CS^+ AS A PLANT ION CHANNEL BLOCKER: IS IT THAT SIMPLE?

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Giant internodal cells of macroalgae *Characeae* have a long history of being used as a model system for electrophysiological investigations such as ion channel research [1]. Characeaen intermodal cells can survive after being cut out of the thallus and function as single organisms. Their large size (up to 25 cm in length, ~1 mm in diameter) enables easy access via microelectrode techniques. Recent publication of another Characeaen *Chara braunii* genome [2] encourages functional research (for example electrophysiological investigation of ion channels) that in the future could be combined with the structural data.

Plant action potentials are transient excitations of plasmalemma and tonoplast (vacuolar membrane) that transduce information about various external stimuli, including salt stress, mechanical excitation and temperature change. Action potentials are generated when cell membrane potential depolarizes (becomes less negative) to a threshold value and activates voltage-dependent Ca^{2+} ion channels. Activated ion channels produce an inflow of Ca^{2+} ions into the cytoplasm where they activate Ca^{2+}-dependent Cl^- ion channels. Influx of Ca^{2+} ions and efflux of Cl^- ions produce a rapid membrane depolarization. Plasmalemma is repolarized to its resting potential (in *Nitellopsis* <-200 mV) by the activation of H^+-ATPase as well as depolarization-activated K^+ ion channels' produced efflux of K^+ ions.

Cs^+ ions are frequently used as K^+ ion channel blockers [3] and our data using patch clamp technique confirm that. Cs^+ effects on actions potentials of *Nitellopsis obtusa* cells using current clamp technique (Fig. 1) and effects of membrane currents during excitation using voltage clamp technique were evaluated. However, the effects of Cs^+ cannot always be explained as only being caused by K^+ ion channel blockage.

Our future aims include investigating the effects of other Cs^+ salts (such as $CsSO_4$) and HCl in order to isolate the effect on actions potentials and membrane currents during excitation of Cs^+ ions with anion component eliminated.

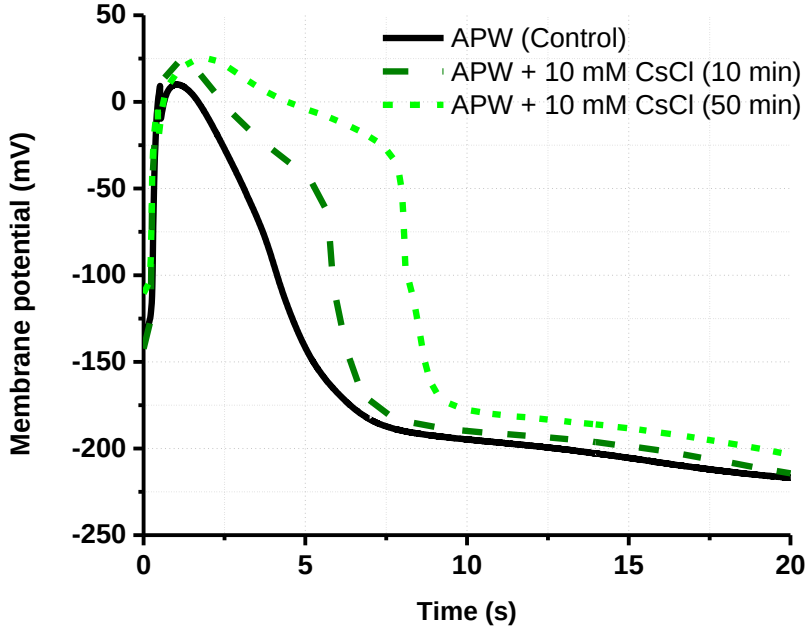

Fig. 1. Recordings of repolarization phases of 3 action potentials of *Nitellopsis obtusa*, showing effects of 10 min and 50 min exposure of 10 mM CsCl. Longer exposure time increases duration of action potential.

[1] M. J. Beilby, M. T. Casanova. *The physiology of characean cells* (Springer Science & Business Media, 2014).
[2] T. Nishiyama, H. Sakayama, J. de Vries, H. Buschmann, D. Saint-Marcoux, K.K. Ullrich, F.B. Haas, L. Vanderstraeten, D. Becker, D. Lang, S. Vosolsobě. The Chara genome: secondary complexity and implications for plant terrestrialization. Cell, **174**(2), 448-464 (2018).
[3] L.P. Zanello, F.J. Barrantes. Blockade of the K^+ channel of Chara contraria by Cs^+ and tetraethylammonium resembles that of K^+ channels in animal cells. Plant Science, **86**(1) (1992).