Guided Reading in Microbial Ecology (2 credit) 1-2-3355

Weekly Lecture Hours	Exercise	Laboratory	Field Trip
2			

Course description and objective:
Explaining biodiversity is a central problem in ecology. Recent advances in genomics are offering fresh perspectives on the previously underappreciated microbial world. Microbial Ecology—the current merger between microbiology, ecology, and molecular biology—has proven very powerful for describing niche differentiation and habitat and functional diversities of microbes. However, the full potential of microbial ecology, which aims to understand how microorganisms interact with each other and with their environment to generate and to maintain such diversities, is still far from being used. Moreover, even today, most studies in microbial ecology are descriptive rather than hypothesis-driven. Thus, it is not clear whether the same ecological mechanisms operate in Macro- and in microorganisms. The guided reading course is aimed to:

(1) Explore the range of subjects, which are already covered by microbial ecology
(2) Reveal similarities and dissimilarities between patterns and mechanisms underlying macro- versus microrganisms
(3) Highlight future directions that microbial ecology needs to take

Detailed description of course units:

1. **Introduction:** Course goals and description; the unique features of microbes.
2. **The different groups of microbes:** bacteria, viruses, archaea, most protozoa, some fungi, some algae, and some animals.
3. **The different habitats of microbes:** microbes in the air; microbes in the soil; microbes in the sea; microbes in the phyllosphere; microbes in arthropods; microbes in mammals
4. **Revealing the diversity and function of microbes:** genomics; transcriptomics, proteomics, metabolomics.
5. **Microbe-microbe interactions:** antagonism; mutualism, predation, commensalism.
6. **Ecology of host-associated microbes:** effects on physiology, behavior, immune response; genome size reduction.
7. **The holobiont and hologenome concepts:** theory; supporting evidence; controversy.
8. **Community ecology of microbes:** alpha, beta and gamma diversity; succession and disturbance; Local and regional factors influencing bacteria community assembly; metacommunity theory.
9. **Effect of disturbance:** resistance; resilience; redundancy in microbial communities.
10. **Macro ecology:** species abundance distributions; partition of community variance; environmental filtering vs. species interactions; latitudinal

gradients in richness; elevational gradients; productivity–diversity relationships.

11. **Microbial biogeography:** the distance–decay relationship (how community composition changes with geographic distance); the taxa–area relationship; the local: global taxa richness ratio
12. **Microevolutionary processes:** phylogeography, host-specificity and speciation, population genetic structure, evolution of virulence, evolution of mutualism.
13. **Course summary:** similarities and dissimilarities between patterns and mechanisms underlying macro- versus microrganisms; future directions that microbial ecology needs to take.

Assessment of students and structure of final grade:
The students will read key and review articles and will provide critical summary for the tested theories and ideas for future research and challenges (100% of the grade).

Lecturer: Hadas Hawlena

Recommended Readings: The relevant article list will be provided during the course.