Summary of Sessions

Session 1. Environmental Constraints and Evolutionary Diversity

Convener: Kenji Kato, Japan Co-convener: Joseph L. Kirschvink, USA

Life evolved most of the basic biochemical machinery for energy metabolism during the first two billion years since it appeared on Earth. These anaerobic and aerobic microbes developed chemilithotrophic and photolithotrophic processes that profoundly modified Earth' environment. Microbes also expanded their environmental tolerance to include almost all conceivable niches, from temperatures below freezing to above boiling, and with wild variations of pH, salinity, and redox state. In parallel with this, they radiated into habitats from the deep sub-surface in rock, to hydrothermal vent systems, and even to the atmosphere. In this session we will gaze at the interaction of microbes with their environment at the molecular level, and discuss their geological role in time and space, including the future. The 'Ecological Theater of Life Itself' is the subject for discussion in this session.

Session 2. Biogeochemical Cycling and Terra Formation

Convener: Hiroyuki Ohta, Japan Co-convener: Vigdis Torsvik, Norway

In this session we discuss "terra formation" and "soil ecosystem evolution" from the aspect of microbial biogeochemical cycling. The process of terra formation is possibly classified into at least two phases: the first phase of wholly new, plant-free ecosystems and the second phase of plant-growing ecosystems. A central model for the first phase is represented by the ecosystem on new substrates laid down by volcanic eruptions or maybe those appeared by glacial recessions. Here we start the session with topics of microbial ecology on volcanic deposits and freshly cut rock. Then we focus on the metabolism and ecology of chemoautotrophic microbes in relation to biogeochemical cycling and finally deal with relationships between microbial diversity and terra formation. In order to gain a better understanding of terra formation, the proposed session includes not only topics with cellular levels of bacteria and fungi but also those with molecular approaches.

Session 3. Symbiosis and Interactions

Convener: Masanori Saito, Japan Co-convener: Bengt Söderström, Sweden

The word "symbiosis" introduced by the botanist de Bary in 1879 meant simply the living together of different kinds of organisms. Vast studies on various symbioses during more than a century stresses that interaction that occurs when different organisms or cells closely co-exist is one of the driving forces of evolution. Emergent properties come from combining different organisms into a single functioning whole. The emergent properties appear at cellular, genetic and population level. In this session, by looking at various microbial symbioses and interactions, we will discuss how the emergent properties appear, what are the mechanisms governing them, and why they have been evolving.

Session 4. Novel Approaches for Microbial Systems

Convener: Kiwamu Minamizawa, Japan Co-convener: Eugene L. Madsen, USA

A number of types of molecular, genomic and isotopic techniques are now developing to find, identify and study in situ various functional groups of environmental microbiology. Modern microbial techniques show a great promise in linking to the ecological concepts and theoretical framework into ecosystem level function and evolution of microbes. In particular, it is important how recent progresses of microbial genomics are linked to these studies. The theme is not to talk about techniques per se but their application, more importantly what new concept / evidence we gained in microbial ecology from using the modern tools of genomics and molecular biology.