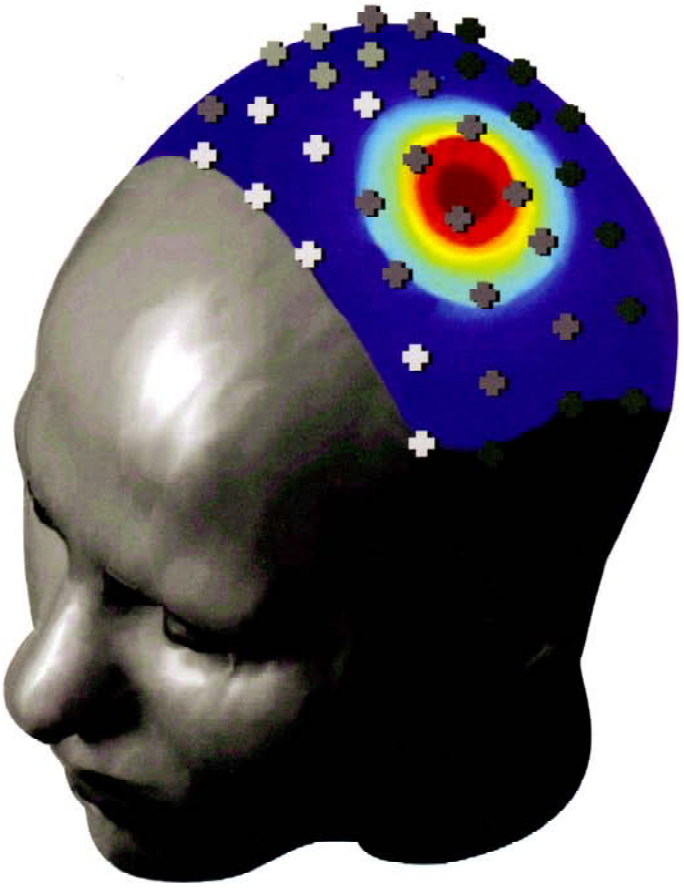
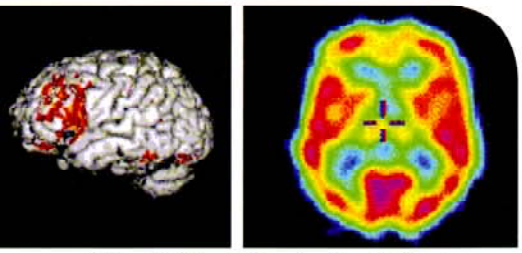


Biomedical Imaging

The Eyes of Science

By Trisha Coffman



Left to right: fMRI and PET imaging. Above: EEG imaging

Intelligent guessing, backed by wisdom and understanding, has for the most part led the progression of medical science. It's accomplished a great deal, to be sure, but there's a new bridge in town, one that makes the pathway between the medical sciences and engineering principles a regular thoroughfare.

"The investigations of complex biological and physiological systems and processes require an extensive collaboration between life and physical scientists and engineers to improve our understanding," says Metin Akay, Interim Chair of the Harrington Department of Bioengineering (HDBE) in the Ira A. Fulton School of Engineering.

Leading the way toward a crisper understanding is a particularly hot field, that of biomedical imaging and informatics, a developing Fulton School thrust area led by HDBE in collaboration with the Department of Electrical Engineering and the School of Computing and Informatics. Biomedical imaging is an interdisciplinary field based on the integration of the physical sciences and the life sciences for the improvement of diagnosis and treatment of disease.

"There's an increased appreciation of the need for cross cutting departments that bridge engineering and medicine."

Where once only the entire body or individual organs could be imaged, advancements in imaging technologies—such as ultrasound, computed tomography (CT), magnetic resonance imaging (MRI) and positron emission tomography (PET)— allow imaging of specific cells or molecules within an organ or tissue. "From system to cell we can use imaging technology to predict and to diagnose disease, as well as to monitor the disease," Akay says. "We were unable to see molecular activities using other tools before. Now we can do it."

That the imaging paradigm has been changing over the past 10 years or so is due to improved resolution and progress in developmental chemistry, allowing for the labeling of individual molecules and seeing how they interact, says Zhi-Pei Liang, Professor of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign.

Reduced healthcare expenses and more individualized medical treatment are just two of the visualized benefits of advancing imaging technology. For example, heart bypass surgeries were once always considered major surgeries; new imaging technology allows for a much less invasive procedure with minimal collateral damage, Liang says.

