



Research agreement to reveal secret lives of cells

6 August, 2008

Cells will get a dose of reality TV when image analysts at CSIRO and cell biologists at the Garvan Institute of Medical Research work together to observe their secret lives.

The two organisations today signed a three-year collaboration agreement to investigate important cellular processes, including those impaired by diseases such as diabetes.

At a conference last December, CSIRO and Garvan scientists announced that they had developed a new computer vision system to quantify a process called 'vesicle fusion' in which bubble-like structures containing insulin move around inside pancreatic cells then merge with the cell's outer membrane. This is the main process that fails in diabetes.

While other researchers have to trawl for days through movies of microscope images of living cells to see the elusive fusion events, the CSIRO and Garvan team developed software that locates the relevant images in minutes.

Dr Pascal Vallotton, Leader of CSIRO's Biotech Imaging group, says the system works by rapidly number crunching data from masses of pixels in the moving images to find the vesicles and track their movements.

"The manual method of looking for vesicle fusion is a bit like watching Big Brother," Dr Vallotton says.

"You have to do a lot of viewing to find the interesting parts.

"But by using automated image analysis software, our team were able to home in on the right locations in the right images much faster. This allows them to quickly gather critical information about how cells and their activities are affected in diseases like diabetes."

This is good news for diabetes sufferers as it will hasten understanding of the disease.

The research agreement, representing an overall investment from the two organisations of about one million dollars, will build on this research and should yield benefits that reach across the globe.

Professor David James, Director of the Garvan's Diabetes and Obesity program, says that the research will help the international cell biology community better understand how cells work and what can go wrong.

"Most academic institutions have fancy microscopes but the real challenge is data analysis," Professor James says.

"This unique collaboration will allow us to push the envelope in biological imaging, opening up all kinds of new possibilities in cellular and possibly even animal imaging."

Vesicles in the pancreatic beta cells are identified with a fluorescent protein and then filmed using a type of microscopy called Total Internal Reflection Fluorescence Microscopy, or TIRFM.

In videos of the cells, the positions of individual vesicles are marked. Their movements are then tracked through the pancreatic beta-cells to capture the instant they fuse with the membrane and release insulin outside the cell. After that, the vesicle disappears.

In hundreds of frames from a video, vesicle fusion might appear in only two and then only in a small part of the frame.

Further research will improve the method and apply it to other cellular events.

Other projects that are part of the three-year agreement include studying the dynamics of microtubules, an important part of the cell's scaffolding; and developing imaging techniques for measuring cell structures as small as one nanometre (one billionth of a metre).

Information for Editors

Reference: P. Vallotton, David E. James, and William E. Hughes. Towards fully automated Identification of Vesicle-Membrane Fusion Events in TIRF Microscopy. In Tuan D. Pham and Xiaobo Zhou, editors, in Proceedings of International Symposium on Computational Models for Life Sciences, Gold Coast, Queensland, Australia, 17-19 December 2007.

Footage of live cells, still images and pdf of above reference available from:

Alison Heather, Garvan Institute of Medical Research (02) 9295 8128
a.heather@garvan.org.au

Dr Pascal Vallotton, CSIRO Mathematical and Information Sciences (02) 9325 3208, 0400 801 245
pascal.vallotton@csiro.au

Background information available at: <http://www.csiro.au/science/BiotechImaging.html>

ABOUT GARVAN

The Garvan Institute of Medical Research was founded in 1963. Initially a research department of St Vincent's Hospital in Sydney, it is now one of Australia's largest medical research institutions with approximately 400 scientists, students and support staff. Garvan's main research programs are: Cancer, Diabetes & Obesity, Immunology and Inflammation, Bone, and Neuroscience. The Garvan's mission is to make significant contributions to medical science that will change the directions of science and medicine and have major impacts on human health. The outcome of Garvan's discoveries is the development of better methods of diagnosis, treatment, and ultimately, prevention of disease.

All media enquiries should be directed to:

Garvan

Alison Heather 02 9295 8128 or Jackie Crossman on 0402 218 662

CSIRO

Carrie Bengston, CSIRO Mathematical and Information Sciences 0417 266 190
Email: carrie.bengston@csiro.au