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Shedding light on life at the edge of our cells

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In the same way that the Hubble telescope has revolutionised astronomy by providing deep and clear views of the universe, sophisticated new microscopes are revolutionising medical research by providing new insights at a molecular level into the myriad processes that affect our health.

Scientists from Sydney's Garvan Institute of Medical Research and CSIRO have used a potent mixture of sophisticated microscope, camera and computer technology to shed light on life, or 'fusion events', at the very edge of our cells.

Using Total Internal Reflection Fluorescence Microscopy (TIRFM) and making a movie of the result (10 images a second for up to 50 minutes), new aspects of our cells in action are revealed.

To the uninitiated observer, the cell in motion looks a particularly unstable universe with exploding stars and continuous meteor showers. Particles fly towards us and appear to explode, emitting small bursts of light.

To the initiated, these bursts of light translate into meaningful concepts, and in this case, scientists track and interpret what happens inside our cells after we eat. The bursts of light are 'fusion events' – when glucose transport proteins (GLUT4 molecules), activated by insulin, merge with the cell surface to allow glucose into the cell.

Garvan scientists Drs James Burchfield and Jamie Lopez have made new observations, enabled by TIRFM, about how the intracellular scaffold protein actin controls GLUT4 movement to the cell surface. Their findings are now online in the international journal *Molecular Biology of the Cell*.

"Our finding is important for a better understanding of Type 2 diabetes, where glucose uptake through GLUT4 becomes compromised" said project leader Dr Hughes. "Every advance in our understanding insulin-mediated glucose uptake takes us one step closer to eventually finding a cure."

"We believe the process we describe is probably generic, suggesting that actin is also involved in the same way in the movement of other substances, such as hormones and neurotransmitters, out of cells."

"We've made several advances in our approach. We went to great lengths to do our imaging at the correct temperature, or body temperature. We also did it very fast and for a very long time, getting over 30,000 continuous images."

"Our technique allows us to see the very last steps of the process – where little vesicles or packets get close to the surface of the cell and you can see what they do in great detail."

A critical part of the project has been the collaboration with Dr Pascal Vallotton, Leader of CSIRO's Biotech Imaging group, which helped develop the software. It allows a very specific kind of image analysis on a previously unimagined scale.

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 nearly 500 scientists, students and support staff. Garvan's main research programs are: Cancer, Diabetes & Obesity, Immunology and Inflammation, Osteoporosis and Bone Biology, 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.

MEDIA ENQUIRIES

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