

# NJIT & UMDNJ

## A JOINT RELATIONSHIP

**NJIT and the University of Medicine and Dentistry of New Jersey (UMDNJ) have forged alliances in diverse disciplines to improve our health and well-being.**

### **BUILDING ON SUCCESSFUL JOINTS**

A pioneering “joint” collaboration was one of the earliest projects in the long and fruitful relationship between NJIT and UMDNJ, two preeminent Newark institutions. Shortly after New Jersey Medical School (NJMS) opened in Newark more than four decades ago as part of UMDNJ, NJIT mechanical engineering professor and alumnus Michael J. Pappas ’59, ’64 was asked to teach a course in biomechanics. One of his students, Frederick Buechel, would go on to become an orthopedic surgeon and collaborate with Pappas in creating a series of innovative prosthetic joints – including the extraordinarily successful New Jersey Low Contact Stress Knee.

Today, the links between NJIT and UMDNJ span educational programs and cooperative leading-edge research. NJIT students can enroll in accelerated medical and dental programs, pursue degrees as a physical therapist or physician assistant, and study for a PhD in biomedical engineering. The urban-systems PhD program established by NJIT’s New Jersey School of Architecture in 2001 includes an urban-health track offered in cooperation with the School of Nursing at UMDNJ.

While NJIT’s Biomedical Engineering Department is the focal point of much of the interaction with UMDNJ, a growing number of researchers from other departments are collaborating with colleagues not far away in Newark.

*Right: A model of the “New Jersey Knee,” which has given millions pain-free mobility.*

[CONTINUED ON PAGE 10]



## CHEWING ON THE PROBLEM

An expert in materials testing, NJIT's Allyn Luke '88, '90, Department of Civil and Environmental Engineering (CEE), is helping to advance research involving dental implants and biomaterials at New Jersey Dental School's Department of Restorative Dentistry. He coaches dental researchers in using their unique closed-loop servo-hydraulic multi-axial testing system to duplicate chewing motions. Luke, assistant to the CEE chair for laboratories, has taught concrete and construction materials testing as an adjunct at NJIT for more than two decades and shared his expertise at UMDNJ for ten years.



PHOTO: ANDREW HANENBERG, COURTESY OF UMDNJ

NJIT's Allyn Luke (third from right) with UMDNJ's Professor Robert Flinton, DDS (seated), and Professor Saul Weiner, DDS. On Luke's right are Associate Professor Hoda Yousef, DMD, and other restorative dentistry researchers with their unique testing system.

## COMPUTING INSIGHTS

Working with members of the Pediatrics and Biochemistry and Molecular Biology Departments at NJMS, Associate Professor of Computer Science Usman Roshan has analyzed genetic data for indicators of susceptibility to disease and for insights into basic biological processes.



PHOTO: ROBERT FECHTNER

Jason Wang, professor of bioinformatics and computer science, has collaborated with researchers in the Department of Microbiology and Molecular Genetics and the Department of Cell Biology and Molecular Medicine. Projects include developing algorithms for mining useful data from biologically significant areas in the genomes of organisms such as the parasite that transmits sleeping sickness.

## MATHEMATICS AND HEALTH

The evolving relationship between mathematics and medicine encompasses analytical efforts that clarify how physiological systems work and provide new knowledge in situations where physical experimentation is very challenging. Mathematics – a complementary tool in research ranging from neurophysiology to cardiac function – can help to evaluate the potential importance of data obtainable from various procedures, with the aim of maximizing the yield of data using statistical inference analysis.

In recent collaborations at UMDNJ, Associate Professor Sunil Dhar, Department of Mathematical Sciences, has applied statistical analysis in areas that include anesthesiology. An example of the goals of such analysis is to gain meaningful information from patient data about lung function and the effects of anesthetics such as propofol.

Professor of Physics Gordon Thomas (left) testing an early model of the personal tonometer at UMDNJ with Albert Khouri, MD, and NJIT PhD candidate Irene Nwosuh.

## APPLIED PHYSICS

Professor of Physics Gordon Thomas has created more than a half-dozen inventions to help people lead healthier and more productive lives. Among them is a personal tonometer licensed jointly by NJIT and UMDNJ that enables individuals susceptible to glaucoma, a leading cause of blindness, to monitor eye pressure without the assistance of medical personnel. Developed by a team led by Thomas and Robert Fechtner, MD, professor of ophthalmology and director of the glaucoma division at NJMS, the new tonometer could minimize the possibility of blindness by allowing users to monitor eye pressure more often and check whether their doctor has missed a problem or if their medication is working.



