Background

The Physics of Medicine laboratory at the University of Cambridge was established on the grounds of the Cavendish Laboratory in West Cambridge in 2008. Its goal is to bring together researchers in a variety of fields, from both the physical and biological sciences, to tackle the world’s major biological challenges in a multi-pronged interdisciplinary manner.

The group’s key focus is on molecular transport across lipid membranes. One of their major experiments is researching antibiotic transport. Antibiotic resistance is one of the major public health challenges of the 21st century, and a detailed understanding of drug transport is key to the development of a new generation of drugs.

Challenge

Traditional methods of determining drug permeability coefficients across cell membranes depend on measuring partition coefficients of drugs in an artificial aqueous: organic phase interface, a method that completely ignores the variability of lipid composition and its effect on drug transport. The team used lipid vesicles as model systems to investigate the transport of antibiotics in a label free manner, using the autofluorescence of these molecules in the UV.

The system involves a microfluidic assay, where vesicles are exposed to the drug, the fluorescence is stimulated by measuring the autofluorescence intensity within the vesicles at varying time intervals in the microfluidic chip. To increase throughput, the vesicles must flow quickly through the device, but throughput is always restricted by the frame rate of the camera.

Solution

Until now, the team had been using the Evolve 512 EMCCD camera from Photometrics for their research and recently learned about the optiMOS sCMOS camera from QImaging. The optiMOS offered the capability for much higher frame rates with the advantage of low noise. They purchased the camera and have been using it for less than a year. However, in this short time, they’ve found the camera is an excellent solution for increasing both the throughput and the image quality of the vesicles. “The optiMOS camera enables us to capture vesicles at 100 frames per second, allowing better image processing and measurement of the relevant quantities,” said Jehangir Cama, a member of Dr. Keyser’s team. Cama explained how this same system can be used to investigate antibiotic transport through membrane proteins as well as synthetic nanopores. “The technical advances of the optiMOS sCMOS camera should be of great use to medical research” Cama concludes.

Learn more about the team’s work and these techniques using the Evolve 512 EMCCD from Photometrics in this recently published paper “A label-free microfluidic assay to quantitatively study antibiotic diffusion through lipid membranes”: http://pubs.rsc.org/en/Content/ArticleLanding/2014/LC/C4LC00217B#!divAbstractLanding/2014/LC/C4LC00217B#!divAbstract

More about Dr. Ulrich Keyser at the University of Cambridge is available at: http://www.bss.phy.cam.ac.uk/~ufk20/index.html