Preface

Dictyostelid social amoebae are a unique group of organisms with a life cycle that includes both unicellular and multicellular stages. They belong to the eukaryotic supergroup Amoebozoa, which is the sister group to Opisthokonta (animals and fungi). At the unicellular stage the amoebae prey on other microorganisms, mostly bacteria, by phagocytosis and multiply by binary fission. When food becomes scarce, dictyostelids have developed different responses to survive, including a remarkable process whereby a multicellular structure is formed by aggregation of individual amoebae. These aggregates behave as true multicellular organisms, showing processes of cell differentiation and morphogenesis that are reminiscent of those of metazoans. This unique multicellular stage and the position of the dictyostelids in the eukaryotic tree of life led to the sequencing of several genomes across the group. The availability of these genomes, as well as those from other non-dictyostelid sorocarpic amoeba, will allow us to gain insight into one of the great mysteries of evolutionary biology, the evolution of multicellularity across the tree of life. The social behavior of the dictyostelids also offers a unique opportunity to address the roles that multicellularity plays in the evolution of cooperation in complex organisms.

After aggregation, *Dictyostelium* development is governed by a complex interplay of extracellular signals between the different cell types. Despite being initially regarded as a simple system, development in *Dictyostelium* has proved to be more complex than previously expected. The molecular network that regulates cell motility and chemotaxis during the aggregation stage is a major topic in *Dictyostelium* research, which leads the field with astonishing discoveries about the "molecular compass" that allows eukaryotic cells (regardless if they are amoeba or human cells) to move in response to external gradients. A delicate and interconnected regulatory network of gene expression is now emerging as a result of massive transcriptomic analyses, which have helped to illuminate general principles in the evolution of development. One of the species in the group, *Dictyostelium discoideum,* has been used as a model organism since the 1960s. This species is highly amenable to experimental manipulations as well as genetic approaches, which together allow for a deep analysis of the function of genes. Conservation of the molecular mechanisms underlying the most fundamental cellular processes among distant taxa reinforces the use of *D. discoideum* as a

suitable experimental system to address not only basic questions of cell biology, but also issues of importance to human health and disease. These include the study of pathogen infections, mitochondrial diseases, cell motility-related diseases, and developmental and neurodegenerative diseases, among others.

This book highlights some of the most important recent discoveries in dictyostelid cell and molecular biology as well as the latest information about dictyostelid ecology, life cycle, and genomics. We also include a chapter on the study of the multiple independent origins of aggregative multicellularity across eukaryotes, which highlight the complexity of the evolution of cooperation among microbes. The ongoing active research on dictyostelids and the application of high throughput technologies suggest a promising future for the understanding of fundamental questions about living organisms, as inferred from the workings of the humble but wise social amoeba.

Maria Romeralo
Ricardo Escalante

http://www.springer.com/978-3-642-38486-8

Dictyostelids
Evolution, Genomics and Cell Biology
Romeralo, M.; Baldauf, S.; Escalante, R. (Eds.)
2013, VIII, 255 p., Hardcover
ISBN: 978-3-642-38486-8