Researchers peer below the surface of living tissue

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A fluorescent protein found in Monterey Bay's crystal jellyfish is helping University of California-Santa Cruz scientists peer deeper into living tissue.

A team of UCSC researchers is developing new technology that weds methods and equipment used for exploring space with the pursuit of more refined and detailed images of living tissue.

A genetically engineered fluorescent protein, originally derived from the crystal jellyfish, is serving as the reference beacon needed to correct for image distortion.

In 2006, a group from UCSC was inspired to use advanced telescope technology for microscopes, and received funding by the California Institute for Regenerative Medicine.

In July, UCSC was awarded a $1 million grant from the W.M. Keck Foundation to further the research and to launch the W.M. Keck Center for Adaptive Optical Microscopy.

"We can get beautiful images if we look at the surface of the biological structure," UCSC professor of molecular, cell and developmental biology William Sullivan said. "If you try to look deep it gets pretty cloudy pretty quickly. That's where the bottle neck in imaging is."

Astronomers face a similar problem when looking at stars and planets.

The Earth's atmosphere, among other things, distorts the image.

Telescopes use either a bright star or an artificial "guide star" created with a laser as a reference point for measuring the amount of atmospheric distortion.

Sullivan is working on developing the genetically engineered fluorescent proteins to work as guide stars within tissue, while one of his partners, Joel Kubby, an associate professor of electrical engineering, is developing a microscope that can penetrate deep within tissue and make use of the implanted protein.

The UCSC approach is unique in its use of adaptive optics, which first measure for distortion and then correct the image using mirrors and other devices, while other researchers have tried using image optimization and other techniques.

"For example, let's say you have a binary star, two stars right next to each other," Kubby explained. "Without adaptive optics it might look like one star. If you just try and optimize the image, it may place one star on top of the other so you see it as brighter. Unless you are measuring the aberration you don't know exactly how to correct the image."

The new technology could be useful for many studies involving living tissue including stem cell research.

"You can't really follow stem cells deep into the tissue right now," Sullivan said. "If you inject a stem cell you want to see where it goes and how it divides."

Another UCSC researcher, Yi Zuo, is using the technology to look at the brain and how it develops and changes over time as people or animals learn new things.

The UCSC campus, where molecular biologists are neighbors with astrophysicists and engineers, has made the process of collaboration easier.

"A lot of this type of research is done in medical schools, but you'd have to hire engineers and build up a whole infrastructure to support it," Sullivan said. "So, we are in a good position to do that research. With astronomers next door the expertise is here."