

Table 1: Neurotoxins of freshwater and marine cyanobacteria: target, discovery, proposed biosynthetic pathways and genes involved

Toxins	Target/action	Originally found in	Proposed biosynthetic pathways by	Genes involved proposed by
<b>Neurotoxic alkaloids in freshwater cyanobacteria</b>				
Saxitoxins	Nervous voltage-gated sodium channels	<i>Saxidomus giganteus</i> [107], and later freshwater cyanobacterium <i>Aphanizomenon flos-aquae</i> [108]	[109]	[43]
Anatoxin-a and homoanatoxin-a	Acetyl cholin receptor	<i>Anabaena flos-aquae</i> NRC-44h [53]	[103]	[104]
Anatoxin-a(s)	Acetylcholinestrase	<i>Anabaena flos-aquae</i> NRC-525-17 [110]	[111]	–
<b>Neurolipopeptides in marine cyanobacteria</b>				
Jamaicamides	Voltage-gated sodium channels	<i>Lyngbya majuscula</i> JHB [44]	[44]	[44]
Antillatoxin A & B	Voltage-gated sodium channels	<i>Lyngbya majuscula</i> [112]	–	–
Kalkitoxin	Voltage-gated sodium channels	<i>Lyngbya majuscula</i> [113]	–	–
Alotamide A	Unknown / affect calcium concentration in murine cerebrocortical neurons	<i>Lyngbya bouillonii</i> [114]	–	–
Hoiamide A	Partial agonist of the site 2 on the voltage-gated sodium channel	Consortium of marine cyanobacteria <i>Lyngbya majuscula</i> and <i>Phormidium gracile</i> [115]	–	–
Palmyramide A	Voltage gated sodium channels	<i>Lyngbya majuscula</i> [116]	–	–
<b>Cyanobacterial neurotoxic amino acid</b>				
L-beta-N-methylamino-L-alanine (L-BMAA)	Unknown / neurodegenerative illness	Seeds of <i>Cycas circinalis</i> [117] and recently in diverse cyanobacteria [118]	[119]	–