Precision Medicine Research Fellowships

Summer 2017

Feinstein Institute for Medical Research
Northwell Health℠

PRECISION MEDICINE
NOTRE DAME
A Program of Advanced Diagnostics and Therapeutics

We are proud to announce the **2017 Precision Medicine Research Fellowships!**

These competitive awards are given annually to highly qualified undergraduate and graduate students from Notre Dame that enable them to spend eight weeks in summer residence conducting laboratory and clinical research at the Feinstein Institute for Medical Research in Manhasset, New York.

The Feinstein Institute, which is part of 21-hospital Northwell Health, recruits more than 15,000 patients each year into over 2,100 studies. These fellowships, sponsored by Advanced Diagnostics & Therapeutics and its Precision Medicine program, afford Notre Dame students an opportunity to experience **hands-on research in a world-class setting.**

For Summer 2017, four fellowships will be awarded – two each to (2) undergraduate and (2) graduate students. The fellowships will be active concurrent with FIMR's existing summer internship program, which takes place from approx. June 1 to July 31 each year.

Each student will apply to work in a specific lab at FIMR and, thus, must discuss their interests and capabilities with the directors and staff of relevant labs before submitting an application. An information session for all interested students will be held on January 20. Students will be able to hear directly from lab leaders about the kinds of research questions they pursue and ask follow-up questions.

Students can select to do their internship with the following labs:

If you have any questions about the labs at the Feinstein Institute, please contact Meredith Burcyk at 516-562-1256 or mburcyk@northwell.edu.

IMPORTANT DATES TO REMEMBER:
Application Window – January 13-February 28
Information Session – January 20
Notification of Awards – March 15
Internship/Research Period – Approximately June 1-July 31

Please see advanceddiagnostics.nd.edu/opportunities for more information.

Kevin J. Tracey, MD – Presented by Sangeeta S. Chavan, PhD

President and CEO, The Feinstein Institute for Medical Research

Director, The Laboratory of Biomedical Science, The Feinstein Institute for Medical Research

Professor, Molecular Medicine & Neurosurgery, Hofstra Northwell School of Medicine

Kevin J. Tracey is a leader in the study of the molecular basis of inflammation. He and his colleagues identified the neural mechanism for controlling the immunological responses to infection and injury, and developed devices to replace anti-inflammatory drugs in clinical trials of rheumatoid arthritis, a new field termed bioelectronic medicine. The recipient of numerous awards and honors, including an honorary degree from the Karolinska Institute, Dr. Tracey is a fellow in the American Association for the Advancement of Science, and a member in the American Society for Clinical Investigation, and the Association of American Physicians. He is co-founder and Councilor of the Global Sepsis Alliance.

Professor Tracey graduated *summa cum laude* from Boston College, majoring in chemistry, and received his MD from Boston University. He trained in neurosurgery at the New York Hospital/Cornell University Medical Center, and was guest investigator at The Rockefeller University. Since 1992 he has directed the Laboratory of Biomedical Science in Manhasset, NY, where in 2005 he was appointed president of the Feinstein Institute. Dr. Tracey delivers lectures nationally and internationally on inflammation, sepsis, the neuroscience of immunity, and bioelectronic medicine. He is the author of *Fatal Sequence* (Dana Press) and more than 320 scientific papers.

> **Research Focus –** The major focus of Dr. Tracey's laboratory is the molecular basis of inflammation and identifying the mechanism by which neurons control the immune system.
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> Dr. Tracey participated in the discovery of the direct inflammatory activity of tumor necrosis factor-alpha (TNF) and the therapeutic role of monoclonal anti-TNF. He and his colleagues discovered the role of HMGB1 in inflammation, and identified the molecular mechanisms for signal transduction by signaling through pattern recognition receptors. This provided the first direct evidence to unify mechanisms of inflammation produced by molecules derived from the pathogen and host.
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> His laboratory discovered the molecular mechanism for the neural control of inflammation, now termed the inflammatory reflex. They delineated the neurophysiological mechanism as dependent upon action potentials transmitted in the vagus nerve, which regulate a T cell subset in spleen that produce acetylcholine. This lymphocyte derived neurotransmitter interacts with alpha-7 nicotinic receptors expressed in macrophages. Signal transduction via this receptor-ligand interaction inhibits cytokine release by suppressing inflammasome activation.

