agencies around the world in predicting and containing high-risk conditions for malaria and similar diseases. Disease-control programs also include work on the development of a cutaneous leishmaniasis vaccine to prevent parasitic infection; elucidation of the natural transmission of *Bartonella bacilliformis* by the sand fly towards disease prevention and control; and surveillance and treatment of *Rickettsia parkeri* and their associated tick vectors. Basic science investigations of the mechanics of common bacterial infections, such as *E. coli*, *Neisseriae gonorrhoea*, *Shigella spp* and *H. pylori*, are uncovering new information about their virulence genes, invasion mechanisms, and countermeasures.

Larger, long-range programs focus on understanding and managing HIV, developing effective vaccines for a variety of pathogens such as Henipaviruses, and combating the development and spread of community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA). These projects are funded through multiple funding agencies such as the highly competitive National Institutes of Health (NIH), Department of Defense and other non-federal funding sponsors. Often the research involves collaborations with researchers both within the university and at other research institutions across the country and worldwide.

Trauma Care

Investigators at USU and its affiliated treatment facilities are working on a wide range of advances in trauma care for both combat casualties and accidental injuries here in the United States. Most efforts fall into one of five areas: (1) control of hemorrhage and attendant shock; (2) blood preservation and delivery (e.g., the effects of cross-linked hemoglobin in traumatic brain injury, global and local responses to profound hemodilution; the effects of various environmental hazards on heme regulation); (3) treatment of nerve injuries and neural healing (e.g., low-power laser irradiation on nerve regeneration *in vivo*; the role of neurocytokines and plasticity in injury and healing in sensory nerves); (4) the mechanisms, treatments, and preventive strategies for endotoxic shock; and (5) wound healing and sepsis control (e.g., characterization of inflammation and its intracellular mediators, and the use of prophylactic intravenous antibiotics for penetrating eye injuries). The larger, long-range programs in trauma care include programs administered at the university that focus on the diagnosis and treatment of traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD). The Center for Neuroscience and Regenerative Medicine (CNRM) is a collaborative intramural federal program involving the Department of Defense (DoD) and the National Institutes of Health (NIH) to bring together the expertise of clinicians and scientists to catalyze innovative approaches to traumatic brain injury (TBI) research. The CNRM research programs emphasize aspects of high relevance to the military populations, with a primary focus on patients at the Walter Reed National Military Medical Center located in Bethesda, MD.

Health Maintenance and Enhancement

University research on effective means of maintaining and enhancing health status focuses on military operational medicine as well as TRICARE and civilian concerns about proper exercise, diet, and sleep habits. Behavioral and psychological research also falls under this category. The university has a

nationally recognized, interdepartmental research program for the study and treatment on post-traumatic stress disorder (PTSD), which includes studies of endocrine and physiologic responses in addition to behavioral and psychological investigations. A separate interdepartmental program includes investigations of neurological stress and dysfunction, novel treatments for seasonal affective disorder (SAD), and psychological consequences of physiological stressors such as cardiac surgery. The Human Performance Laboratory, part of the Department of Military and Emergency Medicine, uses human performance models to investigate the physiological consequences of exercise and physical stress, several endocrine factors that affect performance, and environmental factors such as temperature and pressure (e.g., functional consequences of operations in mountainous regions, deep-sea diving, or prolonged immersion in cold or warm water). Several projects designed to identify and analyze deployment stressors and similar issues related to maintaining and deploying troops are conducted by the Graduate School of Nursing as well as the School of Medicine's departments of Medical and Clinical Psychology, Preventive Medicine and Biometrics, and Military and Emergency Medicine. Long-term programs, often conducted in collaboration with investigators at USU affiliates in the Washington, DC area, include several projects under the Center for Neurosciences and Regenerative Medicine and the Infectious Disease Clinical Research Program.

Cancer

The university boasts many cancer-related studies, primarily in the basic sciences but also on the clinical level in conjunction with Walter Reed National Military Medical Center. Major programs administered by the university include the Center for Prostate Disease Research (CPDR), the Murtha Cancer Center (MCC), and the U.S. Military Cancer Institute, all of which also support investigators across the Nation. University investigators conduct basic research in the genomics, proteomics, and other basic science aspects of cancer development, diagnosis, and treatment for multiple forms of cancer, including lymphoma, stomach cancer, thyroid cancer, kidney and liver cancer, melanomas, and cancer of the brain.

Radiobiology

The university encompasses the Armed Forces Radiobiology Research Institute (AFRRI), the Department of Defense's preeminent center for radiation biology research.

Armed Forces Radiobiology Research Institute

The Armed Forces Radiobiology Research Institute (AFRRI) executes DOD's Medical Radiological Defense Research Program through its civilian and active duty military scientists and health professionals. In addition, physicians and health physicists form Medical Radiobiology Advisory Teams (MRATs), and in conjunction with the Defense Threat Reduction Agency, respond to radiological crises worldwide. Their expertise is available to Defense Department and other federal, state, and local activities following a nuclear or radiological accident or incident.



AFRRI is the Department of Defense's preeminent center for radiation biology research. Its civilian and military scientists conduct basic and applied research focused on methods to prevent, assess, and treat injuries resulting from the effects of ionizing radiation. With an understanding of the mechanisms of radiation damage, AFRRI investigators are pursuing new and improved pharmacological approaches to prevent the life-threatening and health-degrading effects of ionizing radiation. Using novel cellular and molecular approaches and animal models, they develop these potentially life-saving drugs from discovery to the initial stages of the Food and Drug Administration (FDA) approval process. A number of promising candidates developed at AFRRI have reached FDA Investigational New Drug status. AFRRI partners with other federal agencies and private sponsors for advanced development.

