

The future of bacteria biomarkers

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In this session, the possible use of the organic compound produced by bacteria for some kind of indicator (biomarker) will be discussed from various angles. This lecture discusses the possibility as an index that explores a primitive life, and the life outside the earth in relation to the prospective usage.

There exist a group of bacteria that likes the environments of an extreme high temperature, high acidity, and high salt concentration where almost all living things cannot inhabit. These bacteria are called as archi-bacteria. On presumption of high temperature, oxygen deficient atmosphere, and highly acidic ocean in the early earth, archi-bacteria may be the main living thing species in the initial earth. It is more reasonable to consider that in the inside where the organic evolution advances to eucaryote and Eubacterium with the change of global environment, the resultant archi-bacteria that cannot adapt to the environmental change survives in the unique environments in the recentness.

Cell membrane lipid distinguishes the archi-bacterium from other species of living thing clearly. The long-chain alkyl part consists of the isoprenoid chain for this lipid. Some experiments have been conducted to confirm the possibility of abiotic synthesis of the phosphoric acid ester containing the isoprenoid chain to afford a vessel (cell membrane) to perform synthesis of initial life in the primitive Earth. It seems to become possible that the material foundation for estimating initial stage life evolution, when the lipid component of the archi-bacterium is utilized as a biomarker, is given, and it is expected that the powerful technique will be developed to discuss the origin of life and primeval global environments.

As a discussion using biomarkers on the extraterrestrial life body, there are those on the microorganism in the carbonaceous chondrite and microorganism in the Martian meteorite. In these arguments, biomarkers were used to prove that the object considered having a form similar to the seaweed and microbe that was observed under the microscope is the trace of a living thing. In the case of a Martian meteorite, the used biomarker is only polycyclic aromatic hydrocarbons. It is caused that the instrument to detect organic compounds that locally exist is peculiarly supersensitive to PAHs. Prudent discussions are necessary to use PAHs as a biomarker to confirm the presence of the extraterrestrial microorganism. Naturally bacteria should also live in the habitat environment in which algae and microorganism exist in the extraterrestrial. Since environmental adaptability of bacteria is high, the habitation range is very wide. Therefore, the retrieval of the bacteria biomarker will become the prior alternatives in the planetary exploration in order to verify the existence of the life body including the result of existing in a past.