These discoveries enabled Dr. Tracey and his colleagues to develop devices to replace anti-inflammatory drugs. This new field, termed bioelectronic medicine, utilizes electrons delivered to neurons to modulate pathogenic targets in disease. The lead program utilizes devices to stimulate the inflammatory reflex which inhibits TNF in healthy subjects and in patients with rheumatoid arthritis. His lab participated in reporting the first successful clinical trial demonstrating that vagus nerve stimulation can be effective in methotrexate-resistant rheumatoid arthritis patients.

Chad Bouton, MS

Division Leader, Neurotechnology and Analytics, The Feinstein Institute for Medical Research

Managing Director, Center for Bioelectronic Medicine

Vice President, Advanced Engineering, Northwell Health

Prior to joining the health system, Mr. Bouton was a research leader at Battelle, the world's largest nonprofit research and development (R&D) organization, and was involved in medical device R&D programs for 18 years. He developed cancer detection algorithms in the late 90's to help surgeons pinpoint and remove tumors more effectively. Later, he developed neural decoding methods that allowed the first paralyzed person with a brain implant to move again with their own thoughts.

Mr. Bouton's work has been featured on *60 Minutes* and TEDx, and he holds over 70 patents worldwide. He has been awarded two R&D 100 Awards and was recognized by the US Congress for his work in the medical device field. He has been named Inventor of the Year and Distinguished Inventor by Battelle, and was selected by the National Academy of Engineering in 2011 to attend the Frontiers in Engineering Symposium. Mr. Bouton received his BS in Electrical Engineering at Iowa State University and his MS in Engineering Mechanics at Iowa State University with Honors.

Research Focus – The major focus of Mr. Bouton's lab will be in the following areas related to Bioelectronic Medicine: developing neural bypass technology for paralysis, neural decoding / machine learning methods for correlating neural signals to important biomarkers, microfabrication / bioMEMs technology for neural implant development, bioelectronics and biosensing technologies, and closed-loop neurostimulation devices.

Betsy Barnes, PhD –

Investigator, Head, Laboratory of Autoimmune and Cancer Research

Center for Autoimmune and Musculoskeletal Diseases

The Feinstein Institute for Medical Research

Prior to joining the health system, Dr. Barnes was an Associate Professor in the Department of Molecular Biology, Biochemistry and Genetics at Rutgers, The State University of New Jersey in the New Jersey Medical School –Cancer Center. She received her PhD in Medicinal Chemistry from the University of North Carolina at Chapel Hill in 1999. Dr. Barnes did her postdoctoral training as a fellow in the NIH-sponsored Anti-Cancer Drug Development program in the Department of Oncology at Johns Hopkins University Sidney Kimmel Comprehensive Cancer Center. She then became an Assistant Professor at Johns Hopkins University and moved her laboratory to Rutgers in 2006 where she became a leader in the field of Interferon and cytokine research.

Dr. Barnes has mentored many successful Ph.D. and M.D./Ph.D. students that have gone on to have successful careers in science. She travels both nationally and internationally to deliver lectures on inflammation, immunity, tumor-immunity and autoimmune disease. She is a well-funded researcher who has established numerous collaborations with the Pharmaceutical Industry in the hopes of developing new therapeutic options for patients with autoimmune disease and cancer.

Research Focus – Dr. Barnes' laboratory studies a family of transcription factors – interferon (IFN) regulatory factors (IRFs) – that regulate immune cell signaling and the cellular response to extracellular stressors. She was the first to clone the family member IRF5 and show that it is an integral regulator of type I IFN gene expression. Later studies demonstrated its significant role(s) in mediating Toll-like receptor signaling, DNA damage signaling and death receptor signaling. Her lab is thus interested in understanding the role of IRF5 as an immune regulator and a tumor suppressor.

With the identification of *IRF5* as an autoimmune susceptibility gene for systemic lupus erythematosus (SLE) in 2005, her lab began to study how alterations in IRF5 could contribute to SLE disease pathogenesis in both human and mouse models of SLE. Subsequent studies have now shown that the *IRF5* risk locus is associated with susceptibility to numerous autoimmune diseases.

Given that the immune system plays critical roles in tumor development and susceptibility as well, her lab studies how alterations within a tumor can change the way the immune system recognizes it. Her labs specific interest is in hematologic malignancies and breast cancer.