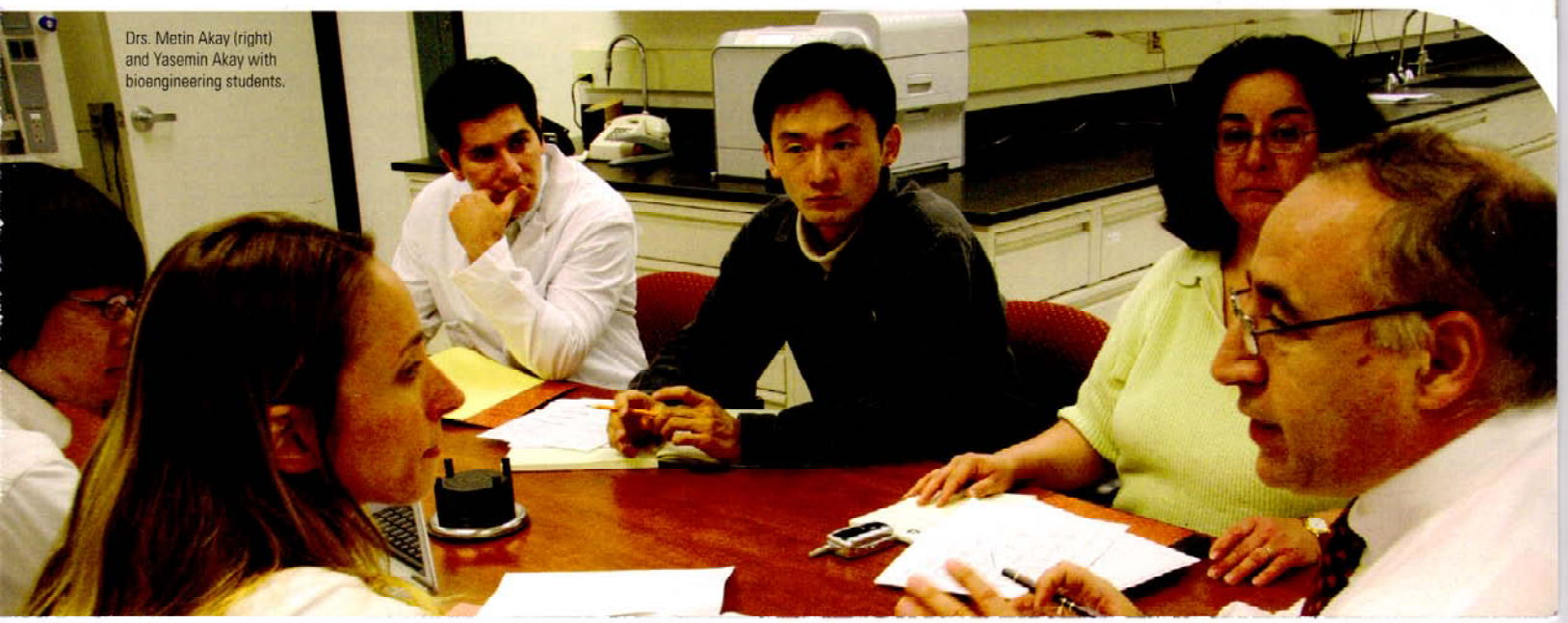
Images can also inform medical professionals about treatment. "Different people have different metabolic rates, so the same treatment won't have the same impact on everyone," Liang says. "How do you know what the impact will be? Imaging technology allows us to get that kind of information."

Technological advancements aren't the only thing driving the field. "There's the realization that things are not less complicated, but more complicated. We need to add principles to medical investigation, and engineering can bring that to the table," says Andrew Laine, Professor of Biomedical Engineering and Radiology at Columbia University.

Biomedical imaging programs such as that being planned at HDBE are "absolutely growing across the country," Laine says. "There's an increased appreciation of the need for cross cutting departments that bridge engineering and medicine. The reality is that a lot of problems in science and medicine today can't be solved by working in a traditional and single discipline, and that's especially true in medicine."

At ASU, the Fulton Biomedical Imaging Program (FBMI) will train a new generation of interdisciplinary researchers, priming them to tackle those problems. "Fulton is building on these advances by supporting pioneering research to develop innovative biomedical imaging technologies and improve existing imaging systems jointly with the internationally-renowned Biodesign Institute, the School of Life Sciences at ASU and our clinical partners," says Akay.

FBMI will expose students to the relatively new approaches of the biomedical imaging technologies, from nano to macro mathematical and computational challenges. The three research areas will include molecular and cellular imaging, clinical medical imaging and image processing.



Drs. Metin Akay (right) and Yasemin Akay with bioengineering students.