Good Laboratory Practice research capability is being developed at AFRRI and will allow research compliant with this increasingly recognized standard.

AFRRI also seeks to discover and develop rapid, high-precision analytical methods that assess radiation exposure doses and predict the severity of the Acute Radiation Syndrome from clinical samples. These tools will aid the triage and medical management of radiological casualties. Researchers are developing dose-assessment assays that test easily obtained samples such as a drop of blood or urine, or even a strand of hair, with transportable equipment. Innovative approaches refine dose accuracy throughout a broad dose range while both improving ease of use and decreasing processing time to clinical results. Another important program examines the impact of combining radiation injury with burns and blunt penetrating



trauma. Investigations also assess the health effects of militarily relevant metals that may become embedded as shrapnel, such as depleted uranium and tungsten alloys.

AFRRI houses a wide array of radiation facilities for the support of *in vivo* and *in vitro* radiation research. The 1.1 MW TRIGA (Training, Research, Isotope, General Atomics) Mark-F nuclear research reactor is capable of delivering a mixed linear energy transfer field of fission

neutrons and gamma-rays to a number of experimental systems. Large exposure rooms allow the flexibility of variable shielding configurations to customize the neutron-gamma ratio, which can range from a nearly pure neutron field to a nearly pure gamma-ray field. In addition, the moveable core combined with neutron filtering material permits shifting of the neutron spectrum energies within the exposure rooms. Other experimental facilities include a pneumatic transfer system, removable beam port, in-core experiment tube, and grid plate sample holders. Steady-state operation of the reactor delivers a peak in-core neutron flux of approximately 1013 n/cm²/s. Pulsing operation of the reactor is capable of simulating nuclear weapon detonations.

The large, wet-source storage panoramic cobalt-60 (⁶⁰Co) irradiator provides a 1.17 and 1.33 MeV gamma-ray field covering a wide range of dose rates. Its bilateral irradiation configuration is ideal for dose uniformity, and is capable of delivering chronic and acute dosing schemes in excess of 75 Gy/min (7,500 rad/min). The Chronic Low-Level Radiation Facility is a ⁶⁰Co panoramic irradiator capable of delivering low dose rate gamma-ray exposures over a longer time scale. The cesium-137 irradiator is capable of delivering 662 keV gamma-rays with a wide range of dose rates, up to 0.2 Gy/h (20 rad/h).

In addition to the sources described above, AFRRI has recently added three new radiation facilities. They complement the Institute's traditional sources of irradiation and will foster research of partial body radiation exposures. The Elekta Infinity™ clinical linear accelerator is a comprehensive image-guided radiation therapy system that utilizes simultaneous manipulation of gantry position and speed, dose rate, and collimator angle for optimized delivery of X-rays or electrons. The Philips Brilliance Big Bore™ computed tomography (CT) features an 85 cm bore size for precise imaging of large sample sizes. The Xstrahl Small Animal Radiation Research Platform combines CT imaging with precise X-ray delivery to provide state-of-the-art Image Guided Micro-Irradiation techniques. AFRRI physicists provide expertise in a wide variety of advanced dosimetry techniques for precise calibration of radiation dose rates.

AFRRI's Veterinary Sciences Department (VSD) oversees all research animals, ensuring delivery of state-of-the-art comprehensive medical and surgical veterinary care and compliance with federal, state and local guidelines governing animal research. The VSD staff is focused not only on providing the best animal care

but also helping AFRRRI researchers design research protocols that deliver concise results in radiation biology.

Military Medical Operations (MMO):

This AFRRRI directorate focuses on using the combined research knowledge at AFRRRI for education and operational purposes. The primary MMO activities are the Medical Effects of Ionizing Radiation (MEIR) courses and the MRAT. The former concentrates on educating DOD personnel on health and medical issues involving radiation exposure and contamination with radioactive material. MMO utilizes this knowledge to provide guidance for warfighters in radiation/nuclear accident or incident environments.

Henry M. Jackson Foundation for the Advancement of Military Medicine

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. (HJF) is a private, not-for-profit organization authorized by Congress in 1983 to support medical research and education at USU and throughout the military medical community. The foundation was named in honor of Sen. Henry M. “Scoop” Jackson (1912-1983; D-Washington). HJF currently manages more than 400 awards on behalf of USU researchers: more than 250 are performed on-site at USU facilities and 150 are performed at off-campus facilities. Much of the off-campus research is conducted in more than 100,000 square feet of office and lab space leased by HJF on behalf of USU research programs. HJF continues to submit proposals on behalf of USU researchers at a rate of nearly 300 per year over the past three years. Typically, 80 percent of the proposals submitted are either the National Institutes of Health or the U.S. Army. These two sponsors account for more than 90% of the funding requests. The remaining proposals are submitted to USU, as well as other federal and non-federal sponsors. To assist investigators, HJF staff members identify funding sources and prepare proposals, purchase supplies and equipment, hire research personnel, and provide financial reports and projections. The foundation employs nearly 1,000 individuals who work directly on research grants and other programs. The foundation also drafts and negotiates research and licensing agreements and assists with identifying and patenting intellectual property. Technology transfer provides support for additional research and development while promoting the development of new medical technologies. To help support medical education and training at the university, HJF secures and administers funds from private sources to meet special unbudgeted needs. The foundation has more than 165 education funds and 93 endowment funds established for the university’s benefit. These funds foster graduate and continuing medical education by supporting visiting speakers, seminars, and other events. The foundation supports research and education at the university and at more than 100 military medical facilities, research institutions and other sites across the country and around the world. Any qualified researcher may become an HJF guest scientist and have access to its services. All university faculty members are considered guest scientists.