Mg Ions in the Skin Mucus of Anemone Fish Block Nematocyst Discharge of Sea Anemone to Its Symbionts

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Clown fish (an anemone fish) Amphiprion ocellaris symbiotically lives among tentacles of sea anemone Stichodactyla gigantean without suffering any attacks of nematocyst discharge from the sea anemone, although how sea anemones discharge their nematocysts to attack nearby animals or fish is not clarified yet. In order to find out factors inducing discharge of nematocysts of sea anemone, its tentacles were soaked in various solutions of sea water (SW) and chemicals, and timed from soak to nematocyst discharge. Distilled water, Mg2+-free SW and SW that had 5% less Mg2+ invariably caused nematocyst discharge in sea anemones within a few minutes. SW containing L-glutamate (NMDA* ligand) and L-aspartic acid (NMDA agonist) also caused nematocyst discharge. Mg2+-free SW containing DAP-5 (NMDA antagonist) failed to cause the discharge. Nematocyst discharge was immediately caused in the solution containing L-glutamate. Nematocyst discharge was significantly slower in SW with 5% less Mg2+ than in Mg2+-free SW. Among 3 species of Pomacentridae examined Mg2+ concentration was the highest in the skin mucus of clown fish and was higher than that of SW. We thus showed that Mg2+ in SW and NMDA receptor in anemone tentacles are involved in nematocyst discharge and that high concentration of Mg2+ in the skin mucus of clown fish blocks nematocyst discharge of sea anemone. Since NMDA receptor is known to play significant roles in memory formation and learning in various animals, sea anemone will also be able to create memory and learning. *NMDA: N-methyl-D-aspartic acid