ABA/ASB Membrane Biophysics session II 2018

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On the morning of Thursday 6th December, the joint Asian Biophysics Association/Australian Society for Biophysics meeting welcomed Prof. Noritaka Kato from the Department of Electronics and Bioinformatics at Meiji University, Dr. Yoshitaka Nakayama from the Victor Chang Cardiac Research Institute in Sydney, and Dr. Qian Peter Su from the University of Technology Sydney, to present their works in the field of *Membrane Biophysics*.

The session got off to a great start with Prof. Kato discussing his latest research into the use of second harmonic generation (SHG) imaging to identify cell membrane damage. For those who are not familiar with the process, SHG imaging is a technique, whereby the use of the frequency-doubling phenomenon of light can contrast chemicals that are asymmetrical in their nanostructure. In his talk, Prof. Kato showed how incorporation of the asymmetric dye RH237 into lipid bilayers can generate sufficient SHG contrast to be detectable. By normalising the relative intensity of the SHG signal to the signal generated using two-photon excited fluorescence (a measure of the amount of dye present), it is possible to create an assay to identify cells that have damaged membranes amongst a cell population.

Our next speaker was Dr. Yoshitaka Nakayama who detailed his investigations into the “force-from-lipids” mechanosensation of the soil bacterium *Corynebacterium glutamicum*. *C. glutamicum* secretes an extraordinary amount of glutamate when membrane tension is increased, and this process is utilised for industrial monosodium glutamate (MSG) production. Their mechanosensitive channels, in

particular, are believed to have a specialised function as glutamate exporter, and improving their ability to secrete amino acids will have a significant economic impact on food industries (Nakayama et al. 2018a). Dr. Nakayama showed with direct patch-clamp technique that the mechanosensitive channels sense mechanical force in soft membranes due to negatively charged lipid components (Nakayama et al. 2018b) and discussed how to create ideal glutamate exporters for improving MSG production.

The final speaker for the session was Dr. Qian Peter Su who demonstrated how he and collaborators utilised the power of super-resolution and single-molecule microscopy to decipher the underlying molecular mechanisms of important biological processes. For instance, they were able to demonstrate that the protein capable of “walking” along microtubules, the *kinesin-1 motor*, through its interaction with the phospholipid PIP2,

Fig. 1 An Australian map-like spreading platelet cell was fluorescently labelled towards integrin $\alpha_{IIb}\beta_3$ and deciphered with conventional microscopy (resolution > 300 nm) vs. super-resolution imaging (resolution < 20 nm). Image credit: Dr. Qian Su

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drives tubulation by pulling on the autolysosome membrane during the late stage of autophagy (Du et al. 2016). Dr. Su also demonstrated how, by using imaging techniques such as structured illumination microscopy (SIM), it was possible to identify the essential mechanisms for mitochondrial network formation and to identify conformational changes in integrin during platelet activation (Wang et al. 2015; Su et al. 2016). As an example of his use of *stochastic optical reconstruction microscopy* (STORM) imaging, Dr. Su provided the audience with a super-resolution image of a platelet in the shape of a map of Australia (Fig. 1).

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