The plant vacuole as a biological model system to study the functional properties of intracellular channels and transporters.

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Plant cells have something that animal cells have not: a large intracellular compartment, the vacuole, which has been investigated for long time. The central vacuole can occupy up to 90% of the cell volume and is easy to isolate, differently from intracellular organelles from animal cells as lysosomes or endosomes. Because of its large dimension (up to 40 μm diameter) it can be successfully studied using the classical patch-clamp technique. We had the idea that the vacuolar membrane could be used as a convenient model to characterize the functional properties of animal intracellular transporters and channels [1]. We focused on the three main families of transporters and channels, namely CLCs, TPCs and TRPs, which have members localised in endo-lysosomes. They are emerging to be very important in cellular physiology, as underlined by they involvement in severe diseases. CLC7, a proton/chloride antiporter is involved in osteopetrosis; TPC2, a sodium channel, plays a role in neoangiogenesis processes linked to vascularization of solid tumors, in neurodegenerative Parkinson disease and in Ebola virus infections; TRPML1, a lysosomal cation channel, is responsible of mucolipidosis. We could successfully express all these proteins in Arabidopsis vacuoles lacking the endogenous counterpart and perform a biophysical study [2–4]. We could find interesting unknown modulations, which can help to shed lights on their physiological role in organellar homeostasis and signalling.

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