Organelle zones

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The "Organelle Zones" Minisymposium was focused on new concepts in functional differentiation of small regions within organelles. Recent improvements in spatiotemporal resolution of live cell imaging has enabled detection of small regions in organelles, which we propose to call "organelle zones." Organelle zones may be categorized as 1) response zones that appear in response to stress, 2) communication zones defined at the contact sites between organelles, and 3) sorting zones present in trafficking organelles such as the endoplasmic reticulum (ER) and the Golgi. Several talks were related to cutting-edge technologies of microscopy, which is very important in this field.

Akihiko Nakano (RIKEN Center for Advanced Photonics, Wako, Japan) as a cochair introduced the concept of organelle zones and presented his efforts to develop superresolution confocal live imaging microscopy (SCLIM) for high-speed imaging of behaviors of small organelle zones and vesicles.

Julia von Blume (Max-Planck Institute for Biochemistry, Munich, Germany), the other cochair, talked about the sorting of soluble secretory cargo in the *trans*-Golgi network (TGN). The key player is Cab45, which is oligomerized upon binding to Ca^{2+} taken up by the SPCA1 pump. Cab45 packages secretory cargo into a TGN-derived vesicular carrier enriched in sphingomyelin, whose synthesis in TGN thus couples Ca^{2+} flux and cargo sorting (www.ncbi.nlm.nih.gov/pubmed/30393074).

Intaek Lee (Shanghai Tech University, Shanghai, China) studied the trafficking of the KEDL receptor and, by proximity-based labeling with BioID, identified ACBD3 as a novel interactant of the KDEL receptor. ACBD3 is a Golgi resident protein and appears to control trafficking of the KDEL receptor to the ER and the cell surface. Knockdown of ACBD3 leads to redistribution of the KDEL receptor to the ER and also to an increase of KDEL receptor expression at the plasma membrane.

Satoshi Goto (Rikkyo University, Tokyo, Japan) is working on sorting of glycosylphosphatidylinositol (GPI)-anchored proteins in *Drosophila*. His group previously demonstrated that distinct functional units of the Golgi exist in *Drosophila* cells (www.ncbi.nlm.nih.gov/pubmed/16174741). In the present study, he focused on the enzymes involved in GPI modifications and showed that DPIG-B is almost exclusively localized on the nuclear envelope. Chimeric experiments demonstrated that the nuclear-envelope localization is critical for its function (www.ncbi.nlm.nih.gov/pubmed/30266758). Evidence that lamin is involved in this localization was presented.

Shigeomi Shimizu (Tokyo Medical and Dental University, Tokyo, Japan) presented his work on alternative autophagy, which is not dependent on the canonical Atg5/Atg7 pathway. In yeast, the alternative autophagy evoked by amphotericin B1 involves Golgi-membrane–associated bulk protein degradation. In mammals, methylamine or DNA damage causes similar alternative autophagy. In both cases, the level of phosphatidylinositol 4-phosphate is very important (www.ncbi.nlm.nih.gov/pubmed/27511903).

Judith Klumperman (University Medical Center Utrecht, Utrecht, Netherlands) investigates multisubunit tethering complexes in the endo-lysosomal system. Her lab found that single subunits of CORVET and HOPS can also act outside these complexes and presented a unique function of the HOPS subunit VPS41 in lysosome positioning. To approach these questions, her lab developed correlative live cell imaging and three-dimensional EM with focused ion beam scanning microscopy (FIB-SEM).

Emma Sundberg (Burd lab, Yale University School of Medicine, New Haven, CT) described a new sorting mechanism for secreted proteins at the TGN. The lab identified soluble lipoprotein lipase (LPL) as a cargo of specialized secretory vesicles whose membrane is enriched in the lipid sphingomyelin (SM). The specificity of sorting is conferred by binding to the integral membrane protein syndecan1 (SDC-1) whose transmembrane domain is responsible for directing LPL-SDC-1 complexes into SM-rich membrane domains prior to export from the TGN.

Christopher Obara (Lippincott-Schwartz lab, Janelia Research Campus, HHMI, Ashburn, VA) is investigating the structure and function of the ER. Here, he presented a high-speed correlative single molecule approach to gain a deeper insight into ER function and organization. He visualized and quantified highly dynamic subdomains such as ER–mitochondria contact sites on a single molecule level in a time resolution of milliseconds.

Lena Schroeder (Yale University, New Haven, CT) described a new structure of the ER. Applying live-cell stimulated emission depletion (STED) microscopy she could visualize highly dynamic sub-diffraction-sized holes in the ER sheets. She demonstrated that the reticulon protein Rtn4 localizes to these holes. Furthermore, she could show that reticulon proteins are required for the formation and maintenance of these structures.

Rui Yan (Xu lab, University of California, Berkeley, Berkeley, CA) presented a recently developed spectrally resolved superresolution microscopy (SR-SRM). Using this method, he found that cellular membranes show distinct polarity characteristics. He also showed three-dimensional PAINT (points accumulation for imaging in nanoscale topography) of cellular membranes using a pulsed excitation of bright lipophilic fluorophores that allows the superresolution mapping of local diffusion coefficients. These methods enable direct visualization and physical evaluation of, for instance, ER–PM (plasma membrane) contact sites.

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