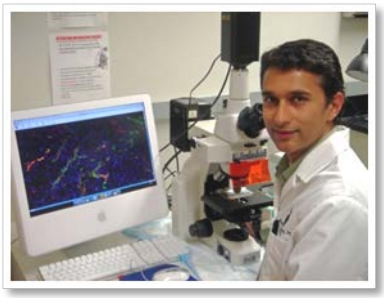
Research Updates July 2013
Grantee Highlight: Dr. Arvind Pathak
Creating Novel Imaging Methods to Facilitate Prognosis

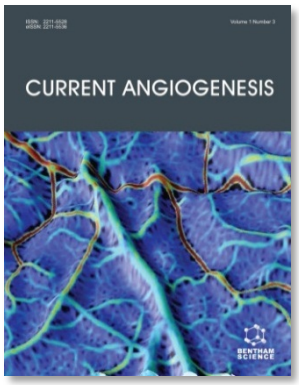


Clinical trials in breast cancer patients show that when anti-angiogenesis drugs are followed by standard therapies such as chemotherapy, there is a marked improvement in patient outcome compared to either treatment used alone. These exciting findings have made it imperative to develop new tools for physicians to plan the dosing of these new drugs, obtain early signs of whether are working, and monitor large numbers of patients repeatedly with minimal discomfort and maximum safety.

Visualizing changes in the complex angiogenic microenvironment at different spatial scales remains a challenge due to the lack of integration between micro- and macroscopic imaging data, and the difficulty in obtaining such data from patients. Dr Arvind Pathak's work seeks to develop and validate tools that will enable physicians to conduct patient assessments in a non-invasive, repeatable and safe fashion, with profound implications for patient management and outcome.

His lab has developed tools for integrating imaging data from magnetic resonance imaging (MRI), computed tomography (CT) and optical microscopy, to come up with a multi-scale picture of these cancer models, so one can then zoom from the spatial scale of the whole tumor, down to the smallest blood vessel.

Recently, part of his Komen funded research was highlighted on the cover of Current Angiogenesis, as well as on the cover of a special issue of the Annals of Biomedical Engineering (ABME) focused on Multiscale Systems Biology. Dr. Pathak gives credit to his mentor on the grant Dr. Zaver M. Bhujwalla, as well as the outstanding students and collaborators he works with at Hopkins.



The work featured on the cover of Current Angiogenesis was an exhaustive review of optical imaging methods for characterizing microvascular morphology and perfusion. Komen funds made it possible to obtain some of the first images of in vivo blood flow in a human breast cancer model using Laser Speckle Imaging (LSI). LSI is a wide-field, high-resolution imaging method capable of characterizing vascular structure and function *in vivo*, for example microvessel density and blood flow. This work was done in collaboration with Drs. Abhishek Rege and Nitish V. Thakor of the Neuroengineering Lab at Johns Hopkins.

The research highlighted in ABME describes the development of multiscale models of tumor angiogenesis, new imaging techniques capable of reproducing the 3-D architecture of tumor vascular, and one of the first descriptions of "image-based models" of tumor blood flow in pre-clinical breast cancer model. This work was performed by Eugene Kim in the Pathak lab, in collaboration with Drs. Spyros Stamatelos and Aleksander S. Popel of the Systems Biology Lab at Johns Hopkins. Eugene is also the recipient of the Bill Negendank Young Investigator Award of the International Society for Magnetic Resonance in Medicine (ISMRM) that recognizes the most promising young scientists in the field of cancer MRI.

Collectively, these developments are helping to gain a fundamental understanding of the cellular and molecular regulation of breast cancer angiogenesis that will benefit the development of new cancer therapies. Details of ongoing research in the Pathak Lab can be found at www.pathaklab.org.