

**NON -TECHNICAL ABSTRACT:** *(State in layman's terms the application's broad, long-term objectives and specific aims, making reference to the potential public benefits of the project for California.)*

We will develop computerized techniques for analyzing microscope images, making it possible to take pictures of features of a cell that are too small to be seen with normal microscope. Whereas a traditional microscope takes a single image with limited resolution, new microscope techniques like those that we are studying can take a series of images highlighting different features, and combine them together to form a very high-resolution image of the details of a cell. The speed and accuracy of these techniques, as well as the number of images needed to achieve sufficient detail, are limited by the power of the computer programs used to reconstruct the images. We will work on developing better computer programs that enable real-time analysis of what is happening inside a cell, and share these programs with biotechnology researchers in California and across the country.

This approach may make it possible to directly visualize the passage of substances moving in and out of a cell, and thereby gain greater control of the activity of a cell. We may also be able to directly observe the “skeleton” of a cell, the pieces that work together to help a cell move, and thereby gain the necessary information to understand and control the movement of cells as they come together to form replacement tissues for surgical use. This work will be conducted with the direct assistance of CSU undergraduates, who will be among the first in California (and among the few in the country) to join in developing and pioneering the uses of this next generation of microscopes. Finally, subwavelength microscopy is a tool with the strong potential to become standard in biological research labs, and developing this crucial expertise in California will enable California industry to lead the development and deployment of this technology, just as California has led in so many other high tech fields.