

Elements for systems of life-support in closed bio-ecosystem

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Living creatures on the earth have been evolved since its origin a long time ago. They equip several important functions affecting each other. Knowledge on those functions and interaction of the ecology is essential for secure design of a closed-ecosystem with limited number of living species under the harsh environments, such as space and deep sea or desert. Here, the important elements related to the closed bio-ecosystem will be discussed by the researchers having each specialized field .

Keywords: systems for life, life-support, closed bio-ecosystem

Closed environmental system view from photosynthetic organisms

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Photosynthetic organisms are said to have changed the environment of the primeval earth. Especially, cyanobacteria, algae and plants have water splitting system and absorption system of light energy effectively and make organic matters, such as sugar. Some of cyanobacteria have nitrogen-fixing activity that changes the nitrogen in the air into amino acid and make polysaccharide from sugar to protect outside of cells. The ability of cyanobacteria may use as food or soil. This presentation may discuss closed environmental system viewed from isolated useful cyanobacteria that can survive in the severe environment and test of removing radioactive cesium using a terrestrial cyanobacterium *Nostoc commune*.

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Keywords: closed environment, cyanobacteria, photosynthesis

Evaluation of allelopathy by volatile natural chemicals in closed ecosystem

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We have developed a bioassay for allelopathy in closed ecosystems. We named this method as a kind of Life cycle assesent (LCA). This method is also valuable to evaluate the allelopathic activity in the closed ecosystems in space and also contribute for the future agricultural interaction in grass house or agriculture on earth. LCA Method was established using agar medium, and Arabidopsis or Rapid Plants (*Brassica* sp.). DNA microarray analysis using plant material with LCA method could analyze the gene expression to specific allelochemicals. *Fagopyrum esculentum* is one of the several crop species possessing strong allelopathic properties. In our previous study we had identified eight allelochemicals in buckwheat and analyzed by microarray analysis two important compounds such as rutin and gallic acid. The gene expressions of 20 days old *A. thaliana* plants were analyzed using Affymetrix GeneChips ATH1. The results showed 168 and 55 genes with higher expression after 6 hours of exposure to gallic acid and rutin, respectively. However, only 14 genes were found common for both compounds. The study revealed some genes which are important in regulating plant responses to stress. Induced genes fell into different functional categories mainly, metabolism; cell rescue, defense and virulence; cellular communication/signal transduction mechanism and transcription. This study may lead to a better understanding of the allelochemicals mode of action which in the future could be used in biological control of weeds..

Keywords: allelopathy, volatile chemicals

Evaluation of products as food in closed bio-ecosystem

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We have been studying life-support in closed bio-ecosystem to provide food and oxygen for the habitation area. A cyanobacteria, *Nostoc* sp. HK-01, has high several environmental tolerance. We have already confirmed that *Nostoc* sp.HK-01 had an ability to grow for over several years on the Martian regolith simulant in a laboratory experiment. *Nostoc* sp HK-01 would have high contribution to control the atmosphere in closed bio-ecosystem. In outer environment, all of materials have to circulate for all of creature living in artificial eco-systems. This material has several functions as the utilization in the agriculture under the closed bio-ecosystem condition. Here, we are proposing using them as a food. We are trying to determine the best conditions and evolution for food using *Nostoc* sp.HK-01 and studying the proposal of utilization of cyanobacteria, *Nostoc* sp HK-01, for the variation of meal under the sever environment.

Keywords: Cyanobacteria, *Nostoc* sp. HK-01, food

Environmental measurement and reproduction of farmland in the DASH MURA which became a closing system by 3.11.

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3.11 caused the nuclear power plant accident. The radioactive material diffused broadly generated strong radiation, and the control area was made by the government. The mountain farm village managed by people's became a closing system, and the ecosystem changed. we perform environmental measurement is performed from immediately after an accident, and the approach to reproduction of future farmland.

Keywords: nuclear power plant disaster, control area, farm village, environmental measurement

”Cell to body dynamic theory” in closed environment

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Human beings will be able to live in space for a long period. But we must consider our body theory even in closed environment. Human beings are evolved to be bipedal standing and walking utilizing gravity at ordinary state and these body traits made human beings as human with culture (see a book ”Thumbs, toes and tears: and other traits that make us human”, by Chip Walter, 2007). Compare to other four-legs animals, musculoskeletal systems especially anti-gravitational skeletal muscles are dominantly developed in our system in order to make us possible to move around on the ground by a bipedal walking. Decreased physical activities of anti-gravitational skeletal muscles induce increased lifestyle related diseases and mental disorder. Human beings are required to move appropriately in order to keep our body and mind healthy and normal. We will try to explain the anti-gravitational muscle adaptable mechanism with an aspect of ”Cell to body dynamic theory”.

Keywords: health, gravity, bipedal-standing, Cell to body dynamic theory, anti-gravitational muscle