

BOOK REVIEW

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FALCIATORE, A. and Mock, T. (eds) (2022): *The molecular life of diatoms*. – Springer Nature, Switzerland AG., 808 pp. ISBN 978-3-030-92499-7

Diatoms are single-celled photosynthetic eukaryotes that have silica cell wall with unique morphology. These algae can colonise not only aquatic environments but terrestrial habitats including soils too. They play important role in ecosystems as primary producers and in biogeochemical cycles.

As we can read in the Preface to the present book, diatoms were first recognised in the 18th century and the researches on them focused on several issues, aiming to find their significance in practice, e.g. as bioindicators in ecological status assessment. The main tool for investigation has been light microscope and later electron microscope, too. Studies on diatoms applying molecular techniques began in the 1990s. The first whole genome sequence was published for *Thalassiosira pseudonana* that was followed by sequencing of several additional model diatoms with new sequencing technologies that were complemented with transcriptomics and metatranscriptomics studies. More and more various researches were conducted aiming to understand the molecular features of diatoms. As a consequence, a conference dedicated to the “Molecular life of diatoms” was initiated in 2011. The idea of a comprehensive synthesis of results of diatom molecular studies arose at the fifth meeting and this led to the publication of present book.

The volume is divided into six main parts that discuss various issues of diatom molecular biology. The first part gives insight into the associations of evolution and ecology of diatoms through the aspects of traits, population genetics and diatom interactions. An interesting chapter deals with ancient diatom DNA. Some diatom species have the ability to form resting stages, allowing them to survive long periods of adverse conditions. These stages can provide abundant DNA providing insight into diatom evolution.

The second part of the book treats with genomics synthesising available knowledge on structure and evolution of diatom nuclear and organelle genomes, as well as their epigenetic control.

The main characteristic of diatoms is their silica cell wall after which they were named. This cell wall, the so-called frustule consists of two parts that fit into each other like halves of a Petri dish. Morphology of the frustule is thoroughly studied and used for classification of diatoms. According to the frustule symmetry diatoms are divided to radial centrics and bilateral pennates and this division is applied in the description of structure and morphogenesis of diatoms. Among microalgae, diatoms have unusual life cycle that is controlled by cell size reduction-restitution cycle and is intimately linked to their peculiar mode of cell division and siliceous cell wall. These specific features of diatoms are described in details in the third part of the book, in which we can learn other interesting issues about organelles, endosymbiotic diatoms as well as adhesion, biofilm forming and motility.

Diatoms perform oxygenic photosynthesis utilising light energy, fixing carbon dioxide and producing oxygen and carbohydrate. Beside assimilation of inorganic compounds some species can also use organic material. The fourth part of the volume is dedicated to

primary metabolism of these algae discussing photosynthetic light reactions, carbohydrate metabolism, lipid metabolism, mechanisms of macro- and micronutrient utilisation. An interesting section presents macronutrient utilisation in the view of genomics.

Studies showed that diatoms could detect environmental variations by sensing differential light signals, nutrients and other stimuli and converting them into activation of specific signal transduction pathways. Moreover, they can adjust their physiology according to these pieces of information. Diatoms can also utilise chemical cues that are exuded by conspecifics and other organisms in their microenvironment. The neurotoxin domoic acid may have role as a signal. These cell signalling pathways and interaction modes are explained in the fifth part. An intriguing chapter in this part is about the interactions between diatoms and bacteria. Another chapter deals with the issues of diatom viruses.

The last part provides a review on molecular and genetic engineering tools employed in diatoms that can be used not only for understanding of cellular functions and metabolic processes in diatoms but for engineering them.

Overall, this book is a great synthesis of the results of molecular biological studies on diatoms. This can be recommended to everyone interested in secrets of life of these tiny but important organisms.

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