**Characterization of Ca\textsubscript{v}2.2 (HEK293) on Nanion’s Port-a-Patch**

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**Summary**

The voltage gated N-type calcium channel (Ca\textsubscript{v}2.2) is encoded by the gene CACNA1B. Ca\textsubscript{v}2.2 is a high voltage activated calcium channel. Ca\textsubscript{v}2.2 is found mainly in the brain, where it mediates neurotransmitter release at the synapse. The strong depolarization of neuronal action potentials causes the opening of the channel. Calcium can then enter the cell and initiates the fusion of the neurotransmitter vesicles with the membrane.

Ca\textsubscript{v}2.2 is inhibited by ω-conotoxin, a neurotoxin of the fish hunting snail, with high specificity. CaV2.2 has been implicated in the transmission of pain. Pharmacological block of Ca\textsubscript{v}2.2 by compounds based on ω-conotoxin has been shown to be effective against strong chronic pain.

The biophysical and pharmacological properties of the cells are presented in this Application Note.

**Results**

Figure 1 shows current responses of an individual cell to a current-voltage relationship step protocol. Potentials were stepped from the holding potential (-80 mV) for 50 ms to the test potential before stepping back to holding. Test potentials were varied between -20 mV and 90 mV in 10 mV increments.

![Figure 1](image1.png)

Figure 1: Representative current responses of an individual cell expressing Ca\textsubscript{v}2.2 to a Ca\textsubscript{v} IV voltage protocol (for details see text).

![Figure 2](image2.png)

Figure 2: Average current-voltage relationship (n = 10). The error bars reflect the standard error of the mean (S.E.M.).
Figure 2 shows the average current-voltage relationship for ten cells. The average mean current at 30 mV of all recorded cells was -744 ± 140 pA (n = 10). The inhibition of Ca_{V_{2.2}} by cadmium was studied using the External Persusion System. Figure 3 shows the current of an individual cell at increasing concentrations of cadmium (as indicated). The average dose-response curve is shown in Figure 4. From this the IC\textsubscript{50} was calculated to be 2.7 ± 0.4 µM (n = 5). The inhibition by cadmium was fully reversible, as can be seen in Figure 5. For the cell shown, cadmium was washed out and applied at its highest concentration another three times after collection of a full dose-response curve. Control current levels were recovered each time cadmium was washed out.

**Methods**

**Cell Culture**

PrecisIOn hCav2.2 (a1B/b3/α2δ1)-HEK293 recombinant cell line (CYL3054) was kindly supplied by EMD Millipore, USA. Cells were cultured and harvested according to Nanion’s standard cell culture protocol.

**Solutions**

Standard patch clamp solutions were modified for the Ca\textsuperscript{2+} channel recordings. The external solution contained 20 mM Ba\textsuperscript{2+} as the charge carrier. The predominant ion in the internal solution was Cs\textsuperscript{+}. It also contained Mg-ATP, GTP, and BAPTA to minimize current run down.

**Electrophysiology**

Whole cell patch clamp recordings were conducted according to Nanion’s standard procedure for the Port-a-Patch. Currents were elicited using a voltage step from a holding potential of -80 mV for 50 ms to different test potentials and back to holding. Pulses were elicited every 10 seconds.