ATP-dependent gating modulation of the Mg^{2+} channel MgtE for Mg^{2+} homeostasis
Doing Science in China

Motoyuki Hattori
School of Life Sciences, Fudan University

The Mg^{2+} ion is an essential element for numerous physiological processes, and Mg^{2+} homeostasis is a crucial mechanism for sustaining life. MgtE is a Mg^{2+} selective channel widely distributed in all domains of life, and is involved in the maintenance of intracellular Mg^{2+} homeostasis. Previously reported crystal structures and electrophysiological analyses suggested the intracellular Mg^{2+}-dependent gating mechanism of MgtE. However, in the previously reports, the threshold of intracellular Mg^{2+} for the channel inactivation was between 5-10 mM, which is much higher than the physiological intracellular Mg^{2+} concentration. Therefore, this discrepancy implied the existence of additional regulatory factors for the Mg^{2+}-dependent gating of MgtE under physiological conditions.

In this meeting, I will show that ATP binds to the cytosolic domain of MgtE. Further biochemical, electrophysiological, genetics and structural analyses revealed that ATP is a regulatory factor of MgtE that switches the channel gating mode. The ATP binding to MgtE enhances the affinity of MgtE for Mg^{2+} within a physiological range, enabling MgtE to act as a Mg^{2+} sensor in vivo. In contrast, the ATP dissociation from MgtE upregulates the Mg^{2+} influx even at the high intracellular Mg^{2+} concentration. Our work would provide the molecular basis for the ATP-dependent gating modulation of MgtE for cellular Mg^{2+} homeostasis.

In addition, I will also briefly introduce the present situation of science in China.