Details of the sessions at OBC4 on "Terra Microbiology 2"

Of the features considered to have made it possible for microorganisms to inhabit various environments on earth, their metabolic diversity and versatility have certainly contributed to their involvement in the essential roles material cycling in these environments. Terrestrial environments constitute the largest cradle of microbes and an astounding variety of microbial life has been discovered. At OBC2 on Terra Microbiology (2004), we held discussions on several topics in the four sessions during which we expanded the horizons of microbiology: 1) Environmental Constraints and Evolutionary Diversity, 2) Biogeochemical Cycling and Terra Formation, 3) Symbiosis and Interactions, and 4) Novel Approaches to Microbial Systems. The benefits associated with the outcomes of these events were considerable and included the establishment of a core scientific society, which has taken life science into a new phase. We are delighted to be able to host the OBC4 on Terra Microbiology 2. OBC4 will not only build upon the successes of OBC2, but also upon the most recent developments in the life sciences. We will have the following three sessions in OBC4:

Session 1. Bio-Geochemical Cycling and Microbial Functions

Convened by MINAMISAWA, Kiwamu (Japan) and ARP, Daniel J. (USA)

Microbial systems exhibit considerable metabolic versatility and are capable of exploiting a diverse array of processes in order to acquire energy. This separates them from plants and animals and has contributed toward numerous material and energy cycling processes on earth. Microorganisms chemically oxidize and reduce various inorganic materials via conventional chemolithotrophic processes by employing novel systems such as ANAMMOX, methane oxidation and hydrogen oxidation.

Recent molecular and genomic research has revealed the existence of novel microbial systems in certain environments and hidden metabolic processes in known species. While microbial ecologists have discovered a diversity of flora and have explored their respective functions in ecosystems at molecular and genomic levels, we do not yet fully understand the following fundamental questions: (1) Who is doing what? (2) What are main driving forces underlying material and energy cycling in microbial systems and how did they evolve? At OBC4, we will discuss these and related aspects to gain an understanding of the current status of environmental ecology. In addition, the development of new interdisciplinary strategies that span ecological niches that vary from agricultural soils to anoxic environments and thermal vents will also be encouraged. In particular, we will focus on a developing area of metabolism, ecosystems, and microbial communities relevant to the nitrogen cycle in OBC4.

Session 2. Gene Hopping among Microbes - From Clinical and Environmental Evidences to Evolution of Life -

Convened by SUZUKI, Satoru (Japan) and TIEDJE, James M. (USA)

Evolution of life can occur by vertical and horizontal gene transfer as quantum leaps. Especially in microbes, it has been thought that horizontal gene transfer plays a significant role in evolution and adaptation, which can be mediated by transduction, conjugation and transformation. All classes of genes such as accessory, operational and informational genes have been observed to be mobile among species, which suggests that a myriad of biological events should relate to 'horizontal gene transfer'. In some cases, a gene wreck can be detected on chromosomes, suggesting that genes are hopping (or jumping) among different species, and leave a wreck by moving to other cells. We would like to look at the transfer and hopping/jumping of genes among different species and in different environments, focusing on drug and metal resistance genes and their transfer mechanisms. This session is not restricted to accessory genes however. We would also consider topics of metabolic and energetic gene cases as an advanced step of this session. The aim of this session is to think and hypothesize what gene hopping contributes to the microbial world.
A variety of approaches will be presented in this session. Expected questions and discussion themes are as follows: “What genes are hopping?” - Recent knowledge of hopping of the drug and metal resistance genes among microbes will be presented. “How are they hopping? How do we observe?” - The role of mobile elements will be presented. The new methods to quantify gene hopping on the single cell level and modern mega-scale analysis such as microarray and metagenome will also be presented. “Where did they come from?” - Movement among different domains will be discussed. “Why do they move and stay?” - This is the center of gene hopping research. Experimental and informatics approaches will discuss about fusion of life and ring of life with some examples. We hope all in attendance are interested in this session and join freely to this monumental theme.

Session 3. Bacterial Cross Talk

Convened by KATO, Junichi (Japan), KJELLEBERG, Staffan (Australia) and NOMURA, Nobuhiko (Japan)

Bacteria are an extremely important component of material cycling on earth. Where and under what conditions do bacteria do this? In environments such as soil, streams, oceans, animals and plants, bacteria usually exist as biofilms in which bacteria cluster and communicate via bacterial signals. Bacteria can alter their behavior through these signal interactions, such as quorum sensing, between the organisms/cells in bacterial communities, and these interactions are accepted in terms of communication that has the function of mediating and coordinating multicellular behavior in

biofilms. One of the challenging issues at OBC4 will be to address how these bacterial communities mediate and regulate material cycling.

To promote discussion of these fundamental issues regarding microbial life histories, this session has been divided into the following topics: 1) Material cycling by biofilms, 2) Mechanisms of interaction in biofilms, 3) Symbiotic metabolism and functioning, and 4) Cell death and evolution in biofilms.