

# Functional Plant Biology

## Contents

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| <p><i>Review: Sap-flux density measurement methods: working principles and applicability</i><br/> <b>Maurits W. Vandegehuchte and Kathy Steppe</b> 213–223</p>   | <p>Sap-flow measurements have become increasingly important in plant science since the early experiments based on the application of dyes. Given the recent developments in heat based sap-flux density methods, this review aims at synthesising the existing but scattered literature. By unveiling the measurement principles and addressing some common pitfalls, users are enabled to make a well founded choice, whether for practical applications or fundamental research questions and further improvement in sap-flow methodology is encouraged.</p>           |
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| <p>Dissecting the mechanism of abscisic acid-induced dynamic microtubule reorientation using live cell imaging<br/> <b>David Seung, Michael W. Webster, Richard Wang, Zornitza Andreeva and Jan Marc</b> 224–236</p> | <p>Abscisic acid (ABA) is a plant hormone involved in signalling developmental and environmental cues to cells and can trigger the reorientation of the microtubule cytoskeleton. Our aim was to dissect the physical mechanism behind this process. We found that changes in microtubule growth rate and stability accompany the progressive rearrangement of the microtubules. These changes may reflect the underlying mechanism on how ABA influences plant growth and development at the cellular level.</p>  |
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| <p>Nitrogen tolerance in the lichen <i>Xanthoria parietina</i>: the sensitive side of a resistant species<br/> <b>Silvana Munzi, Cristina Branquinho, Cristina Cruz and Stefano Loppi</b> 237–243</p>                | <p>Lichens are one of the most sensitive components of the ecosystem to nitrogen pollution. We found that nitrogen tolerance is not only a species-specific feature, but can also result from adaptation to long-term nitrogen exposure. These results are important in understanding the effects of chronic pollution, linking physiological response and ecological consequences.</p>  |
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| <p>Seed reserve dependency of <i>Leucaena leucocephala</i> seedling growth for nitrogen and phosphorus<br/> <b>Martijn Slot, Danielle T. Palow and Kaoru Kitajima</b> 244–250</p>                                    | <p>After seed mineral reserves expire, <i>Leucaena leucocephala</i> seedlings form associations with N-fixing bacteria and with mycorrhizal fungi that aid in phosphorus uptake. We determined experimentally that seed nitrogen is depleted several weeks before P, so seedlings need to invest in N-fixing bacteria first, a process that requires P that seed reserves can still supply. These results are relevant for understanding nutrient-acquisition strategies during establishment of <i>L. leucocephala</i>, which is invasive outside its native range.</p> |
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*Cover illustration:* Immunofluorescent labelling of microtubules in the root tip of an *Arabidopsis thaliana* seedling, as visualised by confocal microscopy (see Seung *et al.* pp. 224–236). Alongside interphase cortical microtubule arrays visible in most cells, pre-prophase bands and mitotic spindles can be seen in some dividing cells. Photograph by David Seung and Jan Marc.

Heteroblasty in bromeliads – anatomical, morphological and physiological changes in ontogeny are not related to the change from atmospheric to tank form  
**Kerstin Meisner, Uwe Winkler and Gerhard Zotz** 251–262

Heteroblasty – an abrupt change in gross morphology during ontogeny – is common in many Bromeliaceae. In this study we set out to understand its functional importance. We show that size-related variation in anatomical and physiological parameters is common, but unrelated to the conspicuous step change in gross morphology. These findings suggest that previous notions of the functional relevance of heteroblasty in bromeliads should be reconsidered.

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Simulation of inflorescence dynamics in oil palm and estimation of environment-sensitive phenological phases: a model based analysis  
**Jean-Claude Combres, Benoît Pallas, Lauriane Rouan, Isabelle Mialet-Serra, Jean-Pierre Caliman, Serge Braconnier, Jean-Christophe Soulié and Michael Dingkuhn** 263–279

Inflorescence abortion and sex determination are the main processes affecting yield in oil palm; these are determined by environmental stresses and source–sink imbalance occurring during specific phases of inflorescence development. Model-based analyses and parameter optimisation procedures were used to estimate the timing of the specific environment-sensitive phases. This study demonstrates that simple modelling approaches can help extracting ecophysiological information from simple field observations on complex systems.

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Plant growth co-ordination *in natura*: a unique temperature-controlled law among vegetative and reproductive organs in mango  
**Anaëlle Dambreville, Frédéric Normand and Pierre-Éric Lauri** 280–291

Temperature is a major driver of plant growth and its effects are usually studied on the leaves of annual plants. This study describes the effect of temperature on the growth of three organs of mango trees: the vegetative axis, the leaf and the inflorescence axis. Results showed that a common temperature-controlled allometric constraint is probably underlying the growth of all these organs.

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Transcriptome identification of the resistance-associated genes (RAGs) to *Aspergillus flavus* infection in pre-harvested peanut (*Arachis hypogaea*)  
**Tong Wang, Xiao-Ping Chen, Hai-Fen Li, Hai-Yan Liu, Yan-Bin Hong, Qing-Li Yang, Xiao-Yuan Chi, Zhen Yang, Shan-Lin Yu, Ling Li and Xuan-Qiang Liang** 292–303

Aflatoxin contamination caused by *Aspergillus flavus* severely impairs peanut productivity and affects human and animal health. Transcriptome analysis using a microarray identifies candidate genes and pathways underlying the resistance mechanism in peanut was conducted, leading to an enhanced understanding of pre-harvest peanut–*A. flavus* interaction. This study will facilitate to develop peanut cultivars with resistance to pre-harvested aflatoxin contamination in future breeding programs.

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AtMYB44 positively modulates disease resistance to *Pseudomonas syringae* through the salicylic acid signalling pathway in *Arabidopsis*  
**Baohong Zou, Zhenhua Jia, Shuangmei Tian, Xiaomeng Wang, Zhenhua Gou, Beibei Lü and Hansong Dong** 304–313

Transcriptional regulation of gene expression that is largely mediated by transcription factors plays a key role in the plant immunity responses. In this study, we found one MYB transcription factor *AtMYB44* involved in plant defense response against a biotrophic pathogen. We demonstrate the regulation roles of *AtMYB44* in plant defense are mainly through the salicylic acid signalling pathway.

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