Via Internet, Australian-based researchers perform real-time cell surgery in California

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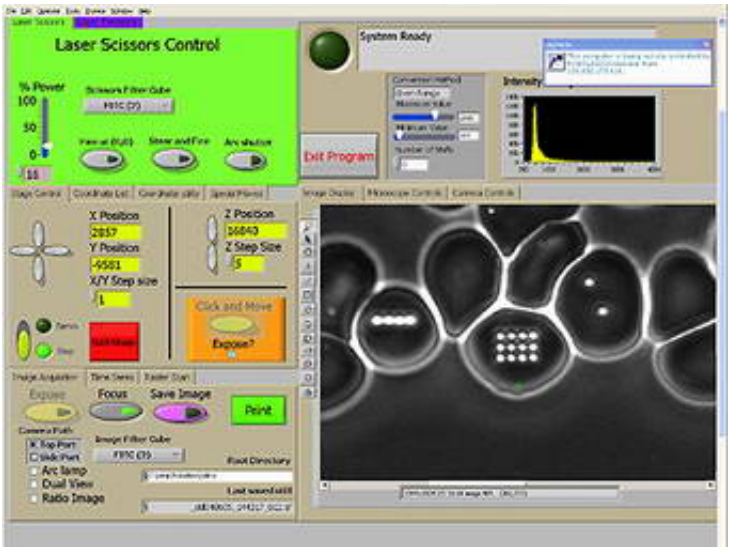

Robolase technology may one day not only bridge laboratories but also allow physicians to perform medical procedures from distant locations

In an effort to combine sophisticated laser and Internet technologies, scientists in Australia have successfully performed laser surgery and "optical trapping" in a Southern California laboratory via the Internet.

Image: RoboLase control panel

The scientists used a new Internet-based laser scissor-and-tweezers technology called RoboLase, demonstrating the potential of using the technology for real-time research activities between laboratories and for physicians to perform medical procedures from distant locations.

In a proof-of-principle series of experiments, the scientists from UC Irvine, UC San Diego and the University of Queensland employed RoboLase to produce surgical holes in a distinct pattern of less than one micron in diameter (1/1000th of a millimeter) in single cells. Utilizing a control panel projected onto a computer screen, Queensland researchers were able to remotely perform the cell surgery on a laser microscope system in the Southern California laboratory.

“The speed and precision of the sub-cellular surgery was equal to what it would be like if we were doing the same surgery in our labs here in California,” said Michael Berns, professor of biomedical engineering at UCI and adjunct professor of bioengineering at UCSD, who led the development of the RoboLase technology.

In addition, the scientists were able to grab onto – or “optically trap” – swimming sperm in the California lab by operating optical-laser tweezers remotely from Australia. This was a particularly noteworthy accomplishment, because it demonstrated the amount of computer bandwidth (1 gigabyte/second) needed by the Australia and California research groups to observe and grab a fast-moving sperm with virtually no detectible delay in image transmission between the two laboratories.

“If there was a detectible delay in either the transmission or reception of the video images, our colleagues in Australia would not have been able to identify and trap a targeted sperm under the laser microscope in the California laboratory,” added Linda Shi of UCSD, one of the key developers of the unique computer software that was used in the sperm-trapping experiments.

According to Berns, who is the founding director of the Beckman Laser Institute at UCI, the general significance of this work is that researchers can now collaborate on experiments with scientists around the world using this expensive and sophisticated instrumentation without having to travel to a single laboratory site. It also serves to demonstrate that the Internet will become increasingly more useful and important for the actual conduct of scientific research and possibly for the delivery of selective medical procedures.

“This technology is now accessible to other scientists who may not have easy access to it,” added Elliot Botvinick, a Beckman Fellow at UCI and co-developer of the RoboLase technology. “And the instrumentation can be used over the Internet as a learning tool by students just about anywhere in the world.”

The research is being presented today at the International Society for Optical Engineering meeting in San Diego and will be published in the September issue of the journal Microscopy Research and Technique.

Halina Rubensztein-Dunlop, professor of physics and head of the team at the University of Queensland, participated in study, which received funding support from the United States Air Force, the National Institutes of Health and the Arnold and Mabel Beckman Foundation.

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