The last two decades have witnessed unprecedented advances in our knowledge of the microbial world. This is due largely to the development of culture-independent techniques (Olsen et al., 1986; Amann et al., 1995) that have permitted the detection and a degree of characterization (Gray & Head, 2001) of the elusive majority of microorganisms that remain to be reliably cultivated in the laboratory. The ultimate expression of the technical innovations that have allowed us to observe that part of the microbial world that was previously invisible to us, has been found in the recent massive molecular surveys of microbial genome fragments recovered directly from the environment (Venter et al., 2004; Sogin et al., 2006; Rusch et al., 2007). Such developments, and those aimed at more directed measurement of the abundance and properties of defined groups of organisms, have led microbial ecologists from a world that was limited by the availability of appropriate measurement tools to one which is limited by our ability to organize and interpret the data that our, now bulging, toolbox provides.

In contrast, theoretical foundations that can explain the patterns observed in microbial communities or their response to perturbation (either at the level of community structure or function) have lagged behind technical advances. In contrast, animal and plant ecologists have a well-developed tradition of the development of theoretical models to explain phenomena observed in biological communities (Macarthur & Wilson, 1967; Tilman, 1982; Hubbell, 2001). Microbial ecologists have only recently begun fully to appreciate the necessity to underpin their empirical research theoretically, and we have much to learn from established ecological theory, as well as the opportunity to determine if the behaviour of microbial communities is fundamentally different from communities of macroorganisms (Curtis & Sloan, 2004; Hughes-Martiny et al., 2006; Prosser et al., 2007). Microbial systems also offer tractable opportunities to test fundamental ecological theories experimentally. Working together, microbial ecologists and classical ecologists can achieve much of mutual benefit.

This issue of *FEMS Microbiology Ecology* is based on a joint symposium of the Society for General Microbiology, Environmental Microbiology Group and the British Ecological Society held on 13 September 2006 at the University of York. The purpose of this symposium was to develop the emerging dialogue between microbial and general ecologists and explore some recent developments in both disciplines with a view to cross-fertilization of ideas.

This selection of papers, the majority of which were associated with the symposium, captures all of these aspects of the interactions between microbial and general ecologists. Attempts to explain broad community structure patterns seen in microbial ecosystems are explored in papers by Hughes-Martiny et al., Sloan et al. and Smith using concepts borrowed from general ecology. The effect of environmental selection on bacterial community composition in a biogeochemically significant group of organisms, the SRB, is covered by Purdy. Demonstration of genuinely chaotic dynamics in real biological systems is notoriously difficult and Graham et al. combined experimentation and rigorous mathematical analysis to assess the significance and drivers of chaotic dynamics in microbial communities and the consequences for the stability of the key process of nitrification. Röling et al. adopt a modelling approach to determine how microbial population size and activity control the flux of matter and energy through anaerobic microbial food chains. One aspect of microbial ecology that may be unique and has no direct analogue in communities of sexually reproducing macroorganisms is plasmid-mediated horizontal gene transfer. The potential importance of this mechanism for the dissemination of beneficial characteristics through a bacterial community is investigated by Miki et al. and Lamour et al. describe the use of graph theory to describe networks of rhizomorphs in *Armillaria* and the influence of connectivity on the distribution of nutrients.

The utility of simple, defined microbial systems to test fundamental concepts relating to competition and cooperation in biological communities is elegantly evaluated by Buckling. Finally, Ramette provides a valuable overview of exploratory statistical approaches that may help reveal patterns and relationships between the environment and microbial community composition. This provides an excellent starting point for microbial ecologists faced with a deluge of complex data.

Microbial ecology and general ecology are both at exciting stages in their development, with controversial theories, such as the unified theory of biodiversity, emerging from general ecology at a time when microbial ecology is freeing...
itself from the shackles imposed by technical difficulties of measurement and observation. However, microbial systems should not simply be viewed as a convenient test bed for theories developed in classical ecology and in many respects the large population sizes and generally short generation times of microorganisms, as well as some of the unique features of their lifestyles and interactions, suggest that microbial systems may exhibit different behaviour from ecosystems viewed from the perspective of macroorganisms. Discovering universal themes and properties that are specific to microbial communities will be extremely important if we are to manage rationally microbial ecosystems that are responsible for providing key environmental services. Ecological theory applied to microbial systems can potentially form the basis for practical environmental management strategies in much the same way that an understanding of population dynamics can be used to manage fisheries and inform conservation strategies for communities of macroorganisms. We hope that this special issue will help stimulate new ideas and approaches that will propel general and microbial ecology along a mutually beneficial path.

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