UCDAVIS
VETERINARY MEDICINE
California Animal Health and Food Safety Laboratory System

SPOTLIGHT ON...

BLUE-GREEN ALGAE (CYANOBACTERIA) TOXINS

LEADING DIAGNOSTICS NATIONALLY, PROTECTING CALIFORNIA LOCALLY

Lab Locations:

CAHFS – Davis

University of California
620 West Health Sciences Dr.
Davis, CA 95616
Phone: 530-752-8700
Fax: 530-752-6253
daviscahfs@ucdavis.edu

CAHFS – San Bernardino

105 W. Central Ave.
San Bernardino, CA 92408
Phone: 909-383-4287
Fax: 909-884-5980
sanbernardinocahfs@ucdavis.edu

CAHFS – Tulare

18830 Road 112
Tulare, CA 93274
Phone: 559-688-7543
Fax: 559-686-4231
tularecahfs@ucdavis.edu

CAHFS – Turlock

1550 Soderquist Road
Turlock, CA 95381
Phone: 209-634-5837
Fax: 209-667-4261
turlockcahfs@ucdavis.edu

Name:

There are many toxigenic (i.e., capable of producing toxins) blue-green algae species (also called cyanobacteria), but two of the most common genera of toxin-producing species are Microcystis and Anabaena.

Description:

Hazardous "blooms" of toxigenic blue-green algae (also called HAB or hazardous algal blooms) in bodies of water result when environmental conditions lead to the rapid proliferation of the algae. Conditions conducive to rapid growth include warmer temperatures, slow moving water, and high concentrations of nutrients such as nitrogen and phosphorus. HAB are often easily spotted and generally appear as thick foam or scum on water surfaces. They can be bright green, blue-green, white or brown in color depending on the species. Unfortunately, it is not possible to visually distinguish a toxic from non-toxic blooms, although any bloom should be considered hazardous to animals until proven otherwise by toxin testing.

Distribution:

HAB occur throughout the U.S. (and throughout the world) in streams, lakes, ponds, and reservoirs. They occur in both fresh water and brackish water ecosystems.

Toxins:

there are a variety of toxins that are produced by blue-green algae including microcystins, anatoxin-a, anatoxin-a(s), cylindrospermopsins, nodularin, and lyngbyatoxin-a. The most common

Blue-green algae sample

toxins associated with animal illnesses and deaths are the microcystins and anatoxin-a. There are many different microcystin analogs (e.g., microcystins LR, YR, RR and RA). The LD50s for the microcystins are low and range from 50 micrograms/kg to 11,000 micrograms/kg depending on the microcystin analog, species, and route of exposure. A reported oral LD50 for anatoxin-a in mice is > 5000 micrograms/kg. All

Continued

Continued

livestock species, horses, pets, and wildlife can be intoxicated by algal toxins.

Microcystins affect the liver by inhibiting protein phosphatases 1 and 2A. This inhibition results in disruption of the hepatocyte cytoskeleton and rapid cell death. Anatoxin-a is a potent nicotinic receptor agonist that causes overstimulation at neuromuscular junctions.

Signs of Poisoning:

Microcystins target the hepatobiliary system. Clinical signs include diarrhea, dark tarry stools, weakness, pale mucous membranes, icterus, and circulatory shock. Clinical pathologic and postmortem lesions are consistent with severe, acute liver injury.

Anatoxin-a targets the nervous system. Clinical signs include muscle tremors, muscle rigidity, paralysis, cyanosis, and sudden death. There are no characteristic clinical pathologic or postmortem lesions.

Death can occur within minutes following anatoxin-a exposure and within hours to a few days following microcystin exposure. There have been many anecdotal reports of pets going for a swim in an impacted body of water and dying within a few minutes of returning to shore. The prognosis for recovery is poor following exposure to either toxin.

In contrast to humans, animals readily swim in or ingest water with algal blooms.

Testing Available at CAHFS:

CAHFS provides testing for four common microcystins (LR, YR, RR, and LA) and anatoxin-a, along with other less commonly encountered toxins such as saxitoxin and cylindrospermopsin in cases involving possible animal exposures. Sampling of water sources can be a challenge depending on size of the body of water, wind, and bloom distribution. We recommend submitting at least one liter of chilled or frozen bloom material.

In cases of animal deaths, exposure can be confirmed by testing GI content samples (microcystins and anatoxin-a), serum (anatoxin-a only), and urine (anatoxin-a only). Requested sample sizes for GI contents, serum, and urine are 100 g, 5 mL, and 20 mL, respectively. It is recommended that a necropsy be conducted on any animal that dies.

In cases less directly involving animal exposures, other laboratories can test water samples for the presence of toxigenic algae and algal toxins. We often refer people to **GreenWater Laboratories** in Florida

Prevention is key: Keep animals out of affected water and obey all posted precaution signs. If an animal comes into contact with affected water, but does not drink the water, it is wise to bathe the animal to rinse off any bloom material that is on the skin or haircoat. If you suspect that ingestion has occurred, animals should be treated immediately (treatment relies on early GI decontamination and symptomatic and supportive care.

There is a wealth of quality information available on the internet regarding blue-green algae and risks to animals and people. The California Department of Public Health and the California Office of Environmental Health Hazard Assessment has prepared a **veterinary guidance document** and other information related to HAB.

Other sources of useful information include:

University of Kentucky, Department of Animal & Food Sciences - Harmful Algal Blooms

U.S. Enviromental Protection Agency

Centers for Disease Control & Prevention