Physicist building advanced microscope

By D.J. Martin

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Stephanie Meyer, a physicist specialising in optics, is bringing new capabilities to the University of Colorado Denver Anschutz Medical Campus by building an advanced, super resolution microscope able to see some of the innermost workings of the cell.

The university began the project after receiving funding from the National Institutes of Health through a shared grant with the American Recovery and Reinvestment Act. Diego Restrepo, Professor of Cell and Developmental Biology and principle investigator of the grant, won the funding by working with a team of researchers at CU Denver. The microscope will open up new opportunities in neuroscience research.

They decided to build their own STED, or Stimulated Emission Depletion microscope, after a review of a commercial microscope made it clear that they required a different design. Stephanie Meyer began work on the microscope in May. She earned her PhD in physics from CU Boulder and gained invaluable experience as an intern at Zeiss, the world-renowned optics manufacturer in Germany. While there, she learned how to build microscopes. Today, she brings that expertise to the CU Denver Anschutz Medical Campus where microscopy is an indispensable tool in cutting-edge biomedical research.

A special beam

The STED uses lasers to achieve extreme precision and clarity. Meyer said lower resolution microscopes are blurrier than the STED because light diffraction limits the size of a focused laser. However, the STED uses a special doughnut-shaped laser beam, combined with an excitation beam, to shine light on a smaller area.

"We want to get better resolution because a lot of biology happens on a smaller scale," Meyer said. "For example, we want to see which proteins are congregating together."

Electron microscopes can also reach high levels of resolution, but unlike the STED, the cells must be dead first. The advantage of examining live cells at higher resolution is that extremely small parts and processes can be seen. This includes being able to see how proteins interact, which can lead to discoveries about the inner workings of cells. At the same time, samples do not need to be as thinly sliced with STED as with the electron microscope.

Building a piece of high technology from scratch requires a keen grasp of scientific principles and a healthy dose of mechanical aptitude. On a recent visit to her the small lab, the physicist stood over a stainless steel table laden with highly machined lenses, mirrors, and a $100 000 laser. It all resembled a high-tech jigsaw puzzle and Meyer already knew what

piece went where. Now, she is plotting how to put the lasers into the microscope body. Exactly when it will be finished is unknown, but given the complexity of the project it will likely take months.

As daunting as it appears, Meyer remains unfazed by the task.

"Once you build one microscope and then another it becomes second nature to you," she said. "This will be a wonderful tool for us and is just another example of how far microscopy has come."

Source: University of Colorado Denver