

Functional Plant Biology

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Editorial: Charles Darwin: an inspiring plant biologist
and author

Rana Munns

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Introduction: Charles Darwin's plant biology
Rosemary Purdie

481–489

Charles Darwin carried out plant biology research for more than four decades. This overview of his botanical studies illustrates how the results helped Darwin to develop and substantiate his theory of evolution, and foreshadowed scientific discoveries made decades later. His work remains an inspiration for budding scientists of the 21st century.

Review: Sexual and asexual (apomictic) seed
development in flowering plants: molecular,
morphological and evolutionary relationships
Matthew R. Tucker and Anna M. G. Koltunow

490–504

Most flowering plants require fertilisation to initiate embryo and seed development, but sex is not a ubiquitous reproductive strategy. Some angiosperms have evolved an alternate form of reproduction termed apomixis, which results in the production of embryos without paternal contribution. Here we consider the early events of apomixis and sex and discuss key relationships between the two processes.

Review: Functional evolution of photochemical
energy transformations in oxygen-producing
organisms
John A. Raven

505–515

Why is chlorophyll *a* the photochemical agent in both photosystems of almost all oxygenic organisms? The paper examines, as have others, the properties of chlorophyll *a* in relation to photosynthetic energetics and solar radiation, and some embellishments are added. Chlorophyll *d*-driven photosynthetic photochemistry, and energy-transducing rhodopsins, in oxygenic organisms are also considered.

Heat acclimation induced acquired heat tolerance
and cross adaptation in different grape cultivars:
relationships to photosynthetic energy partitioning
**Li-Jun Wang, Wayne Loescher, Wei Duan,
Wei-Dong Li, Shu-Hua Yang and Shao-Hua Li**

516–526

According to the new parameters of chlorophyll fluorescence: $Y(II) + Y(NPQ) + Y(NO) = 1$, a mechanism on acquired heat tolerance and cross adaptation in grapevine is related to photosynthetic energy partitioning. Heat pretreated grapevines had less energy partitioned in non-regulated energy dissipation under heat or cold stress.

Model-based analysis of sugar accumulation
in response to source–sink ratio and water supply
in grape (*Vitis vinifera*) berries
**Zhan Wu Dai, Philippe Vivin, Thierry Robert,
Sylvie Milin, Shao Hua Li and Michel Génard**

527–540

The dynamics of sugar accumulation in ripening grape berries was satisfactorily simulated with a mechanistic model. This model enables us to evaluate the relative contribution of sugar import, sugar metabolism and berry water budget to sugar accumulation in response to source-sink modulation and water supply. Overall, this work further develops our understanding of the possible effects of management practices on the sugar accumulation process.

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Hydraulic connection of grape berries to the vine: varietal differences in water conductance into and out of berries, and potential for backflow

Joanne Tilbrook and Stephen D. Tyerman

541–550

How some varieties of grape berries maintain water content while others lose water has been investigated by hydraulic conductance measurements for flow into and out of berries. There is sufficient conductance in Shiraz berries for water flow back to the vine and this is indicated by tracer-dye movement. Differences between varieties may be related to changes in conductance timed with the onset or otherwise of cell death in the mesocarp.

Contrasting response mechanisms to root-zone salinity in three co-occurring Mediterranean woody evergreens: a physiological and biochemical study

Massimiliano Tattini, Maria Laura Traversi, Silvana Castelli, Stefano Biricolti, Lucia Guidi and Rossano Massai

551–563

The species examined differed considerably in the use of Na⁺ and Cl[−] for salt-induced osmotic adjustment. As a consequence, species-specific declines in net photosynthesis determined the extent of biochemical adjustments, mostly aimed at countering oxidative damage. We suggest that the ability to preserve actively-growing shoot organs from severe oxidative stress has to be considered together with growth performance to assess the salt tolerance of evergreen species.

Reduction of root flavonoid level and its potential involvement in lateral root emergence in *Arabidopsis thaliana* grown under low phosphate supply

Huixia Yang, Hong Liu, Gang Li, Juanjuan Feng, Huanju Qin, Xin Liu, Hongwei Xue and Daowen Wang

564–573

This work shows that low phosphate treatment causes significant reduction of root flavonoid level in *Arabidopsis thaliana*, and the involvement of phospholipase D ζ 2 in this process. The reduction may facilitate shoot to root auxin transport and enhanced lateral root development, thereby contributing to plant adaptation to phosphate deficiency conditions.