

## Lecture 7

### 35. Defining complexity in microbial ecosystems

#### 35.1 Complexity on the ecosystem level

- Microbial ecosystems are more than the sum of individual niches.
- Community structures: populations present, relative abundance of species, levels on which they interact (trophic, food web, genetic).
- Diversity and evenness
- Prerequisites for the study of microbial ecosystems: habitat physics, chemical conditions, organismic adaptation, niche diversification, genomic plasticity.
- Mass and energy flow through microbial ecosystems.
- Abiotic, biotic determinants which alter community structures.
- Macroecological patterns and events which regulate microbial ecosystems.
- Reconstructing microbial ecosystems.

#### 35.2 Complexity on the cellular level

- Chemical signaling between cells.
  - Microbial life cycles.
  - Behavior which leads to cell aggregation.
  - Features of a hypothetical "minimum cell".
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## Lecture 8

### 33. Criteria for life: Applications to Exo- and Astrobiology

- Where did life originate, where did it evolve ? It must have developed rapidly during the precambrium on earth or it came from elsewhere.
  - Searching for life on Mars: what are the facts which justify looking for it and the concepts to search for it ?
  - Criteria for extraterrestrial life.
  - Unique chemical signatures which identify life processes.
  - Essential molecular components of living systems.
  - How old is the genetic code ?
  - Criteria for life and survival which determine the spreading of microorganisms on earth.
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### Exercises VII: To topics from

#### 23. Secondary metabolites of Cyanobacteria as signaling molecules

- Products of secondary metabolism: structural diversity and pharmacological/physiological effects of cyanobacterial metabolites.
- Distribution of the ability for their formation in cyanobacteria.
- Cyanobacterial secondary metabolites as "infochemicals".
- Biochemical, molecular and toxicological methods for the detection and identification of cyanobacterial secondary metabolites.
- Natural disasters created by toxic cyanobacterial metabolites: toxins in drinking water infiltration ponds and oligotrophic mountain lakes, harmful algal blooms.

**Exercises VIII:** To topics from

**36. Microbial ecology in the modern era of biology**

- Still a microbe-dominated world.
- The microbial ecologist's contributions to discussions on biological risks and safety.
- Balance between microbes and macrobes.
- Epidemiology: ecology of infectious diseases.
- Disease - evolving symbiosis.
- Gene spreading under natural conditions.
- To what extent has horizontal gene transfer affected the evolution towards diversity ?
- Is sex species-restricted in haploid prokaryotes as well or only in diploid eukaryotes ?