Combating blindness is vision of University of Tennessee

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Millions of people at risk of becoming blind could one day be helped by an Oak Ridge National Laboratory technology originally intended to understand semiconductor defects. The project takes advantage of the Department of Energy lab's proprietary content-based image retrieval technology, which is a method for sorting and finding visually similar images in large databases. Manufacturers of semiconductors have found this technology highly effective for rapidly scanning hundreds of thousands of tiny semiconductors to learn quickly about problems with manufacturing processes.

"We're adapting a proven technology and combining it with new image gathering and analysis tools to help create a database to assist in the diagnosis and treatment of blinding eye diseases such as diabetic retinopathy, glaucoma and age-related macular degeneration," said project co-leader Ken Tobin of ORNL's Engineering Science & Technology Division.

Diabetic retinopathy alone will affect 239 million people worldwide by 2010, according to Tobin, who noted that this number will have doubled since 1994.

Partnering with ORNL is Edward Chaum, an ophthalmologist and Plough Foundation professor of retinal diseases at the University of Tennessee Health Science Center in Memphis.

Researchers plan to use digital retinal photography and optical coherence

tomography -- a technique for examining living tissue non-invasively -- to image and quantify specific disease-based changes in the retina. They will develop an extensive image database of known retinal disease states for clinical validation studies.

Institutional Review Board approval was secured to enable Tobin and ORNL colleagues Tom Karnowski and Priya Govindasamy to assemble a database of thousands of fluorescein angiography and optical coherence tomography images representing hundreds of diagnosed human patients and retinal diseases.

"The dataset provided by Dr. Chaum documents the visual attributes of fluorescein angiography and optical coherence tomography imagery that are used to diagnose a wide range of pathologies," Tobin said. "This is a necessary step to support developing our statistical feature descriptions for image indexing, retrieval and diagnosis."

Tobin and Chaum expect this project to provide benefits not only for diagnosing and treating blinding diseases in broad-based population screening programs, but also for novel biomedical imaging and telemedicine.

"With 180 million people worldwide either blind or at risk of becoming blind, this research has a chance to make a profound effect on people's lives," Chaum said. "By developing a computer diagnosis system to improve early detection of eye disease by non-experts and through telemedicine, we can potentially treat or prevent up to 80 percent of blindness."

Funding for the project, which began in June 2004, is provided by ORNL's Laboratory Directed Research and Development program. ORNL, which is managed by UT-Battelle, employs 1,500 scientists and engineers and is the Department of Energy's largest multipurpose science

and energy laboratory.