DOMOIC ACID

Overview

Domoic Acid is a naturally occurring excitatory neurotoxic amino acid produced by microscopic algae, specifically the diatom species Pseudo-nitzschia, that causes Amnesic Shellfish Poisoning (ASP) (#Jenkins, 1992 and #Washington State DOH). Shellfish ingest the neurotoxic acid when they eat algae and it causes severe neurotoxic damage. The acid is most common when there are severe algal blooms which are triggered by high ocean temperatures and increased oxygenation of the water from pollution and agricultural run-off (#CIMWI, 2006). The acid bioaccumulatesand recently has been damaging larger mammals including sea lions, dolphins, and whales most notably off the California coast where the neurotoxic phytoplankton is naturally abundant (#Thomas-Anderson, 2003).

Toxicology

Domoic acid is a neurotoxin that affects neural pathways of mammals and inhibits neurochemical processes (#Thomas-Anderson, 2003). Jeff Jenkins of Oregon State on the mechanisms of domoic acid:
"*Glutamic acid is an abundant amino acid normally found in humans. It transmits impulses from one cell to another along the central nervous system and some of these impulses end up in the hippocampus of the brain, the site of learning and memory. If a chemical like domoic acid, which mimics glutamic acid, is transported to the hippocampus, the normal impulse balance is disturbed and an excitotoxic event will occur(4). The receptors in the hippocampus send continuous impulses and can "burn out," resulting in brain lesions and permanent memory loss(5). It is this disturbance that characterizes amnesic shellfish poisoning (ASP), named for the neurological symptoms it produces*" (#Jenkins, 19922).

Toxicity

Humans

Japanese studies showed no ill effects on humans in levels 0.5 mg/kg of body weight (#Nantel, 1996). Concentrations of 31 to 128 mg/100g muscle tissue were observed in the 1987 outbreak of domoic acid poisoning on Prince Edward Island, Canada when three people died of Amnesic Shellfish Poisoning (ASP) and 100 were sickened after eating contaminated shellfish (#Nantel,

1996 and #CIMWI, 2006).

ASP symptoms include vomiting, nausea, diarrhea and abdominal cramps within 24 hours of ingestion. In more severe cases, neurological symptoms develop within 48 hours and include headache, dizziness, confusion, disorientation, loss of short-term memory, motor weakness, seizures, profuse respiratory secretions, cardiac arrhythmias, coma and possibly death. Because short term memory loss is permanent, the name **Amnesic Shellfish Poisoning** was given to the problem (#CIMWI, 2006).

Mammals

California sea lions began dying in an Algal Bloom in the summer of 1998 and every summer since there have been widespread kill-offs due to poisoning. Domoic acid binds to a glutamate receptor which disrupts the flow of ions across cell membranes. The damaged receptor is unable to control the flow which eventually kills the nerve cell. The acid affects the hippocampus and amygdale glands that cause neurological distortions including seizures and other uncontrolled movement (#CIMWI, 2006). The inability to control movements force the mammals to beach themselves in an effort to stop from drowning. Pregnant sea lions are most likely to be affected by elevated domoic acid levels because they are forced to eat more algae which causes them to ingest more acid.

Symptoms of Poisoning

Humans

In humans symptoms of Amnesic Shellfish Poisoning (ASP) include:

- vomiting
- nausea
- diarrhea and abdominal cramps within 24 hours of ingestion
- headache
- dizziness
- confusion, disorientation
- loss of short-term memory
- motor weakness
- seizures
- profuse respiratory secretions
- cardiac arrhythmias
- coma and possibly death

Animals

- Head weaving
- seizures
- bulging eyes
- mucus from the mouth
- disorientation

Occurrences

ASP was first discovered in the aforementioned Prince Edward Island outbreak in 1987 and. is relatively rare.

Sea mammal deaths were first observed and noted as a problem in 1998 when numerous California sea lions were killed. It is now a yearly problem, with large amounts of sea lions dying every summer. In 2003, over 1000 animals were taken in due to domoic acid poisoning (#Thomas-Anderson, 2003). Since March 1 - June 6, 2007, over 70 sea lions were brought in at one Los Angeles area center alone with around 35% dying (#Morris, 2007). The problems are expected to get worse as ocean temperatures continue to rise which will result in more algal blooms and more domoic acid consumed.

Domoic acid was also the most likely cause for an incident in 1961 in the Capitola, California when crazed sea birds began seemingly attacking town residents, cars, and shop windows. It is now thought that they were poisoned with domoic acid which caused the erratic behavior (#Thomas-Anderson, 2003). This incident was the basis for the Alfred Hitchcock film *The Birds*.

Precaution

One should find out about what the levels of domoic acid are in the area where one's food comes from. Also, **domoic acid** does not become neutralized through cooking.

Source : http://www.toxipedia.org/display/toxipedia/Domoic+Acid