2P217 静電効果によるジャイアントリボソームの膜チューブ形成
Formation of endocytosis-like membrane tubes in giant liposomes induced by electrostatic effect

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We observed giant liposomes composed of negatively charged lipids (PC/PI) and containing a sugar solution, and found that when they were exposed to a hypertonic KCl solution, very thin membrane tubes protruded into the interior of the spherical liposomes. To investigate the mechanism of this phenomenon, we numerically calculated the free energy of curved membranes, which is determined by the membrane elasticity, the surface charge density and the distribution of electrolytes in the aqueous solution. The result showed that unless the lipid molecules have bulky heads, a cylindrical charged membrane has lower energy than a flat one. This fact suggests that the thin tubes observed in the experiment may be induced by the electrostatic effect of the membrane charge.

2P218 Self-Emergent Cell-Sized Sphere Entrapping DNA through Micro Phase-Segregation

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Environments inside living cells are crowded with macromolecular substances including DNAs, proteins, etc. Recently, microcompartments have been actively studied as model cellular system, by focusing on stabilities and functions of lipid vesicle. Generally, the “aqueous two-phase system (ATPS)” such as the dextran/PEG mixture is applied to separation of biochemical macromolecules. In the present study, we examined an emulsified dextran/PEG solution containing DNAs, and found that, under suitable experimental condition, DNAs were exclusively located inside cell-sized dextran-rich droplets by avoiding the fusion among the droplets. Emergence of such kind of cell-like structure is discussed in relation to the mechanism of origin of life.

2P219 Conformational Transitions in Voltage Sensor Domains

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Voltage gating - the opening and closing of ion channels in response to changes in membrane potential - is fundamental to signal transduction in living organisms. Voltage gating is achieved by four voltage sensing domains (VSDs) that surround the ion-conducting pore of the channel protein. In these VSDs, conserved positively charged residues located in the S4 transmembrane helix move according to the transmembrane electrical field, and the resulting conformational change is transmitted to the channel pore. The extent and direction of this movement, however, remain controversial. Here, we attempt to shed light on this transition using a combination of engineered probes, mutagenesis, observation, and manipulation.

2P220 破骨細胞膜に存在する新規の (?) プロトン流入経路
A novel (?) proton influx pathway in the plasma membrane of osteoclasts

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Osteoclasts, multinuclear bone-resorbing cells, face to highly acidic extracellular environments (~pH 4) in the resorption pit formed on the bone surface. Resultant pH gradient across the plasma membrane could generate a large driving force for protons entering into the cells, but the proton flux mechanism is unknown. In murine osteoclasts, we identified proton influx currents activated by extracellular acidification (< pH 5.5). The currents were featured by proton-selectivity, inward rectification and insensitivity to blockers for acid-sensitive cation channels, like ASIC and TRP channels. These results suggested that osteoclasts may possess an electrogenic proton-selective pathway which could mediate proton influx upon severe extracellular acidification.

2P221 Kv1.2 でのイオン透過における透過パターンの解析
Analysis on Ion Permeation Pattern through the Kv1.2 Channel

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States in ion permeation through the K⁺ channel can be defined by the queue of water and ions in the selectivity filter. The cyclic paths formed by the transition among states are called the permeation patterns here. Ion permeation is now described by the transitions among the permeation patterns. We analyzed the rates of the patterns used in permeation through the Kv1.2 channel at several concentrations using the molecular dynamics simulation. The transport ratios of water molecules over ions, which can be estimated by the measurement of the streaming potential, are also evaluated, yielding to a similar concentration dependency of them to the experiment. It is found that a slight difference in the ratio reflects a large difference in the patterns used in permeation.

2P222 two-pore 型カリウムチャネル TWIK-1 の特徴的なイオン選択性を生み出すメカニズムについての全反射赤外分光解析
ATR-FTIR spectroscopic analyses of interaction modes underlying unique ion selectivity of a two-pore domain potassium channel TWIK-1

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Most of K⁺ channels are highly K⁺ selective and impermeable to Na⁺, but a mammalian two-pore domain K⁺ channel TWIK-1 (or K2P1, KCNK1) shows a "loose" ion selectivity. In this study, we applied attenuated total reflection Fourier-transform infrared (ATR-FTIR) spectroscopy to TWIK-1 in order to elucidate the molecular mechanism underlying the unique ion selectivity. The difference spectra upon ion exchange from K⁺ to other monovalent cations were recorded in TWIK-1 WT and a mutant having a high K⁺ selectivity. We compared the spectra between WT and the mutant, and found specific absorption bands that reflect different interaction modes of the channels with cations. Based on the IR spectra, we propose a model explaining how TWIK-1 achieves the unique ion selectivity.