Confocal Laser Scanning Microscopy By Remote Access

J.H. Youngblom, J. Wilkinson, J.J. Youngblom
California State University, Stanislaus

In recent years there have been a growing number of facilities interested in developing remote access capabilities to a variety of microscopy systems. While certain types of microscopes, such as electron microscopes and scanning probe microscopes have been well established for telepresence microscopy, no one has yet reported on the development of similar capabilities for the confocal microscope.

At California State University, home to the CSUPERB (California State University Program for Education and Research in Biotechnology) Confocal Microscope Core Facility, we have established a remote access confocal laser scanning microscope facility that allows users with virtually any type of computer platform to connect to our system. Our LEICA TCS NT confocal system, with an interchangeable upright and inverted microscope set up, is accessible to any authorized user via the internet by using a free software program called VNC (Virtual Network Computing). A high speed connection with a transmission rate of at least 384 kilobytes per second is highly recommended to handle the transfer of the live image data.

Remote users are able to connect to the confocal microscope by visiting our web site at <http://science.csustan.edu/confocal>. Under the category of "Remote Access", users are able to download the VNC software which allows them to connect to the confocal site with either a PC or MacIntosh computer. Another available option for connectivity that is platform independent is to use a JAVA enabled browser. Once the connection is established, users are able to control essentially all the critical parameters associated with the confocal microscope system, including focus, zoom, pinhole size, filter selection, laser attenuation using the acousto-optical tunable filter, PMT intensity for each of the three separate laser channels, x-y stage movement, series number and accumulation number for optical sectioning. A motorized stage allows users to scan the entirety of their specimen area by electronically moving the stage along specified x and y axis coordinates determined by the users. A technical assistant is on hand to initially set the specimen under the microscope and provide the initial plane of focus.

Quantitative analysis of the scanned images can be conducted on-line and the data saved with annotation. Two dimensional stacks can also be saved to generate pseudo 3D images and 3D reconstruction images on-line (coming soon), or reconstructed off-line using freeware programs such as NIH IMAGE or SCIONIMAGE.

All files generated during a session are saved into a user's folder on the confocal computer. At the end of the session, this folder is transferred to a special folder located on the confocal computer desktop. By logging on to the confocal web site provided above, users are able to access this desktop folder and download all their saved files directly to their computers. The user's folder is then deleted by the user from the desktop folder immediately before closing out the session.

The ease of connectivity to the microscope and the rapid speed of image transfer allows accessibility of this highly sophisticated instrument to a large sector of the population that would not

otherwise have the opportunity. A share resource facility of this type, without geographic constraints helps to catalyze the interaction of individuals with diverse interests and expertise, which invariably leads to a thriving center for academic collaboration and innovation. This technology is having its greatest effect on education, where students and faculty at multiple institutions are able to simultaneously connect to the instrument for viewing real time specimen demonstrations, collaborate on research projects involving academic and private industries and share specimen resources among a diverse global community. ■