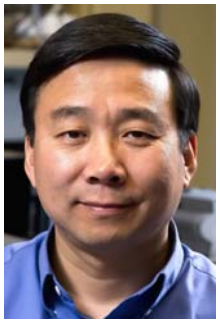
THE HARTWELL FOUNDATION

2010 Individual Biomedical Research Award

Review of Proposed Research

Investigator: **Xingde Li, PhD**
Associate Professor
Department of Biomedical Engineering

Institution: **The Johns Hopkins University**



Proposal: **Ultracompact Nonlinear Optical Endomicroscope for Predicting Preterm Birth**

Preterm birth (PTB) has an incidence of 12.7%, affecting about 500,000 babies in the U.S. each year. It is the principal reason for death of newborns in the U.S. and is associated with serious long-term health complications for those who survive. Currently, there are no effective clinical methodologies for predicting PTB; worse, half of all pre-term births occur in the absence of known risk factors. New methodologies are urgently required for prediction, prevention and treatment of PTB. Recently researchers have observed that the structure of collagen fibers in the cervix changes over the course of normal pregnancy and that these changes were associated with PTB. In those studies (mouse model), a laser imaging technology called second harmonic generation (SHG) microscopy was applied to record the changes in cervical collagen in tissue biopsies. SHG is currently the most sensitive methodology available for imaging collagen fiber structures and holds tremendous potential as a clinical diagnostic tool because the imaging signals come directly from collagen without the need for any external stains or contrast agents. Unfortunately, the current requirement for tissue biopsy clearly makes the microscopy technique unacceptable for monitoring human pregnancy. To identify the risk of PTB requires an adaptation of SHG microscopy, in what Dr. Li proposes as SHG endomicroscopy. The endoscope will provide direct imaging of cervical collagen by a physician during prenatal exams. To overcome the formidable engineering challenges required for obtaining the same information obtained from the SHG microscope, he proposes a small, flexible, high resolution fiber-optic endomicroscope of his design based upon state-of-the-art optics. The initial design will be scaled for use in mice to enable confirmation of earlier findings by SHG microscopy; a subsequent design will be appropriately scaled for human patients. If Xingde is successful, his innovative SHG endomicroscope will provide a powerful ObGyn diagnostic technique for clinical translation, enabling for the first time an analytical approach to identifying the risk of PTB, including assessment of new therapeutics for intervention and management of PTB. Practical access to SHG endomicroscopy during a prenatal exam will also make it possible for the technology to move into the clinic for evaluating other diagnostic applications, as well.