Lance Becker, MD, FAHA – Presented by Joshua Lampe, PhD

Department Chair, Emergency Medicine, Northwell Health

Department Chair, Emergency Medicine, Hofstra Northwell School of Medicine

Professor, Emergency Medicine, Hofstra Northwell School of Medicine

Before joining the health system, Dr. Becker served as founder and director of the Center for Resuscitation Science at the Hospital of the University of Pennsylvania in Philadelphia, and professor of the Center for Mitochondrial and Epigenomic Medicine at The Children's Hospital of Philadelphia. Prior to that, he was founder and director of the Emergency Resuscitation Center at the University of Chicago and Argonne National Laboratory.

He has received numerous honors and awards from such organizations as the American Heart Association, the American College of Emergency Physicians and American Society of Critical Care.

A recipient of prestigious teaching awards, he has mentored many successful research fellows. He is a renowned, well-funded researcher who holds many patents for his discoveries. His professional affiliations include membership in the American Heart Association, Society of Academic Emergency Medicine, the US Institute of Medicine, the National Academy of Science, the American College of Emergency Physicians and the American Physiological Society. In addition, he holds many offices in professional and scientific societies, and has organized many national and international scientific meetings. He is an elected member of the Institute of Medicine/National Academy of Medicine.

Research Focus – A national and international leader in academic emergency medicine, critical care and the science of resuscitation, Dr. Becker has research interests that are translational and extend across the basic science laboratory into animal models of resuscitation and to human therapies.

He has been a leader in the field of resuscitation for more than 25 years, pioneering advances in improving the quality of CPR, AED use, defining the "three phase" model for cardiac arrest care, and therapeutic hypothermia. He has worked closely with the American Heart Association in emphasizing the importance of a "systems of care" approach to improving survival within communities. His cellular studies have helped define reperfusion injury mechanisms, mitochondrial oxidant generation, reactive oxygen and nitrogen species responses to ischemia, apoptotic activation following ischemia, signaling pathways, new cellular cytoprotective strategies and hypothermia protection.

Yousef Al Abed, PhD

Investigator, Head, Center for Molecular Innovation, The Feinstein Institute for Medical Research

Professor, Molecular Medicine & Medicine, Hofstra Northwell School of Medicine

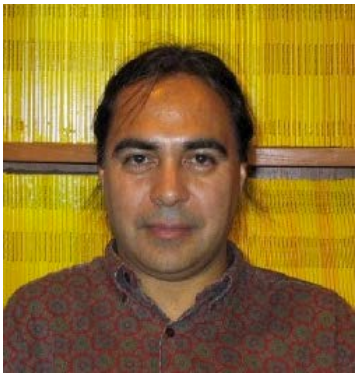
Dr. Yousef Al-Abed received his bachelor's degree from College of Science and Technology in Jerusalem, Israel, and his master's from the University of Jordan. He later received his doctorate in organic chemistry from the University of Tubingen in Germany. His thesis focused on developing novel methodologies for the utilization of carbohydrate scaffolds in the syntheses of complex molecules.

In 1994, Dr. Al-Abed was recruited as a postdoctoral fellow by Dr. Anthony Cerami to work at the Picower Institute in Manhasset, NY. He became an assistant professor in 1997, and in 2002 he accepted a position as an associate investigator and director of Drug Discovery Programs at The Feinstein Institute for Medical Research. In 2009, he became a professor of molecular medicine at Hofstra Northwell School of Medicine.

Recently, Dr. Al-Abed was named the head of Feinstein's newly established Center of Molecular Innovation. This Center leads the discovery and development of novel therapeutics for human diseases including lupus, arthritis, diabetes, Alzheimer's disease and sepsis. It is an essential component of The Feinstein Institute that integrates target discovery with medicinal chemistry approaches to generate molecular probes (small organic compounds) and potential drugs. So far, the Center has successfully identified several drug candidates and has repurposed existing drugs to target critical proteins involved in neurodegenerative and autoimmune diseases.

> **Research Focus** – Molecular Innovation's impact on drug discovery can be exemplified by Dr. Al-Abed's laboratory team's previous work with macrophage migration inhibitor factor (MIF), a pro-inflammatory cytokine involved in many inflammation-mediated diseases. Their research so far indicates that MIF is a prime candidate for small molecule drug development. Based on their successful approach, the pharmaceutical industry (e.g., Novartis, Sanofi-Aventis, Vertex and others) has begun to invest heavily in MIF as a drug target.