PHOTO: JED MEDINA

Treena Arinzeh, professor of biomedical engineering, has helped to pioneer bone repair with adult stem cells.

## NJIT AND UMDNJ, ALLIES IN:

- DEVELOPING BETTER DENTAL MATERIALS
- MINING GENOMIC DATA FROM DANGEROUS ORGANISMS
- STUDYING BASIC PHYSIOLOGICAL FUNCTIONS
- PREVENTING BLINDNESS
- REPAIRING DAMAGED BONE
- REHABILITATING STROKE PATIENTS
- DIAGNOSING MILD TRAUMATIC BRAIN INJURY

### THE BIOMEDICAL ENGINEERING CONNECTION

Biomedical engineering courses have long been part of NJIT's curriculum, for some two decades before the Department of Biomedical Engineering was established in 2001. Over the years, the relationships between NJIT biomedical engineering faculty and UMDNJ researchers have increased in number and scope. NJIT faculty engaged in ongoing cooperative work include Professor Treena Arinze and Associate Professors Sergei Adamovich, Tara Alvarez and Bryan Pfister.

Widely recognized for investigating how adult stem cells can be used to repair damaged bones, Arinze and her colleague, orthopedic surgeon Sheldon Lin, have developed a therapeutic technique now in preclinical evaluation.

Adamovich is developing therapies based on robotic assistance and virtual-reality exercises that help stroke patients regain arm and hand movement. He is collaborating with UMDNJ's Alma Merians, PhD, and Eugene Tunik, PhD, in studies that employ transcranial magnetic stimulation to determine if this therapeutic approach can be validated by discernible changes in the brain.

Merians is a professor and chair of the Department of Rehabilitation and Movement Sciences at the UMDNJ School of Health Related Professions, and Tunik is an associate professor in the department. Adamovich is also an adjunct associate professor in the department.

Collaboration between Alvarez and UMDNJ's Bharat Biswal, a biophysicist and imaging expert, has indicated an important diagnostic link between patterns of eye movement and mild traumatic brain injury (TBI).

They were also the first to publish that rehabilitative eye exercises for convergence insufficiency – a condition causing blurred vision and fatigue after 15 to 20 minutes of reading – can be correlated with functional changes in the brain. Further, they report that the incidence of convergence insufficiency seems to be increasing as more workers spend full days at computers and the use of smartphones and other devices with video screens continues to grow.

Traumatic brain injury is also the focus of research for Pfister and colleagues Professor Kevin Pang and Assistant Professor Viji Santhakumar, both affiliated with the Department of Neurology and

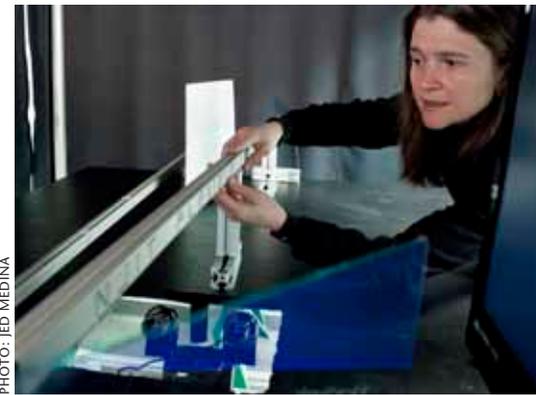


PHOTO: JED MEDINA

Associate Professor Tara Alvarez adjusting the system used to record eye movements with high-speed cameras.

Neuroscience at NJMS. They are investigating TBI from the level of individual neurons up through its manifestation in complex behavior. Their goal is to ascertain whether mild and repetitive TBI causes physiological changes in neurons and neural circuits without clear loss of brain cells, and how these changes may be linked to learning, memory and motor impairments.

### A POWERFUL SYNTHESIS

The work of these and other NJIT faculty members partnering with researchers at UMDNJ is being advanced by funding from many organizations, including the National Science Foundation, the National Institutes of Health, the New Jersey Commission on Brain Injury Research, the Coulter Foundation, the Glaucoma Foundation and the Hoffman Foundation. This support and the diverse talents of NJIT and UMDNJ investigators are energizing a powerful synthesis for better health. ■

Author: Dean L. Maskevich is editor of NJIT Magazine.



PHOTO: HAMID BAGCE

Sergei Adamovich (left) and UMDNJ's Eugene Tunik (standing) are working with student volunteer Jony Scheynin to map the brain's response to tasks performed in virtual reality.