Katharina Gaus 1972–2021

It is with utter sadness and the deepest regret that we inform our community of the untimely passing of Katharina Gaus, 48-years young. To her friends, of which there were many across the globe, Kat leaves behind a remarkable legacy of pioneering research, research trainees and, more broadly, contributions to the research community of Australia, which had been her adopted country since 1999.

Born in Germany and educated as a physicist, Kat undertook her PhD (1996–1999) in Cambridge University, supervised by Lisa Hall. Kat then moved to Australia to work with Roger Dean and Wendy Jessup in Sydney. Kat relocated to the University of New South Wales (UNSW), the institution that generously supported her research program while she forged her stellar independent career. She was quickly recognized with various fellowships and promotions, and became a full professor at UNSW in 2012 at the age of 39.

“Kat established the world class Biomedical Imaging Facility at UNSW and nurtured the careers of the next generation of gifted scientific leaders as part of the UNSW EMBL Australia node in Single Molecule Science. The scientific insights she made, the collaborations she led and the careers she mentored are part of her lasting legacy.”
Ian Jacobs, Vice Chancellor, UNSW.”

Kat made significant contributions to the research fields of membrane biology and T cell signaling, underpinned by novel fluorescence microscopy approaches. Kat focused on how the nonrandom spatial organization of lipids and proteins in the plasma membrane regulated signaling processes. To overcome the methodological shortcomings in the study of membrane biology and signaling, her team implemented novel imaging approaches to investigate membrane

Katharina Gaus, image courtesy of ARC Centre of Excellence in Advanced Molecular Imaging.

protein oligomerization and dynamics, developed FRET sensors for probing membrane charge and innovated data analysis techniques to extract biologically meaningful information from super-resolution microscopy, enabling a better understanding of protein clustering, colocalization, diffusion and transport, and membrane topography. The ability to image membrane organization in living cells and intact organisms helped to transform the concept of lipid domains, linking them to cholesterol homeostasis. Focusing on receptor signaling, for example by controlling ligand spacing, her imaging approaches revealed membrane heterogeneity in phagosomes, cell–cell junctions, caveolae and other membrane morphologies. In collaboration with Ludger Johannes, she identified an endocytosis mechanism involving the nanoscale membrane bending induced by oligomeric galectin-glycosylated membrane protein complexes. Her body of work provided insights into the assembly mechanisms of multimolecular complexes. Her achievements were recognized by a number of prestigious awards, including the Gottschalk Medal from the Australian Academy of Science (2012) and the NHMRC Australia Elizabeth Blackburn Fellowship (2013), and, in 2018, Kat received the Khwarizmi International Award.

“She was so full of life, intelligent, interesting and scientifically vibrant. I asked her what she did and she explained features of super-resolution microscopy, how the technology could be useful to look at immunological problems, and I was hooked.” Ellis Reinherz, Harvard University.”

Kat was deeply interested in how the organization of membrane receptors controls their signaling potential, and she established novel concepts for T cell signaling. Her team identified how subsynaptic LAT vesicles facilitate the extreme signal amplification required for T cell activation. Furthermore, she demonstrated that the conformational state of the kinase Lck controls diffusion and clustering. More recently, she used single molecule localization microscopy to distinguish signaling from nonsignaling T cell receptors in the same cell. She proposed that receptor clustering is a mechanism of signal transduction that allows T cells to respond to both the dose and affinity of antigens and that electrostatic membrane potential regulates T cell signaling.

“Kat Gaus’ research was truly creative and pioneering. By developing cutting-edge technology to tackle big questions in immune cell biology, she showed how immune responses can be regulated by miniscule, nanometer-scale, changes to the organization of immune cell surfaces.” Daniel M. Davis, Manchester University.”

Many national and international researchers sought to collaborate with Kat. She established and led the research-only department in single molecule science

at UNSW, which also became an EMBL Australia node. Additionally, she was deputy director of the ARC Centre of Excellence in Advanced Molecular Imaging. These initiatives provided unique opportunities for early and mid-career researchers to flourish under Kat's guidance, with numerous researchers receiving prestigious fellowships to launch their own careers.

“Kat’s vision for single molecule science was key to the success of our Centre of Excellence—her inventions and discoveries allowed our community to actually

see how individual immune receptors behaved in response to recognition events.”

James Whisstock, Monash University.”

Kat was a shining light to all those fortunate enough to work alongside her. She was no ordinary light—rather, she was a super-resolution light that provided key molecular insight into T cell function. Her contributions extend well beyond papers published, and we are all much more visible having walked alongside her. Kat is survived by her husband, Justin, who is coauthor of many fine papers with his beloved wife.

Outside the laboratory, Kat and Justin hiked together, travelled the globe together and spent hours talking science together. But, most of all, they just loved to be together. □

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