THE RESEARCH INSTITUTES OF VIRGINIA TECH

VIRGINIA TECH CARILION RESEARCH INSTITUTE

http://research.vtc.vt.edu/

Michael J. Friedlander
Executive Director

MISSION STATEMENT

To make major scientific advances in understanding the fundamental processes of human health and disease. Towards accomplishing this mission, the Virginia Tech Carilion Research Institute (VTCRI) will become an internationally acclaimed epicenter for basic and translational biomedical and behavioral research. The VTCRI will achieve these goals by recruiting premier scientists in key areas, facilitating discovery by providing an intellectually rich and technically superior environment, contributing to the scientific foundations of future physicians by supporting discovery-based medical education, and sustaining and strengthening the Virginia Tech Carilion partnership by contributing to healthy lives through improved prevention, diagnosis, treatment and cures of disease as well as through enhanced decision-making by patients and their health care providers.

Goals and Objectives Achieved for FY 2012

- Recruit at least 3 or 4 leading faculty research team leaders in cardiovascular repair and regeneration, cancer biology, aging, infectious disease and brain development. Recruit an additional 10-20 postdoctoral fellows.  
  Goal accomplishment: VTCRI successfully recruited seven outstanding new faculty members and their research teams in most of these areas, working closely with several colleges and departments. Four of seven of these new faculty hires come to VTCRI with active NIH research funding while the other three are newly independent investigators. 18 postdoctoral fellows were also recruited during this period. Also, senior Virginia Tech Lilly Nanoscience Professor of Chemistry, Harry Dorn, who develops enhanced imaging approaches for cancer and studying living brain function, moved his research operation to VTCRI, where he has initiated collaborative work with the human neuroimaging program.

- Increase research grant funding above $10M per year.  
  Goal accomplishment: The VTCRI increased its active grant portfolio by 40% with 39 active research grants in 2011-2012 with an annual award amount of $11.7M. 38 new research grants are currently in submission with an annual cost of $15.2M.

- Complete the third floor of the VTCRI.  
  Goal accomplishment: The third floor was finished in July, 2012. This $15M fit-out includes the completion of four additional research bays, a new major conference/seminar facility and a laboratory animal housing facility that has capacity for up to 5,000 ventilated environmentally controlled rodent cages for the study of mouse models of a wide range of human diseases.

- Develop a Ph.D. program in brain and cognitive science.  
  Goal accomplishment: The VTCRI initiated the medical research scholars program with the first 5 Ph.D. students who matriculated through existing Virginia Tech doctoral programs but who are supported by VTCRI and will be carrying out their dissertation research in VTCRI labs under the mentorship of VTCRI faculty in areas of brain and cognitive science.

- Integrate Virginia Tech Carilion School of Medicine students into major research programs within the VTCRI.  
  Goal accomplishment: VTCRI faculty are actively participating in the mentoring of VTCSoM medical students. Currently, 22 medical students are carrying out their basic and translational medical research in VTCRI labs under the primary mentorship of our faculty members.

- Enhance interactions with Virginia Tech departments through shared visiting scholars programs and collaborative research opportunities.  
  Goal accomplishment: The VTCRI Visiting Distinguished Scholars Series presented 20 world-renowned scholars in medical science, who gave public lectures and research seminars and met with many Virginia Tech faculty members, graduate students, fellows, medical students, and the community. VTCRI faculty have initiated collaborative research with faculty from the Colleges of Engineering, Science, and Veterinary Medicine.

- Grow collaborative research programs with Carilion Clinic.  
  Goal accomplishment: Research collaborations are now underway with Carilion Clinic on mild traumatic brain injury, psychiatric disorders, children’s health, addiction and brain cancer. New initiatives in wound healing, cardiac repair, infectious disease and stroke are in planning.

- Facilitate transfer of VTCRI faculty members’ technology and development of partnerships for key areas of technology development with business and industry.  
  Goal accomplishment: Faculty members filed several patents including one for a new microfluidic device for visualization of molecules and cells at high resolution in aqueous environments and one for a new brain machine interface. One faculty member started up a company based on his ultrasound technology. The VTCRI Director served on the Roanoke...
Challenges and Opportunities in the top major biomedical scientific journals.

**Goal accomplishment:** VTCRI faculty members published their work as over 60 peer-reviewed publications in a wide range of leading scientific journals, including many high-impact journals such as Cell, PNAS, Trends in Cognitive Science, and the Annals of Biomedical Engineering. VTCRI investigators’ publications were featured in major national and international media including the Wall Street Journal, BBC, NBC Today, ABC and CBS News, the Washington Post, Newsweek and Time.

