

## Seafood Toxins

PHR 250

## Seafood Toxins

- Dr. Robert Price has retired & died.
- Excerpts from the US FDA "Bad Bug Book"
- Order of presentation is according to my perception of relative risks in the US.

## Selected Illnesses

- Shellfish-associated toxins
- Scombroid poisoning
- Ciguatera poisoning
- Tetrodotoxin (pufferfish)

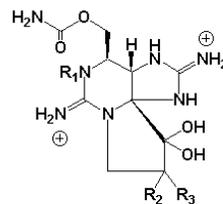
## Shellfish-associated toxins

- Paralytic Shellfish Poisoning (PSP)
- Diarrheic Shellfish Poisoning (DSP)
- Neurotoxic Shellfish Poisoning (NSP)
- Amnesic Shellfish Poisoning (ASP)

## Paralytic SP

- PSP, predominantly neurological (tingling, burning, numbness, drowsiness, incoherent speech, and respiratory paralysis)
- Onset in 0.5 – 2 hr, death from respiratory or circulatory failure

## Saxitoxin (PSP)



STX	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>
STX	H	H	H
GTX-II	H	H	OSO <sub>3</sub> <sup>-</sup>
GTX-III	H	OSO <sub>3</sub> <sup>-</sup>	H
NeoSTX	OH	H	H
GTX-I	OH	H	OSO <sub>3</sub> <sup>-</sup>
GTX-IV	OH	OSO <sub>3</sub> <sup>-</sup>	H

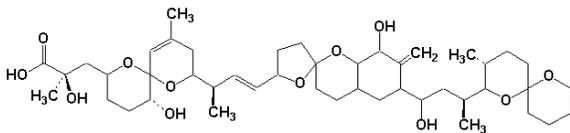
## Paralytic SP

- Mussels, clams, cockles, & scallops
- Detecting PSP toxins (saxitoxin, etc.): mouse bioassay or HPLC
- Beach “postings” (language)

## Diarrheic SP

- Mild GI disorder (nausea, vomiting, diarrhea, & abdominal pain with chills, headache, and fever)
- Onset 0.5 – 2 or 3 hr, lasts ≤3 days, complete recovery

## Okadaic acid (DSP)



(plus others)

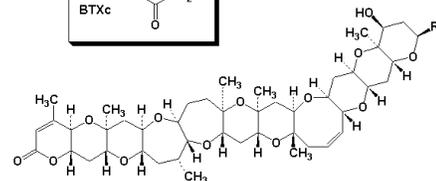
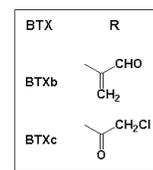
## Diarrheic SP

- Mussels, oysters, & scallops
- Detecting DSP toxin (okadaic acid): mouse bioassay unreliable; HPLC or ELISA used

## Neurotoxic SP

- GI & neurological symptoms: tingling & numbness of lips, tongue, & throat, muscular aches, dizziness, reversal of the sensations of hot & cold, diarrhea, & vomiting
- Onset mins–hrs, duration hrs–days, complete recovery

## Brevetoxin (NSP)



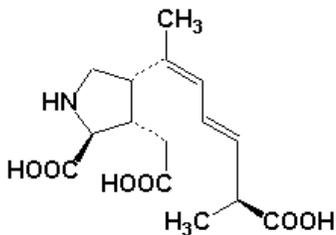
## Neurotoxic SP

- Shellfish harvested along Florida coast & Gulf of Mexico
- Detecting NSP toxin (brevetoxin): no method mentioned

## Amnesic SP

- GI disorders (vomiting, diarrhea, abdominal pain) & neurological problems (confusion, memory loss, disorientation, seizure, coma); serious (sometimes fatal) in elderly

## Domoic acid (ASP)



## Amnesic SP

- GI onset  $\leq 24$  hr, neurological onset  $\leq 48$  hr, long-term neurological effects
- Mussels
- Detection of ASP toxin (domoic acid) by HPLC

## Scombroid Poisoning

- Tingling or burning in mouth, rash on upper body, drop in blood pressure.
- Frequently, headache & itching skin

## Scombroid Poisoning

- Onset immediate – 0 min, duration ~3 hr (rarely, several days)
- May progress to nausea, vomiting, & diarrhea



## Ciguatera

- Ciguatera toxins difficult to extract & purify; mouse bioassay may be replaced by EIA
- Diagnosis only!

## Tetrodotoxin

- Slight numbness of lips & tongue at 20 min – 3 hr
- Increasing paraesthesia, face & extremities; sensations of lightness or floating

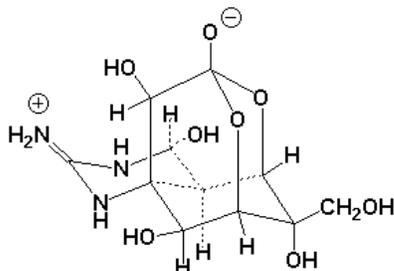
## Tetrodotoxin

- Possible headache, epigastric pain, nausea, diarrhea, vomiting (reeling or difficulty in walking)
- 2d stage: increasing paralysis, dysphonia, dyspnea, cyanosis, and hypotension

## Tetrodotoxin

- Increased paralysis, convulsions, mental impairment, cardiac arrhythmia
- Victim (completely paralyzed?) may be conscious & completely lucid until shortly before death (at 4–6 hr, range 20 min–8 hr)

## Tetrodotoxin



## Tetrodotoxin

- Pufferfish from Indo-Pacific ocean regions (~20 spp., toxin distributions differ — gonads, viscera, skin)
- Testing: mouse PSP bioassay; HPLC & GC/MS methods await validation

## 7 seafood poisonings

- Transient: DSP, NSP, (ASP), scombroid (ciguatera)
- Life-threatening: PSP, ASP (elderly), tetrodotoxin
- Prevention: PSP, monitoring; scombroid, product care; tetrodotoxin, knowledge + skill