

Functional Plant Biology

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Editorial

Review: Expanding roles of plant aquaporins in plasma membranes and cell organelles

Maki Katsuhara, Yuko T. Hanba, Katsuhiro Shiratake and Masayoshi Maeshima 1–14

This review on aquaporin function in plants follows Kaldenhoff's and Chaumont's recent efforts on the topic, and is fascinating reading for both the expert and the non-aquaporin researcher. The authors differ from the rigid classification underlined in Kaldenhoff's review, where functions of the four plant aquaporin family subclasses are distinctly treated, according to specialist's expectations; similarly, the philosophy of Chaumont's set-up is reversed here: expression is seen not as a key to understand function, but efforts are pointed on discovering function to set a (even putative) role in plant, this determining in turn aquaporin expression.

Overexpression of the vacuolar metal/proton exchanger AtMHX in tomato causes decreased cell expansion and modifications in the mineral content

Irina Berezin, Emil Brook, Keren Mizrahi, Talya Mizrachy-Dagry, Meirav Elazar, Suping Zhou and Orit Shaul 15–25

It is currently unknown whether the main role of the vacuolar metal/proton exchanger AtMHX is related to metal or proton homeostasis. These authors expressed AtMHX in tomato and observed transgenic plants that were significantly smaller than wild-type plants and showed decreased cell expansion. The plants had altered mineral content, including a reduction in the content of K, the main vacuolar solute. They propose that overexpression of AtMHX decreases the vacuolar proton motive force necessary to drive K influx into the vacuole and cell expansion.

Protection mechanisms in the resurrection plant *Xerophyta viscosa*: cloning, expression, characterisation and role of *XvINO1*, a gene coding for a *myo*-inositol 1-phosphate synthase

Arnaud Lehner, Denis R. Chopera, Shaun W. Peters, Felix Keller, Sagadevan G. Mundree, Jennifer A. Thomson and Jill M. Farrant 26–39

These authors report on the isolation and functional characterisation of a cDNA (*XvINO*) encoding the enzyme *myo*-inositol-1-phosphate synthase from leaves of the resurrection plant *Xerophyta humilis*. This enzyme catalyses the first step in the synthesis of a polyol involved in many aspects of plant metabolism. They show that both the transcript and protein are constitutively expressed, but are upregulated in response to salt and desiccation stress; they propose that this gene is differentially regulated in response to abiotic stresses and that the sugars perform different functions in salt v. desiccation stress.

A potential nuclear envelope-targeting domain and an arginine-rich RNA binding element identified in the putative movement protein of the GAV strain of *Barley yellow dwarf virus*

Zongliang Xia, Yan Wang, Zhiqiang Du, Junmin Li, Richard Y. Zhao and Daowen Wang 40–50

These authors investigated structural elements in the movement protein encoded by barley yellow dwarf virus, providing deep insight into its function. They show that the movement protein is targeted to the nucleus and accumulates at the nuclear envelope (NE) in plant cells. They identify a novel NE-targeting domain that is functional in the context of plant cells and independent of the rest of the protein.

Cover illustration: Plants have a large number of aquaporin isoforms. They are divided into four groups; PIP, TIP, NIP, and SIP. Top, intracellular localisation of plant aquaporins. Bottom, a schematic model of aquaporin (see Katsuhara *et al.* pp. 1–14).

Short-term ^{15}N uptake kinetics and nitrogen nutrition of bryophytes in a lowland rainforest, Costa Rica

Wolfgang Wanek and Katja Pörtl

51–62

The paper presents the first detailed study of uptake kinetics of nitrate, ammonium and amino acids in several Costa Rican bryophytes using N-15 tracer and Michaelis-Menten analysis of uptake data. The authors discuss the implications for N nutrition *in situ* under natural N availabilities in a tropical lowland rainforest.

Annual variation of the steady-state chlorophyll fluorescence emission of evergreen plants in temperate zone

Julie Soukupová, Ladislav Cséfalvay, Otmar Urban, Martina Kořvancová, Michal Marek, Uwe Rascher and Ladislav Nedbal

63–76

The manuscript describes a long-term study on the seasonal changes in chlorophyll fluorescence for three evergreen species. The authors assess the information potential of steady-state chlorophyll fluorescence yield (Chl-F_s) as one of the factors determining the passively-sensed chlorophyll fluorescence emission by remote sensing techniques. They show that Chl-F_s yield paralleled the CO_2 assimilation rate during the year, with a steep increase in the spring and rapid decrease in the autumn combined with an elevated Chl-F_s signal variability. They propose that the elevated variability of the Chl-F_s indicates seasonal onset and offset periods of photosynthetic activity in evergreen plant species.

Optically-assessed preformed flavonoids and susceptibility of grapevine to *Plasmopara viticola* under different light regimes

Giovanni Agati, Zoran G. Cerovic, Anna Dalla Marta, Valentina Di Stefano, Patrizia Pinelli, Maria Laura Traversi and Simone Orlandini

77–84

A non-destructive tool for rapidly predicting grapevine susceptibility to *Plasmopara viticola*, the pathogen responsible for downy mildew, is urgently required. These authors use a new spectroscopic tool, the chlorophyll fluorescence-based portable leaf-clip Dualex, for the non-invasive determination of flavonoids in grapevine leaves under two different light regimes, and the evaluation of the relationship between the constitutive flavonoids and the resistance of grapevine to the infection by downy mildew. The results indicate an inverse relationship between preformed flavonoids and the susceptibility of grapevines to infection.

Dehydrins in *Lupinus albus*: pattern of protein accumulation in response to drought

Carla Pinheiro, Maria H. Cruz de Carvalho, Dorothea Bartels, Cândido Pinto Ricardo and M. Manuela Chaves

85–91

This work characterises the expression of dehydrins in different tissues of lupin in response to drought. The analysis reveals the presence of a 29-kDa polypeptide, the SK3 dehydrin LaDhn1, in roots, regardless of the water state, whereas in stem it depended on the water state. The authors suggest that this protein might be phosphorylated and present ideas on why dehydrins are always present in some tissues and inducible by stress in others.

A mutant ankyrin protein kinase from *Medicago sativa* affects *Arabidopsis* adventitious roots

Delphine Chinchilla, Florian Frugier, Marcela Raices, Francisco Merchan, Veronica Giammaria, Pablo Gargantini, Silvina Gonzalez-Rizzo, Martin Crespi and Rita Ulloa

92–101

Previous data suggest the involvement of the microtubule cytoskeleton in adventitious root organogenesis. These authors have functionally characterised the *Medicago sativa* *MsAPK1* gene (*Ankyrin Protein Kinase 1*) that is structurally related to the Integrin-Linked Kinases (ILKs) from animals. *MsAPK1* is able to phosphorylate tubulin. *Arabidopsis* plants expressing a mutant *MsAPK1* protein (DN-lines) showed increased capacity to develop adventitious roots. The *A. thaliana* *AtAPK2* gene is expressed in roots apices and hypocotyls. These results suggest that APKs may control the formation of adventitious roots.