New Imaging Center to Help Make Better Diagnoses, Evaluate Drug Effectiveness

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Researchers at the Moores Cancer Center at the University of California, San Diego are taking advantage of a five-year, $7.5 million grant from the National Institutes of Health (NIH) and sophisticated imaging technologies at the newly established In Vivo Cellular and Molecular Imaging Center (ICMIC) – one of only eight in the country – to develop new ways to detect early cancers that require treatment and monitor the effectiveness of new molecular-based cancer therapies.

"We want to develop diagnostic tools that define the cancer at its earliest stage, not just whether it is there, but its characteristics," said co-principal investigators Robert Mattrey, MD, professor of radiology at the UC San Diego School of Medicine.

The new center, which is led by Mattrey and co-principal investigator David Vera, PhD, professor of radiology, is one of only three such centers in the nation to receive funding recently from the NIH's National Cancer Institute.

Researchers will focus initially on three main basic research projects – all of which are aimed at translating laboratory findings in animals to the clinic. Mattrey and recent Nobel Prize winner Roger Tsien, PhD, professor of pharmacology, chemistry and biochemistry at UC San Diego, are leading a project to improve the ability to characterize the aggressiveness of certain tumors. According to Mattrey, cancers that express an enzyme called a matrix metalloproteinase tend to be aggressive and are likely to spread. Such enzymes are instrumental in breaking down tissues, enabling cancers to escape and enter the bloodstream and/or lymphatic system and metastasize, or spread, to distant sites.

"Such cancers will stay local until they are able to break down the tissue matrix that allows loose cells to get out and seed distant tissues," Mattrey said. "It's thought that metastases develop this way."

Mattrey and Tsien are developing imaging contrast agents to use with ultrasound that will help them detect such enzymes in prostate and breast cancers. Determining the likelihood that a cancer could be aggressive has implications for treatment decisions, especially for diseases

where the treatment adds risk, Mattrey said. For example, a 60-year-old man who is diagnosed with aggressive prostate cancer might elect to undergo surgery, whereas a man with a slow-growing malignancy might decide to wait and let physicians monitor his tumor.

In another project, Vera and co-investigator Stephen Howell, MD, professor of medicine at the UC San Diego School of Medicine, will use nuclear imaging and ultrasound to virtually crawl inside of cancer cells and monitor the presence and activity of an experimental platinum-based chemotherapy drug – in essence to find out if the therapy is hitting its targets and working or not.

Because drugs are expensive, drug companies want to know if agents are hitting targets before they invest hundreds of millions of dollars in testing and development, rather than waiting the months that it can sometimes take for some drugs to have any kind of visible effect. Doctors and patients would like to know a therapy's efficacy much sooner than that in order to pursue a different treatment option.

"It's difficult to know if a drug is reaching its molecular target," Mattrey explained. "It's not just a matter of knowing that the drug reaches the tumor, but also if it was able to inhibit or stop the chemical reaction that it was designed to do."

The team will develop an imaging 'reporter' molecule to attach to a chemotherapy agent, enabling physicians to tell where the drug went in the body and whether it reached the tumor with effective concentration.

In the third major project, Dwayne Stupack, PhD, assistant professor of pathology at the UC San Diego School of Medicine, is studying the use of tiny nanoparticles to image and detect changes in the blood vessels that serve tumors. Since tumors, in particular metastatic tumors, alter the behavior of their associated blood vessels, Stupack is hoping to develop a novel, sensitive imaging system that will detect these tumors at their earliest stages.

ICMIC is a shared university resource open to a wide range of disciplines, such as radiology, surgery and pharmacology, and also carries a teaching component. Researchers will educate fellows and faculty in the use of state-of-the-art imaging tools, particularly molecular imaging.

As part of its training mission, ICMIC will initiate a seminar series highlighting ongoing molecular imaging research, and will oversee the awarding of more than $200,000 annually to support UC San Diego researchers' career development and pilot projects in in vivo molecular imaging research of cancer.

The Moores UC San Diego Cancer Center is one of the nation's 41 National Cancer Institute-designated Comprehensive Cancer Centers, combining research, clinical care and community outreach to advance the prevention, treatment and cure of cancer.

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