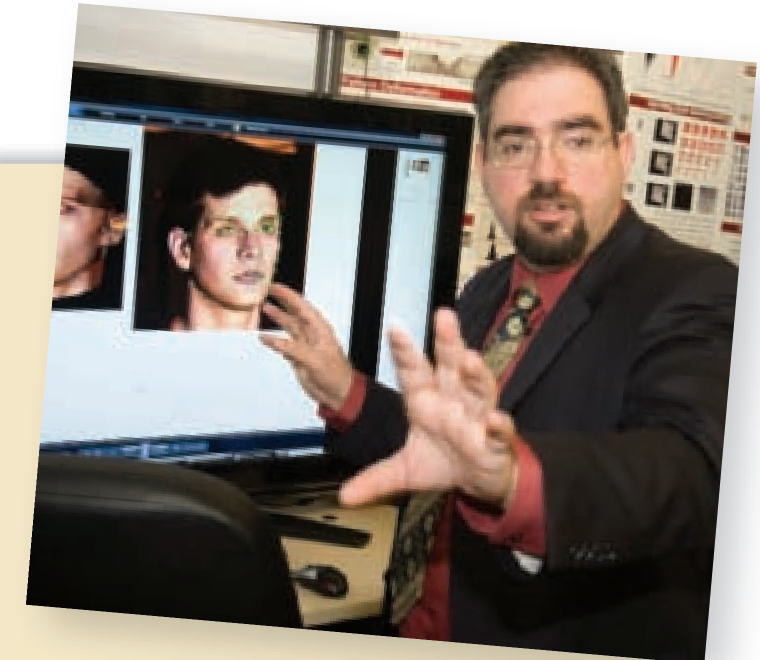
research brief 1

One Look Says It All

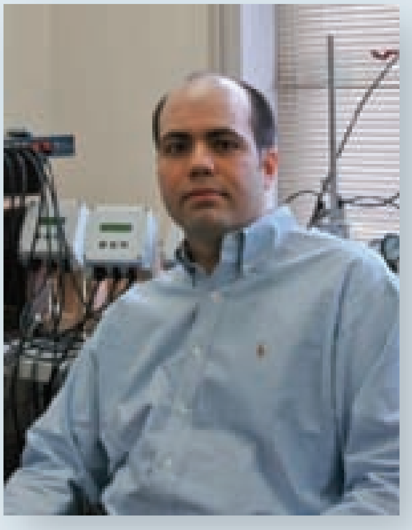


Mario Savvides directs CyLab's Biometrics Lab

Whether we're shopping at the local quick mart or waiting for a flight at the airport, making the places we frequent more secure is the goal of the biometics research that is being conducted by Mario Savvides, a research assistant professor in ECE and Carnegie Mellon CyLab. He and his research group are developing cameras and sensor networks that rapidly identify people by homing in on their faces and especially their eyes. While a quick pass through a checkpoint that's outfitted with these high-tech devices could flag criminals, the same technology can be used in verification and authentication processes, giving people access to computers or buildings.

The Carnegie Mellon CyLab building has become a test bed for several of these innovative technologies. At key entrance ways and outside of select offices, Multi-Modal Sensor nodes, consisting of pan-tilt-zoom cameras (PTZ), and iris acquisition cameras are being installed. The cameras and sensors have both wired and wireless capabilities and are able to interface with a wireless sensor network. Only people who pass authentication and verification processes will be granted access. Currently, most authentication systems rely on single biometric modality (like fingerprints) to perform identification and verification. The advantages of face and iris systems is that they employ nonintrusive, touchless interactions (during the past SARS outbreak, people were scared to touch fingerprint sensors in airports). While it is possible for an attacker to access one biometric ID system, it is very difficult for someone to slip past a system that relies simultaneously on two or more biometric measures—such as the face and iris. By installing these devices on campus, CyLab's researchers will be able to test their theories and develop methods for improving deployment. This same technology is being harnessed to enhance national security and to protect U.S. borders.

research brief 2



research brief 3

Improving Aerosol Drugs for Cystic Fibrosis Therapies

Inhaled aerosol drugs can deliver substantial doses of medication directly to the lungs. Dispensing medications in this manner prevents drugs from amassing elsewhere in the body and can spare patients uncomfortable side effects. Antibiotics are often administered this way to treat infections that are associated with cystic fibrosis, a genetic disorder that causes mucus to thicken, resulting in serious breathing problems. However, patients with cystic fibrosis and other lung diseases breathe irregularly and this can cause inhaled drugs to deposit non-uniformly in their lungs, creating wide variations in local dosing. This results in a reservoir of infection that is never effectively treated by the therapy.

To help these seriously ill patients, engineers from Carnegie Mellon's Center for Complex Fluids Engineering, including Bob Tilton (BME and ChemE), Todd Przybycien (BME and ChemE), and Steve Garoff (Physics) are collaborating with researchers Tim Corcoran and Joe Pilewski at the University of Pittsburgh Medical Center (UPMC) to develop surfactant-based aerosol drug carriers. These carriers are designed to help inhaled drugs spread uniformly over airway surfaces. When the drugs are inhaled, aerosol droplets are deposited near obstructions in the diseased lung. Surfactants in the drugs modify the surface tension of the complex mucus liquids that line the airways, producing a unique surface flow pattern that allows the medicine to be evenly distributed. With support from the National Institutes of Health, the group is fine tuning the formulations of the surfactants to improve their ability to spread on mucus gels. This research is now being tested in human volunteers at UPMC .

A Tool That Predicts When Aortic Aneurysms Will Rupture

Ender Finol, associate research professor and head of the Vascular Biomechanics and Biofluids Laboratory at Carnegie Mellon's Institute for Complex Engineered Systems (ICES), received a $602,000 grant from the National Institutes of Health to develop tools that will help doctors predict if an abdominal aortic aneurysm is going to rupture.

The aorta, which runs through the center of the human body, is the major artery responsible for supplying the body with blood. When an aneurysm, or a weakened, bulging area, develops in the aorta, the potential develops for it to rupture, resulting in life-threatening bleeding. Nearly 2 million Americans suffer from abdominal aortic aneurysms and more than 15,000 of those die each year.

Fortunately, most aneurysms don't burst if they are detected on time, and patients are carefully monitored to determine if surgery is necessary. The problem that physicians encounter, however, is that they cannot predict when a rupture will occur. Usually the decision to operate is based on the aneurysm's size and how rapidly it grows. To help doctors identify those patients most likely to suffer a dangerous rupture, Finol has developed a biomechanical tool that evaluates the risk of a rupture by analyzing changes in the shape and thickness of the arterial wall. The tool works in a non-invasive manner by examining three-dimensional computed tomography (CT) and magnetic resonance (MR) images of the aorta.

These images show flow patterns and wall stress distributions in two different aortic aneurysms.