

= Calitoxin =

Calitoxin , also known as CLX , is a sea anemone neurotoxin produced by the sea anemone *Calliactis parasitica* . It targets crabs and octopuses , among other invertebrates . Two isoforms (CLX @-@ 1 and CLX @-@ 2) have been identified , both of which are formed from precursors stored in the stinging cells of the anemone . Once the toxin is activated and released , it causes paralysis by increasing neurotransmitter release at invertebrate neuromuscular junctions . Along with several other toxins derived from anemones , CLX is useful in ion channel research . Certain structural aspects of calitoxin are dissimilar from sea anemone toxins that also target the sodium ion channels . Other toxins resembling calitoxin function in completely different ways .

= = Source and discovery = =

Calitoxin is a highly potent neurotoxin produced by the sea anemone *Calliactis parasitica* , which is stored in the nematocysts of stinging cells (cnidocytes) . This sea anemone is a species from the Hormathiidae family and is present along the European coasts of the Atlantic Ocean and in the Mediterranean Sea . The name calitoxin is derived from the organism from which the toxin was isolated . The toxin was isolated by a team of researchers in Naples , Italy from animals collected in the Bay of Naples . The team isolated the polypeptide through a series of centrifugations until the supernatant had lost toxic activity . The resulting pellet was purified using the techniques liquid chromatography , gel filtration , and chromatofocusing . The team then sequenced the purified polypeptide chain . They also published details on the toxin 's effects in vitro on crustacean tissue preparations , including nerve and muscle . Their findings were published in the journal *Biochemistry* in 1989 .

= = Structure and chemistry = =

The formula for calitoxin is C₂₀₃H₃₀₅N₅₅O₇₂S₇ . It has a molecular mass of 4886 Daltons and an isoelectric point at pH 5 @. @ 4 . The amino acid sequence is markedly dissimilar from other known sea anemones toxins . There are two known genes coding for two highly homologous calitoxins ? CLX @-@ 1 and CLX @-@ 2 . Both originate from a precursor peptide of 79 amino acids where the C @-@ terminus determines whether it will be the mature CLX @-@ 1 or CLX @-@ 2 . The activated toxins consist of 46 amino acids with three disulfide bonds . Researchers suspect that the toxins are stored as precursors in cnidocytes . Under the effects of some triggering stimulus , the precursor is modified and released in the active form . The patterning of cleavage sites targeted during maturation of the peptide suggest that the active quaternary structure might be a tetrapeptide .

Calitoxin and other sea anemone toxins are used in studying ion channels , with potential applications in biomedical and physiology research . In the mature CLX , one base @-@ pair substitution is responsible for a single glutamic acid to lysine replacement in the coding region of CLX @-@ 2 , leading to the difference between the two isoforms . The structural organization of these two genes show a high degree of homology . This suggests that the two different peptides have the same biological function . This cannot yet be confirmed because only CLX @-@ 1 has been isolated from *C. parasitica* . Calitoxin has a very different sequence from another sodium channel binding sea anemone toxin , ATX II , which is produced by the distantly related *Anemonia sulcata* . A better understanding of these differences might offer insights about the function of particular amino acid residues . Despite markedly dissimilar gene sequences , CLX @-@ 1 affects crustacean axon potentials similar to two other classes of anemone toxins . Alternatively , certain aspects of the structure of the CLX genes are found in scorpion toxins as well as other sea anemone toxins that block potassium channels .

= = Target and activity = =

Calitoxin causes massive neurotransmitter release from the nerve terminals of the neuromuscular junction , which in turn causes a strong muscle contraction and even paralysis . The exact target of calitoxin has not yet been clarified ; since it has a similar action on the neuromuscular junction as *Anemonia sulcata* toxins , calitoxin may slow down the inactivation of voltage @-@ gated sodium channels in motor neurons . Calitoxin has been tested for activity on the crab *Carcinus mediterraneus* . Purified toxin was injected into the hemocoel of the crab . The minimum dose of 0 @. @ 2 µg of toxin triggered muscle contractions in the crab , causing paralysis within 1 minute . The median lethal dose (LD50) is unknown .

= = Function in nature = =

Sea anemones produce toxins , such as calitoxin , in their stinging cells (cnidocytes) . These cells contain organelles called nematocysts . When triggered , an envenomation response occurs . This can result in injury to target organisms , including capture of prey , defense against predatory organisms , or against aggressors from within their own species . In its natural setting , *C. parasitica* can establish a mutualistic relationship with the hermit crab *Pagurus bernhardus* . The sea anemone identifies shells inhabited by the hermit crab and attaches . *C. parasitica* provides protection for the hermit crab , by stinging or intimidating potential predators . Octopuses will avoid shells bearing *C. parasitica* . In return for the protection , the sea anemone gains an advantage in accessing a broader distribution of food sources , as the crab moves across the ocean floor .