# ELECTROPHYSIOLOGICAL TECHNIQUES REVEAL $Cs^+$ EFFECT ON ELECTRICAL SIGNALING IN MACROALGAE *NITELLOPSIS OBTUSA*

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*Nitellopsis obtusa* is a macroalgae found in fresh and brackish waterbodies. Its giant internodal cells (up to 30 cm in length) have been used in plant electrophysiology for decades, enabling thorough biophysical research of plant bioelectrical phenomena from investigations of single ion channel activity to cell-to-cell communication [1].

*Nitellopsis* cells, often called "green axons", are excitable [2]. Exposure to external stimuli of various modality (electrical, mechanical, termo- stimulation, salt stress) may evoke generation of action potentials, remarkably similar to those observed in animal cells. In plants, an over-threshold stimulus abruptly depolarizes cell plasmalemma by activating voltage-dependent $Ca^{2+}$ and $Ca^{2+}$-dependent $Cl^-$ ion channels, thus allowing $Ca^{2+}$ ion influx and subsequent $Cl^-$ ion efflux. Membrane repolarization is achieved by activation of voltage-dependent $K^+$ ion channels ($K^+$ efflux) as well as $H^+$-ATPase activity ($H^+$ efflux).

Our research aimed to investigate effect of $Cs^+$ ions (known to block $K^+$ channels [3]) on electrical signaling properties of *Nitellopsis obtusa*. Special attention was paid to repolarization phase of action potentials, since it is mainly governed by the activity of $K^+$ ion channels. *Nitellopsis* action potentials in single cell were registered using conventional sharp microelectrodes via current clamp technique. Voltage clamp technique enabled evaluation of dynamics of cell excitation current transients. Patch clamp technique was used to investigate activity of tonoplast (vacuolar membrane) $K^+$ ion channels.

It was confirmed that tonoplast $K^+$ ion channels are blocked by $Cs^+$ ions. $Cs^+$ ions substantially decrease velocity of repolarization of *Nitellopsis* action potentials and determine a characteristic shape. Unexpectedly, $Cs^+$ ions also increase amplitude of excitation current transient (Fig. 1). The results indicate that $Cs^+$ effect on electrical signaling patterns of *Nitellopsis obtusa* is complex and may involve altering activity of ion channels other than $K^+$ channels.

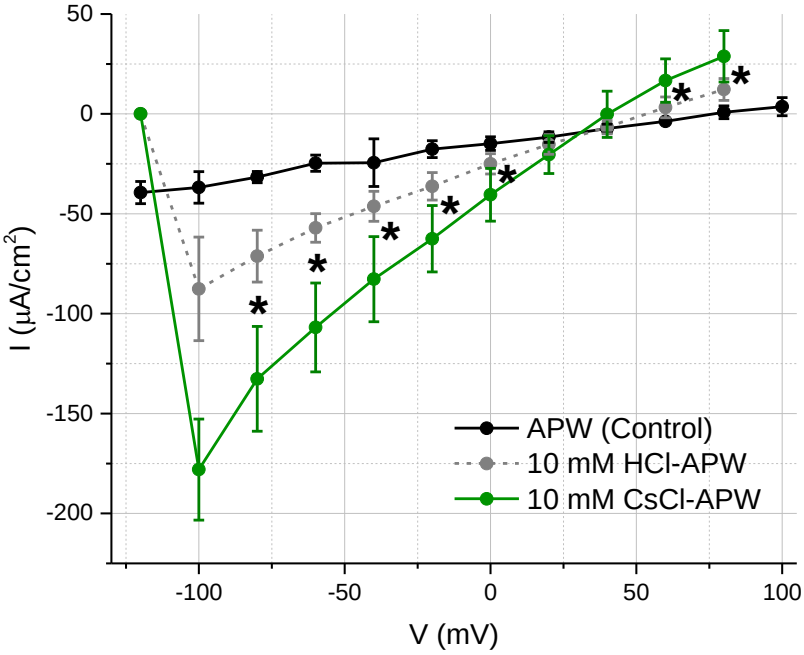


Fig. 1. I/V characteristics of excitation current transients of *Nitellopsis obtusa*. APW and 10 mM HCl-APW solutions were used as double control; 10 mM CsCl-APW solution significantly (asterisks indicate $p<0,05$) increased amplitudes of current transients during excitation.

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[3] G. Yellen. Ionic permeation and blockade in $Ca^{2+}$-activated $K^+$ channels of bovine chromaffin cells. The Journal of general physiology **84**(2): 157-186 (1984).