Blue Green Algae Toxicoses
Who Am I?

Veterinary Toxicologist

College of Veterinary Medicine
Organisms

Exposure

Toxins

Cases

Questions
Organisms

Blue Green Algae

Cyanobacteria

Cyanophyta

Energy via Photosynthesis

Nitrogen Cycle
Organisms

Blue Green Algae

Today’s Focus

*Anabaena sp*

*Aphanizomenon sp*

*Microcystis sp*
Exposure

Surface Fresh Water

Food Supplement

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Blue Green Algae Workshop
March 2008

College of Vet Med
U of M
Exposure

Conditions of Bloom Formation

Wind
Temperature
pH
Nutrients
Exposure

Conditions of Bloom Formation

Wind = leeward side
Exposure

Conditions of Bloom Formation

Temperature

• 25°C
• (77°F)
Exposure

Conditions of Bloom Formation

pH

➤ 7.5 – 9.0
Exposure

Conditions of Bloom Formation

Nutrients
Nitrogen, Phosphorous
Zinc, Iron
Exposure

Conditions of Bloom Formation

Nutrients
Nitrogen > 1.0 mg/L
Phosphorous > 0.1 mg/L
Zinc
Iron

2.5 uM = growth
< 2.5 uM = toxin
Toxins

**Microcystins**

*Anabaena* sp

*Microcystis* sp

*Planktothrix* sp

*Nostoc* sp

*Anabaenopsis* sp
Toxins

Anatoxin

Anabaena sp

Aphanizomenon sp
Toxins

Saxitoxins

Anabaena sp

Aphanizomenon sp
Toxins

Cylindrospermopsins

*Aphanizomenon sp*
Toxins

Focus
Microcystin

*Microcystis aeruginosa*
Toxins

*Microcystis aeruginosa*

Not all strains produce microcystin
Production varies during season
Intra- vs extra-cellular location
Toxins

Microcystin

80 congeners

Microcystin-LR
Toxins

Microcystin

Toxicity

Biochemistry

Organ

Clinical Signs

Dose

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Toxins

Microcystin

Biochemistry

Inhibition of Ser/Thr protein phosphatases 1 & 2A
Toxins

Biochemistry
Inhibition of Ser/Thr protein phosphatases 1 & 2A

Inhibition of cytoskeleton structure
Apoptosis
Cell death
Toxins

Organ

Uptake
organic anion transporting polypeptides
Oatp1b2, 1B1, 1B3

Hepatic
Necrosis, endothelium, bile canaliculi

Renal
Toxins

Clinical Signs

Jaundice, shock, colic, weakness, vomiting, rapid pulse, death
Toxins

Dose

IP

IV

Oral
Toxins

Dose
IP
LD$_{50}$ =

122 ug/kg rats
65.4 ug/kg mice
Toxins

Dose

IV

Lethal dose

72 ug/kg – swine
100 ug/kg – rats
Toxins

Dose
Oral
LD 50 =

10.9 mg/kg – mice
5.7 mg/kg – trout
0.4 mg/kg – carp
Cases

Dog

Cat

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Cases

Dog

October 2
Morning hunt – vomit slew water
4 hours later – depressed, anorexia
3 hours later – seizure, colic
DVM - necropsy
Cases

Dog

Pathology
Massive hepatic necrosis
Renal tubule degeneration
Cases

Dog

Water

Microcystis aeruginosa

Microcystin LR, YR, RR
Cases

Cat

July 13

normal blood values

ALT = 20
Cases

Cat

July 15 - ALT = 5,924 IU
July 16 – ALT = 3,925 IU
July 17 – ALT = 2,071 IU
Cases

Cat

July 14 – 2 BG Algae Tablets
Cases

Cat

Capsule = 780 ng/g dw
Microcystin

LC/MS/MS
Cases

Anatoxin – a

Dogs (6)

Seizure & death
1 hour after swimming
in water
with anatoxin
Questions ?