Patricio Huerta, PhD –



Professor of Neuroscience, Center for Autoimmune and Musculoskeletal Diseases, The Feinstein Institute for Medical Research

Professor, Molecular Medicine, Hofstra Northwell School of Medicine

Dr. Patricio Huerta attended the University of Chile, where he studied biology and philosophy and later earned a master's degree in physiology. He then moved to Boston to pursue doctoral studies at Brandeis University under the advise of Dr. John Lisman. Dr. Huerta's doctoral thesis dealt with the topic of theta-band oscillations and synaptic plasticity in the hippocampus. Dr. Huerta stayed in Boston for his postdoctoral fellowship and joined the laboratories of Susumu Tonegawa and Matthew Wilson at the Massachusetts Institute of Technology. His postdoctoral work focused on the mechanisms by which the synaptic receptor, known as N-methyl-D-aspartate receptor, participates in the molecular basis of episodic memory.

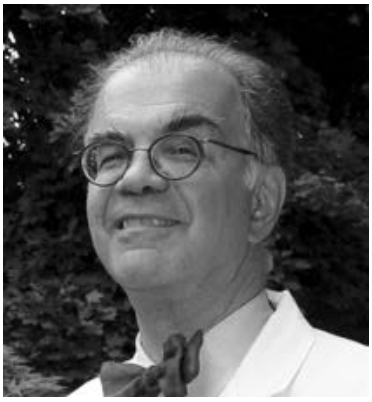
Dr. Huerta worked as an assistant professor at New York University and, subsequently, migrated to the Burke Institute, an affiliate of Cornell Medical School, which allowed him to pursue biomedical research in preclinical models in conjunction with clinical studies in human patients.

Dr. Huerta is highly interested in exploring the interactions between the nervous system and the immune system in health and disease. During his training, and as an independent investigator, he has gained expertise in neural recordings of ex vivo brain slices, in vivo neural recordings of freely moving mice, brain anatomy and imaging, behavioral science, molecular genetics, genomics, immunology, and animal modeling of neurological and autoimmune diseases.

Research Focus – Dr. Huerta's Laboratory of Immune & Neural Networks explores how the brain organizes cognitive behavior. The brain areas that are relevant for cognition, such as the hippocampus and cortex, have been well mapped anatomically but the functional aspects remain elusive. Dr. Huerta's team uses a multi-level approach to study the physiological processes and the brain areas that are engaged in cognition.

Current projects include the development of clinically relevant murine models for the brain abnormalities that occur during immune-related diseases, such as systemic lupus erythematosus, overwhelming sepsis, maternal transfer of antibodies, and neuroinflammation. His laboratory's overarching goal is to isolate key neural and immune mechanisms that can guide us in the generation of rational therapies for brain disorders and autoimmunity.

Bruce Volpe, MD –



Investigator, Laboratory of Biomedical Science, The Feinstein Institute for Medical Research

Professor, Department of Molecular Medicine, Hofstra Northwell School of Medicine

Dr. Bruce Volpe graduated with a BS from Yale University and an MD from Yale Medical School. He completed a residency in internal medicine at the University of Chicago Medical Center and at Columbia Presbyterian Medical Center and received further clinical training in neurology at Cornell-New York Hospital Medical Center.

Dr. Volpe has headed brain trauma and stroke recovery units at Cornell affiliated hospitals, and directed the neurorehabilitation fellowship training for neurologists also at the Cornell-Burke Program. He worked with the first interactive robotic devices in the dawn of the modern age of neuro-recovery, testing whether these devices were effective.

He is a member of the Departments of Neurology and Physical Medicine and Rehabilitation at the Northwell Health Hospital Center, and he mentors residents from those departments in performing clinical research projects.

Research Focus – At The Feinstein Institute for Medical Research, Dr. Volpe is attempting to extend the reach of restoration after neurological injury with non-invasive technology and with novel pharmacology. Clinical research in stroke recovery has demonstrated that many stroke survivors can relearn skills that are lost when part of the brain is damaged. Rehabilitation efforts focus on teaching new ways of performing tasks to circumvent or compensate for residual disabilities. This approach leaves aside training for the affected limbs. Now, robotic devices can be used to re-train weakened upper limbs. This novel technology moves a patient's paralyzed or paretic limb and senses when a patient is moving so that it can get out of the way and let the patient execute the movement. The lab is also testing whether robotic training can be complemented and enhanced by transcranial direct current stimulation (tDCS), and eventually by repetitive trans-cranial magnetic stimulation (rTMS).

His laboratory at The Feinstein Institute also applies techniques of quantitative histopathology in collaborative projects that study the effect of autoantibodies on the brain and the toxic delayed effects of severe sepsis on the brain.