Researchers develop novel methods to observe disease processes

October 15 2013, by Angela Rizk-Jackson

(Medical Xpress)—The ability to directly observe the body is an invaluable tool in the arsenal of any medical professional. In fact, physical inspection comes only second to discussion of symptoms and medical history in a standard health assessment.

For many years, scientists have been harnessing the physical properties of light, with magnifying lenses, for example, and magnetism, as with Magnetic Resonance Imaging or MRI, to enhance visualization capabilities. Currently, teams of scientists at UC San Francisco are collaborating to build upon these imaging modalities and find new ways to monitor diseases using creative applications of emerging technologies.

Developing biophotonic markers of neurodegenerative processes

Ari Green, MD, and Michael Ward, MD, PhD, are partnering to develop an optical imaging technique that will allow physicians and researchers to peer into processes directly related to neurodegenerative diseases.

Green is a UCSF neurologist who has an expertise in treating visual problems associated with multiple sclerosis and other inflammatory diseases of the central nervous system, and Ward, formerly a behavioral neurology fellow at UCSF and postdoctoral fellow at the Gladstone Institutes, is now an assistant professor at UCSF's Memory and Aging Center. He connected with Green through a clinical rotation during his residency at UCSF.

Ward admits to being more of a basic scientist, while Green is more of a clinical researcher; but this multi-disciplinary team finds value in playing off varied backgrounds. Together they envisioned a biomarker for neurodegenerative disease based on evaluation of the retina. To accomplish that, Ward is working to refine the imaging methodology and Green is bringing a clinical perspective.

"The retina is really just an extension of the central nervous system that is available for light-based imaging and allows us to look directly at the tissue of interest," says Green. He explains that unlike other potential biomarkers such as MRI features or levels of specific molecules in the cerebral spinal fluid, evaluation of the retina via biophotonic methods is amenable to large-scale screening efforts.

"It's non-invasive, it's inexpensive, it's rapid," three elements that make for an ideal biomarker, says Ward. Such measures can serve as clinical outcomes, which are required for moving any potential new therapeutics into clinical trials. "We want to develop the method for transforming those early discoveries into therapies," explains Green.

Green and Ward's research has benefited from the support of the Catalyst Awards program, an initiative managed by UCSF's Clinical and Translational Science Institute (CTSI) to foster early translational research at UCSF. Green admits that typically scientists don't think about how to actually bring scientific discoveries to a marketplace, but the Catalyst Awards Program consultants provided counsel to help develop a framework for moving their novel method in that direction

Green's advice to researchers looking into translational work: "It's as much about networking within the university as anything else. The Catalyst Awards Program has the capacity to create those networks, but that potential exists throughout the university."

Ward agrees, noting that "new potential discoveries can happen at the interface between two fields that don't necessarily talk to each other."

Engineering new mri methods for clinical applications

Another UCSF investigator – and recipient of a Catalyst Awards consultation – is navigating the "interface" Ward describes and working to build a new view of disease using a different strategy.

Peder Larson, PhD, a faculty member in the department of Radiology and Biomedical Imaging, is focused on developing enhanced MRI diagnostics using metabolic contrast agents – substances that improve visibility of internal bodily structures that are metabolically active, such as tumors. Larson has a background in engineering and is finding partners in the medical sciences to help him apply this new technology to assess certain types of cancers.

Larson's new MRI methods use hyperpolarized carbon-13 contrast agents, which have unique magnetic properties that allow for real-time visualization of the metabolism of molecules. These new metabolic contrast agents have many potential applications, but Larson believes that cancer imaging – prostate cancer and brain tumors in particular – are strong candidate targets.

In fact, the first clinical trial of hyperpolarized carbon-13 pyruvate was recently completed at UCSF using Larson's methods, which demonstrated the technique is safe and can accurately detect biopsy-proven prostate tumors. *Science Translational Medicine* recently published this trial, which will enable future clinical studies.

His vision for prostate cancer applications is to provide images that provide more accurate staging – an assessment of how aggressive a given tumor is. Unlike positron emission tomography (PET) and computed tomography (CT) which involve radiation, hyperpolarized carbon-13 contrast agents are non-toxic. The images can be collected in rapid succession, providing doctors with immediate metabolic measures indicating whether a tumor is responding to treatment so they can select the most effective therapy for each patient.

More information: stm.sciencemag.org/content/5/198/198ra108.short

Provided by University of California, San Francisco