H^+-mediated control of ATP synthase reaction at a biotransducer/lipid bilayer interface

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Controlling the flow of ions and electrons at the device/biological interface has become an important challenge in broad fields such as bioelectronics and medical biology. These devices provide a new way to translate bidirectionally between the ionic language of biology and the electronic language of circuitry.

Along with ions and small molecules, protons (H+) play an important role in biology. Examples include the homeostatic pH regulation in body and bacteria, acid sensing ion channels activating in neuron cells, proton activated bioluminescence in dinoflagellates, and pH responsive flagella in bacteria. Mitochondria in particular are a noteworthy organelle that utilize the transport of protons and electrons across a membrane to synthesize adenosine triphosphate (ATP) molecules by ATP synthase. Previously, we developed an electrochemical pH modulator (biotransducer) using sulfonated polyaniline (SPA) and then combined it with an isolated mitochondria from pig hearts. We have successfully modulated the rate of ATP synthesis in mitochondria by altering the solution pH [1]. Here we demonstrate our pH modulator at a supported lipid bilayer (SLB) incorporating ion channels (Gramicidin A and Alamethicin) or ATP synthase to control proton flow across the SLB by the applied V to SPA biotransducer. In the presentation, we will explain more details of the experimental results and discussion.

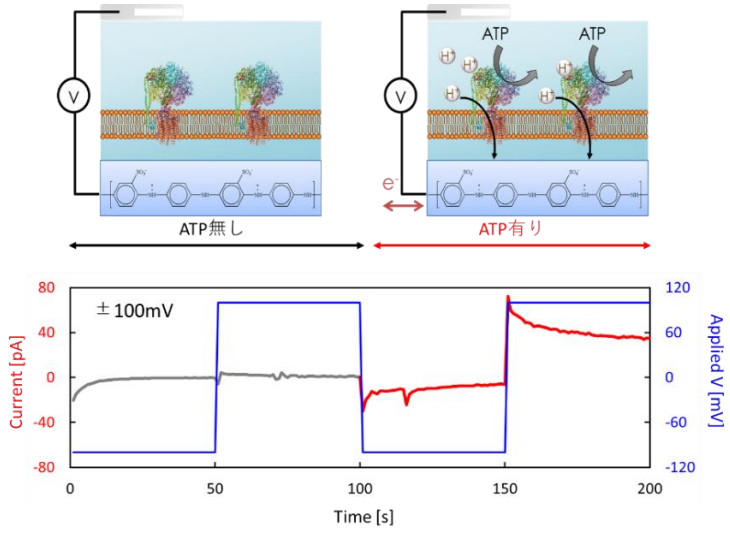

Figure 1. Proton current measurement at SPA biotransducer/ATP synthase interface.

REFERENCES

[1] Z. Zhang, et.al, *Scientific Reports*, 8, 10423 (2018).

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