

# **Blue Green Algae Toxicoses**

Mike Murphy  
DVM, Ph.D.

Blue Green Algae Workshop  
March 2008

College of Vet Med  
U of M

Who Am I ?

Veterinary Toxicologist

College of Veterinary  
Medicine

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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

# 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

# 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

# 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 ?

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