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Editorial

Special Issue: The biology of plant mitochondria☆

The International Conference for Plant Molecular Biology is held biennially and for the first time it was located in Latin America (Rosario, Argentina) in 2013. The 2013 Conference was an excellent opportunity for the exchange of ideas and results by researchers from all over the world that study plant mitochondrial biology using different approaches. About 130 researchers and students from 20 different countries assisted the Conference and, for Latin American and especially for Argentinean students, it was an excellent opportunity to get in contact with world leaders in the field.

The Conference was organized in 12 oral sessions that included 48 speakers plus 2 poster sessions and covered different aspects like mitochondrial evolution, structure and expression of the plant mitochondrial genome, nucleus–mitochondria crosstalk, mitochondrial respiration and energetics, mitochondria and photosynthetic metabolism, the role of mitochondria in plant development and stress responses, mitochondrial dynamics, protein structure and proteomics and RNA processing and metabolism. In addition, an EMBO lecture was presented at the end of the Conference by Prof. Dr. Axel Brennicke about "Plant mitochondrial research, progress and perspectives". The Conference reflected the growing interest in the study of mitochondrial dynamics and proteomics, as well as in the study of the signaling pathways involved in the communication between mitochondria and other cellular compartments.

This Special Issue was originated as a means to put together recent advances in the field of plant mitochondrial biology, to summarize many of the aspects discussed during the 2013 Conference, and as a starting point for the next Conference to be held in 2015 in Poland. The issue was also enriched with the participation of researchers that did not attend the 2013 Conference.

The Special Issue is composed of several works, either in the form of reviews or original articles, which contribute to the understanding of many mitochondrial processes. Reviews covering the biogenesis and function of several mitochondrial proteins and protein complexes are presented. Particularly, a comprehensive review dealing with Complex I, which represents an excellent model system for studying the connection of respiration and photosynthesis, the cooperation of mitochondria and the nucleus during organelle biogenesis and the evolution of the mitochondrial oxidative phosphorylation system, covers the many processes involved in the assembly and functioning of this complex structure. A couple of articles analyze aspects of Complex IV biogenesis. Functional and biochemical aspects of the alternative oxidase (AOX), pyruvate dehydrogenase and the glycine decarboxylase complex (GDC) are also discussed.

Mechanisms involved in the maintenance and expression of higher plant mitochondrial genomes are discussed. Reviews covering the most relevant discoveries dealing with mitochondrial DNA replication and the role of mitochondrial DNA-binding proteins in mitochondrial gene transcription are presented. Post-transcriptional gene expression mechanisms, particularly RNA editing and the role of pentatricopeptide repeat (PPR) proteins in this process, are also discussed, as well as the role of the redox state of the electron transport chain in the regulation of mitochondrial gene expression. In addition, a global analysis of the post-translational modification of mitochondrial proteins by acetylation, like proteins which participate in the TCA cycle, respiration and photorespiration, is also presented.

Finally, this Special Issue includes articles showing the increasing evidence about mitochondria participation in many processes like the defense against pathogen attack, the response to stress, germination and the development of female and male reproductive structures.

We hope that this Special Issue will be helpful for those interested in the many aspects of plant mitochondrial biology. The collection of articles presented here represents only a small fraction of the knowledge related with plant mitochondrial biogenesis and function. We hope that readers will enjoy this issue as much as we enjoyed its assembly and the organization of the 2013 Conference. We thank all authors for their contributions that highlight the most recent advances of this exciting research field.

Carlos Bartoli
Instituto de Fisiologia Vegetal (INFIVE-CONICET), Universidad Nacional de La Plata, La Plata, Argentina

María Victoria Busi
Centro de Estudios Fotosintéticos y Bioquímicos (CEFOBI-CONICET), Universidad Nacional de San Martín, San Martín, Argentina

Diego F. Gómez Casati
Centro de Estudios Fotosintéticos y Bioquímicos (CEFOBI-CONICET), Universidad Nacional de Rosario, Rosario, Argentina

Daniel H. Gonzalez
Instituto de Agrobiotecnología del Litoral (CONICET-UNL), Universidad Nacional del Litoral, Santa Fe, Argentina

Elina Welchen
Instituto de Agrobiotecnología del Litoral (CONICET-UNL), Universidad Nacional del Litoral, Santa Fe, Argentina

Eduardo Zabaleta
Instituto de Investigaciones Biológicas (CONICET-UNMdP), Universidad Nacional de Mar del Plata, Mar del Plata, Argentina

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