Foundational Study on Selective Extraction of the Rare Metal from Seawater, Based on the Mechanism of Accumulation of High Levels of Vanadium by Ascidians

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Summary

Ascidians (tunicates, known as sea squirts) are marine animals that live under water, either free in the sand or attached to stones, rocks, and other solid surfaces. Phylogenetically, ascidians are treated as a subphylum of the Chordate, between the vertebrates and the invertebrates.

High levels of vanadium were found by mere chance in the blood cells of an ascidian by the German chemist Friedrich Wolfgang Martin Henze in 1911. The remarkable phenomenon has attracted many investigators from various field including physiology, biochemistry, biophysics, and the chemistry for natural products. Several years ago, we redetermined the content of the metals in several tissues of ascidians, employing a definitive method of neutron activation analysis and found out that the highest level of vanadium, 350mM, was contained in the blood cells of *Ascidia gemmata*, which concentration corresponds to 10,000,000 times the concentration in sea water.

Although we have extracted a vanadium-binding substance, named vanadobin, from the blood cells, it is necessary to make clear what kind of substance is bound with vanadium ions in the blood plasma, how the ions are transferred to the blood cells and whether a receptor for vanadium ions exists on cell membrane of the blood cells, in order to resolve the mechanism of accumulation of vanadium.

In the present experiments, we have succeeded to extract a vanadium-binding protein (vanadium-transfer) from blood plasma and vanadium-bound proteins (vanadium-receptors) from cell membranes of blood cells of ascidians. Purification of these proteins is in progress.