

Conotoxins as tools to understand the physiological function of voltage-gated calcium (CaV) channels

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Voltage-gated calcium (CaV) channels are widely expressed and are essential for the completion of multiple physiological processes. Close regulation of their activity by specific inhibitors and agonists become fundamental to understand their role in cellular homeostasis as well as in human tissues and organs. CaV channels are divided into two groups depending on the membrane potential required to activate them: High-voltage activated (HVA, CaV1.1-1.4; CaV2.1-2.3) and Low-voltage activated (LVA, CaV3.1-3.3). HVA channels are highly expressed in brain (neurons), heart, and adrenal medulla (chromaffin cells), among others, and are also classified into subtypes which can be distinguished using pharmacological approaches. Cone snails are marine gastropods that capture their prey by injecting venom, *conopeptides*, which cause paralysis in a few seconds. A subset of conopeptides called conotoxins are relatively small polypeptides, rich in disulfide bonds, that target ion channels, transporters and receptors localized at the neuromuscular system of the animal target. In this review, we describe the structure and properties of conotoxins that selectively block HVA calcium channels. We compare their potency on several HVA channel subtypes, emphasizing neuronal calcium channels. Lastly, we analyze recent advances in the therapeutic use of conotoxins for medical treatments. © 2017 by the authors.

Conotoxins

Therapeutic potential

Voltage-gated calcium (CaV) channels

α-conotoxin structure

alpha conotoxin

chi conotoxin

conotoxin

delta conotoxin

epsilon conotoxin

gamma conotoxin

iota conotoxin

kappa conotoxin

mu conotoxin

omega conotoxin

omega conotoxin CVID

omega conotoxin MVIIA

rho conotoxin

sigma conotoxin

tau conotoxin

unclassified drug

voltage gated calcium channel

calcium channel

calcium channel blocking agent

conotoxin

adrenal medulla

brain nerve cell

chromaffin cell

chronic pain

disulfide bond

drug activity

drug potency

drug structure

heart

homeostasis

human

membrane potential

nonhuman

pharmacological blocking

protein expression

protein function

Review

snail

animal

chemistry

drug effect

metabolism

Animals

Calcium Channel Blockers

Calcium Channels

Conotoxins

Humans

Membrane Potentials

Snails