Ryerson University Faculty of Science

Biomedical Physics
March 2016

Ryerson researchers develop first-of-its-kind lensless platform for tissue imaging

In humans, the microcirculation network lies somewhere between 200 and 800 microns underneath the surface of our skin and other organs. In medical science, the ability to image microcirculation has become extremely helpful in early diagnosis of many health conditions, including cancer.

Given this crucial role, methods for microcirculation imaging are constantly being refined. At Ryerson, Irina Schelkanova is completing a PhD in Biomedical Physics. And under the supervision of Dr. Alexandre Douplik, she and fellow researchers in Ryerson's Department of Physics have developed a device to address some present-day imaging challenges. Irina was lead author of an article recently published in the *Journal of Biomedical Optics* which summarizes the Ryerson study.

Of existing limitations, Irina says, "Visible light scatters highly in biological tissues making imaging deeper in tissues challenging." Previously, she says, to overcome scattering, advanced imaging techniques have been applied – including confocal imaging and hybrid imaging modalities such as photoacoustic tomography. "However these methods require complex instrumentation, mechanical scanning and are also generally costly."

Now, Ryerson researchers have applied a first-of-its-kind device towards imaging tissues. Irina explains, "In this study, a fiber optic arrangement and an imaging sensor are emulated through scanning a single fiber optic cable in a grid pattern over a microfluidic device to perform spectroscopic imaging."

While diffuse reflectance imaging/spectroscopy (DRI/DRS) is a well-established field with previous usage towards disease detection, Irina says DRS has been mostly applied towards superficial imaging, to collect spectra and assess functional information (i.e., oxygenation states of blood). With the Ryerson study, she says, "The proposed device tries to merge the DRI/DRS fields and provides images of microvasculature beneath the surface at relatively high spatial resolutions."

The result? Ryerson researchers discovered that a fiber optic-based lensless imaging sensor could be designed to overcome scattering and resolve microvasculature at different depths – while eliminating the need for scanning and complex instrumentation. The new platform is also relatively inexpensive. Ultimately, says Irina, "This would allow rapid assessment of structural and functional information of microvasculature leading towards point-of-care applications."

Strong Support

Of her doctoral studies at Ryerson, Irina says, "The graduate assistants at our department were always kind and generous with their time and assistance…Ryerson's physics department has a unique combination of helpful staff and diverse colleagues which allows for a pleasurable exchange of scientific information and social interchange."

Funding

Irina’s research was supported by the Erlangen Graduate School in Advanced Optical Technologies (SAOT) by the German National Science Foundation (DFG); Ryerson Health Research Grant; NSERC Discovery Grant and Ontario Graduate Scholarships.