化学グローバル COE 講演会報告書

理学研究科　三木邦夫

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演題：The Na^+/H^+-Antiporter NhaA and Cytochrome *c* Oxidase, A Comparison of Two Proton Translocating Enzymes

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講演内容（博士自身の講演要旨に基づく）：In the mitochondrial respiratory chain complexes I, III (cytochrome bc_1 complex) and IV (cytochrome *c* oxidase) translocate ("pump") protons across the mitochondrial membrane. The resulting electrochemical proton gradient drives protons back via the ATP-synthase leading to the synthesis of the universal biological energy carrier ATP from ADP and inorganic phosphate. Cytochrome *c* oxidase transfers electrons from cytochrome *c* onto oxygen and consumes protons to form water as a product. This reaction creates an electric voltage and a pH difference, because cytochrome *c* delivers its electrons from the outer surface of the membrane whereas the protons originate form the inner surface of the mitochondria or bacteria. In addition, the enzyme pumps four protons from the inner to the outer surface per reaction cycle enhancing the both electric voltage and pH difference. Prof. Michel's view, based on known X-ray structures of cytochrome *c* oxidases, was presented for the catalyzed reaction. On the other hand, electric potentials and ion gradients across biological membranes are also used for the active transport of other ions and polar substances against their concentration gradients. For instance, sodium ions can be exported from the cell by sodium ion/proton exchangers, which are essential components of all cells. They are also involved in the maintenance of the intracellular pH and of the cell volume. The structure of the sodium ion/proton exchanger NhaA from *E. coli* shows a double funnel type structure so that the transport of sodium ions and protons has to occur over rather short distances. The potential mechanisms of regulation and transport were discussed.