

Tara Alvarez, associate professor of biomedical engineering, and graduate student Sang Jin Han study the relationship between vision and neural function.

Designing a

HEALTHIER FUTURE

THE INTERSECTION OF MEDI-

Medical Partnerships

“In a nation of technological riches, there is no better way for engineers to use their talents than to find new technologies to help people with disabilities, especially children.”

— Richard Foulds, director of NJIT’s Rehabilitation Engineering Research Center

CINE AND TECHNOLOGY IS WHERE SCIENCE TRANSFORMS INTO PRACTICAL TREATMENTS AND THERAPIES, AS DEMONSTRATED BY THE WORK OF ASSOCIATE PROFESSOR OF BIOMEDICAL ENGINEERING TARA ALVAREZ, DIRECTOR OF NJIT’S VISION AND NEURAL ENGINEERING LABORATORY. SHE AND HER COLLEAGUES FROM THE UNIVERSITY OF MEDICINE AND DENTISTRY OF NEW JERSEY (UMDNJ) AND THE STATE UNIVERSITY OF NEW YORK (SUNY) ARE WORKING TO DEVELOP SPECIAL TECHNIQUES AND EQUIPMENT FOR STUDYING TRAUMATIC BRAIN INJURY (TBI). SHE IS SUPPORTED IN HER STUDIES BY A PRESTIGIOUS NATIONAL SCIENCE FOUNDATION CAREER GRANT, WHICH RECOGNIZES PROMISING YOUNG RESEARCHERS AND HELPS THEM INTEGRATE THEIR RESEARCH AND TEACHING ROLES.

The sensory preeminence of vision underlies a strong connection between the physiology of sight and other neural and muscular functions — functions that can be impaired by afflictions such as TBI. Now a major focus of her research, Alvarez says that TBI is emerging as a serious national health issue, with automotive accidents being one major cause. In New Jersey, a portion of fines collected for traffic violations helps to further the work of the state's Commission on Traumatic Brain Injury as well as that of the Commission on Spinal Cord Research.

Current military action in Afghanistan and Iraq has been even more instrumental in calling the nation's attention to TBI. That's because a substantial percentage of the wounds sustained by U.S. personnel involves TBI. This is due to the ordnance used by adversaries in both areas, particularly weapons that include the improvised explosive devices often referred to as IEDs.

Alvarez says that mild TBI is especially difficult to diagnose with conventional MRI scans because the neural damage tends to be more diffuse and subtle compared to the localized effects typically associated with illnesses such as a stroke. But as her previous work has demonstrated, a great deal about neural impairment affecting memory, attention and visual functions can be inferred from eye movement.

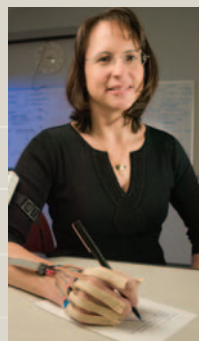
A primary goal is to gain new knowledge about TBI by integrating the use of equipment that monitors eye movement with functional magnetic resonance imaging (fMRI), a relatively new and more capable neuroimaging tool. Individuals tested will visually track targets displayed on the interior of the fMRI enclosure while performing exercises only with their eyes to accommodate the need to keep one's head immobile for the fMRI scans. Ocular movement utilizing motor learning and memory exercises will be correlated with fMRI data about blood flow in the brain. In addition to increasing basic physiological knowledge, Alvarez and her colleagues hope that their functional-imaging research will lead to better therapies for TBI.

Convergence insufficiency is another condition under study. A common manifestation of this difficulty is an inability to read for more than 15 or 20 minutes without experiencing blurred vision and fatigue, debilitating impairments in the workplace and in many other situations.

In each instance, investigation of the basic science has been complemented by applying the insights gained to developing therapeutic exercises. Such exercises can be beneficial because of our neural plasticity. In Alvarez's words, that's our capacity to "rearrange the brain's real estate" to achieve functional improvement.

In Other Projects...

Lisa Simone, assistant research professor of biomedical engineering, is developing the wearable



wireless Shadow Monitor, a device to assess hand function rehabilitation in individuals following brain

injury, under a grant from the National Institutes of Health. The goal of this research is to characterize and understand hand function over long periods of time as individuals participate in home and community activities. ■

understanding of the functionality of RNA sequences, the detection of RNA structural motifs and the clustering of RNA molecules. His work, which appeared in *Nucleic Acids Research*, will facilitate design of new drugs and therapies. He received an NSF grant to continue his studies in RNA mining. ■



Carol A. Venanzi, distinguished professor of chemistry and environmental science uses quantum chemistry and molecular modeling to elucidate DNA/ligand binding. With grant support from the NIH, she is collaborating with NIH scientists and with Professor **Rajesh Dave**, director of the New Jersey Center for Engineered Particulates, in the development of a treatment for cocaine abuse. ■



Professor of Computer Science **Yehoshua Perl** is leading a team of researchers under a grant from the National Library of Medicine to track down and correct incorrect or misplaced medical terms in the Unified Medical Language System, a terminological knowledge base of 1.3 million concepts taken from 100 specialized medical terminologies and coding systems. ■



Associate Professor **Treena Livingston Arinzeh** and Postdoctoral Fellow **Norbert Weber** work to create therapies from adult stem cells such as those for repairing and regrowing bones. Their work will benefit from the Newark Institute for Regenerative Healthcare, to be created with \$50 million in state funding to translate basic research in stem cell science into practical and deliverable therapies for patients. ■



Jason Wang, professor of computer science and director of the Data and Knowledge Engineering Laboratory, has developed RADAR, a web server to analyze RNA data that will assist scientists in performing many important RNA mining operations, including the