

Toxin + Organism Type	Major Producers	MOA	Symptoms
Microcystins	Variety of microcystis, anabaena, Planktothrix, Hapalosiphon and Synechococcus	Alteration of protein polymers known as intermediate filaments Inhibition of protein phosphatase 1 and 2a Excessive phosphorylation Hepatocytes "round-up" and dissociate -Sinusoidal damage -intrahepatic hemorrhage -hypovolemic shock	Hepatotoxic Hypovolemic shock Hepatic insufficiency Death due hv shock, hyperkalemia or hypoglycemia Watery, bloody, diarrhea *Hepatic enlargement, external evidence of bloom exposure Hepatic necrosis, rounding of hepatocytes, hemorrhagic enteritis
Alkaloid toxin Anatoxin-a Anatoxin-a(s)	Anabaena, Aphanizomenon, Planktothrix	a: Nicotinic agonist (depolarization) Death from respiratory paralysis as: Naturally occurring OP-AChE inhibitor Incapable of penetrating BBB S=salivation Death from respiratory failure	Rapidly fatal, muscle rigidity and tremors, paralysis, cyanosis
Saxitoxins (paralytic shellfish toxins) PSP *Both Cyanobacteria and Dinoflagellates	Anabaena spp. Aphanizomenon spp., Lyngbya spp., Cylandrospermopsis, Trichodesmium	Reversibly binds Na ⁺ channels of excitable membranes which disrupts signal transduction	Paralysis
Domoic Acid (DA)	Pseudonitzschia spp. Marine diatom Accumulates in filter feeding marine species (anchovies, sardines, mackerel etc.)	Structurally similar to glutamate (excitatory neurotransmitter) Activation of glutamate receptors, increasing intracellular Ca ²⁺ concentration Neuronal swelling, cell death Affected neurons mainly located in hippocampus	Amnesic shellfish poisoning humans Short-term memory loss Neurologic disease, stranding, seizure activity, disorientation, visual and locomotor deficits, scratching behavior, coma, death