**Develop three new potential disease diagnostic approaches and rehabilitative strategies.**

**Goal accomplishment:** Read Montague and his team discovered several major new approaches to human neuropsychiatric disorders and treatment including the human brain as a biosensor for psychopathology, the neurobiological substrates for suspicion, that IQ in individuals is dynamic and can be visualized as it changes in the brain in a group setting and the processes that underlie good and bad decision-making in physicians; Sharon Ramey’s team found that particular doses of constraint induced movement therapy for children with cerebral palsy are most effective and persist for extended periods beyond the treatment; Michael Friedlander’s group found that a molecule that can sense viruses and tumors in the body has another, surprising function in the brain: to finely tune the excitability of interconnected networks of neurons, thus enabling the biological imprint of experiences during learning; Deborah Kelly developed a way to isolate biological specimens in a flowing, liquid environment while enclosing those specimens in the high-vacuum system of a transmission electron microscope to visualize how receptors respond to cancer therapeutics; Jamie Tyler developed a new protocol utilizing ultrasonic stimulation through the skull to treat epileptic seizures; Stephen LaConte developed new approaches using fMRI feedback to modulate human brain activity in specific motor regions of the brain for the development of training methods for enhancing motor rehabilitation following stroke; Sarah McDonald found that large-scale, comparative genomics analysis of modern human rotavirus that causes over 500,000 deaths in the world each year, provides significant insight into how this pathogen evolves while spreading throughout the community providing new insight for vaccine design; Harry Dorn found that peptide-conjugated gadolinium metallofullerenes can serve as molecular platforms for the delivery of combined imaging and therapeutic agents to tumor cells in the brain.

**VTCRI** has outstanding physical resources within which to develop collaborative translational research programs and forge partnerships. The facilities were purposefully designed to maximize research efficiency, encourage collaboration among researchers, clinicians, and visiting scientists, and provide a comfortable, productive, and safe working environment. The institute’s infrastructure provides an extraordinary environment for cutting-edge biomedical and health sciences research. The VTCRI is rapidly filling up the space with a projected complete fill-out by 2015-2016. In order to develop nationally prominent research teams in the four targeted areas, the VTCRI will likely require additional research space at the end of that time.

The increasingly challenging and highly competitive federal funding system at NIH presents challenges, particularly for a new biomedical research institute. But by recruiting very highly competitive scientists, the VTCRI is performing solidly, although the uncertainties of the future national funding, economic and political climate remain a challenge.

There are considerable opportunities for new research success for the VTCRI, particularly in the areas of regenerative medicine, wound healing, traumatic brain injury, and post-traumatic stress disorder and substance abuse. These are all areas of major national research emphasis, particularly from the Department of Defense. VTCRI has vast expertise in these areas and several major novel technological approaches.

With the increasing national awareness and attention to the aging population, VTCRI has a critical mass of convergent and interactive leading-edge technologies and conceptual approaches to the study of aging and development of new diagnostics and therapeutics.

There are also considerable opportunities for collaborative research between VTCRI investigators and clinical colleagues at Carilion and at several regional major medical centers, giving the researchers in Roanoke new possibilities for utilizing clinical material and having access to patients for increased grant activities that require basic, translational and clinical approaches.

VTCRI and VBI have begun to develop at least three areas of collaborative research utilizing VBIU’s strengths in genomics and large-scale computational and data analysis in conjunction with VTCRI’s human neuroimaging, computational psychiatry and brain machine interface research programs.

**GOALS AND OBJECTIVES for FY 2013**

Increase extramural funding by 20% to over $14M per year.

Recruit at least two additional faculty in the areas of infectious diseases/inflammation and in cardiac biology and/or regeneration.

Finalize the major graduate research tracks in the biomedical and health sciences for new Ph.D programs in conjunction with a wide variety of stakeholders from the university and in cooperation with the graduate school and the Provost’s office.

Develop the heart regenerative medicine research center.

Increase philanthropic support to the VTCRI.

Obtain at least 2 large scale multi-investigator research grants from NIH and/or other appropriate federal agencies.

Bring at least an additional 10 postdoctoral fellows to the VTCRI.

Develop a formalized dual institution collaborative medical research program with at least one outside major academic health center.

Begin the development of the infrastructure necessary for biomedical training grants, a CTSA application and several NIH P30 Center grants.

Publish at least 20 papers in major high impact biomedical journals.

Make at least 3 major discoveries in the areas of brain and heart health and cancer therapeutics and diagnostics.

Have at least two VTCRI faculty win major national or foundation awards recognizing their research accomplishments.