Chapter Outline

Taxonomy

Epidemiology

Toxic coelenterates (invertebrates)

Echinoderms
Cnidarians
Mollusks

Toxic vertebrates

Chondrichthyes — stingrays
Scorpaenidae — scorpaenid bony fish
Trachinidae — weeverfish
Reptilia — sea snakes
### TABLE 17.1 Coelenterates (Invertebrates)

<table>
<thead>
<tr>
<th>Phyla</th>
<th>Species</th>
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<tr>
<td>Porifera</td>
<td>Sponges</td>
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<tr>
<td>Cnidaria</td>
<td>Corals, hydroids, anemones, jellyfish</td>
</tr>
<tr>
<td>Annelida</td>
<td>Worms</td>
</tr>
<tr>
<td>Mollusca</td>
<td>Snails, octopuses</td>
</tr>
<tr>
<td>Echinodermata</td>
<td>Starfish, sea urchins, sea cucumbers</td>
</tr>
</tbody>
</table>

### TABLE 17.2 Chordates (Vertebrates)

<table>
<thead>
<tr>
<th>Classes of the Vertebrate Chordates (Phylum Chordata)</th>
<th>Species</th>
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<tr>
<td>Chondrichthyes</td>
<td>Stingrays and sharks</td>
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<tr>
<td>Osteichthyes</td>
<td>Bony fishes</td>
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<tr>
<td>Scorpaenidae</td>
<td>Lionfish, stonefish, scorpionfish, zebrafish</td>
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<td>Trachinidae</td>
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<tr>
<td>Reptilia</td>
<td>Sea snakes and sea kraits</td>
</tr>
<tr>
<td>Hydrophiliidae</td>
<td>Sea snakes</td>
</tr>
</tbody>
</table>
Coelenterates, especially corals and jellyfish, cause most marine envenomings.

The Australian box jellyfish (Chironex fleckeri) is the most venomous and deadly (case fatality rate [CFR] 20+%%) of all toxic marine life.

The fire coral (Millepora spp.) is the most toxic Cnidarian; the blue-ringed octopus (Hapalochlaena maculosa) is the most toxic mollusk; and the crown-of-thorns (Acanthaster planci) starfish is the most toxic Echinoderm.

Stingrays cause 1800 painful envenomings per year in the United States.

The stonefish (Synanceja horrida) is the most venomous Scorpaenid bony fish.

The lionfish (Pterois volitans) is the most common Scorpaenid in home aquariums.

Marine venoms are very complex mixtures of low- and high-molecular-weight (MW) proteins, including histamine, prostaglandins, serotonin, kinins, indoles, and many other vasoactive compounds. Most venoms are heat labile and can be inactivated by warm-water immersion.
Toxic Coelenterates
(Invertebrates)

**Echinoderms**

**Starfish**
- Latin: *Acanthaster planci*.
- Venom: Toxic saponins with hemolytic, anticoagulant, histaminergic, and neurotoxic properties.
- Antidote: None.
- Diagnosis: Puncture wounds, pain, surrounding erythema, nausea, vomiting, parasthesias muscular paralysis, syncope, ataxia.
- Treatment: Hot water immersion (110–115°F) to inactivate heat-labile toxins, tetanus prophylaxis, analgesics.

**Sea Urchins**
- Common name: Long-spined sea urchin; some species communicate with a venom sac. Venom may also be delivered via triple-fanged jaws called pedicellariae.
- Latin: *Diadema antillarum*.
- Venom: Hemolysins, proteases, serotonin, and steroid glycosides.
- Antidote: None.
- Diagnosis: Edema, erythema, nausea, vomiting, syncope; potential respiratory paralysis, paresthesias and possibly ataxia; and later foreign body (FB) granuloma and sterile nodule formation.
- Treatment: Hot soaks to inactivate heat-labile toxins, tetanus prophylaxis, remove radiopaque spines (especially those embedded in or near joint spaces).

**Cnidarians**

**Corals**
- Common name: Fire coral.
- Venom: Histaminergic kinins.
- Antidote: None.
- Diagnosis: Burning/stinging, pruritus, regional urticaria, prolonged wound healing, eventual scarring.
- Treatment: Seawater irrigation, vinegar (acetic acid) soak, papain containing meat tenderizer, skin shave, antihistamines, steroids, tetanus prophylaxis.

**Jellyfish**
- Common name: Box jellyfish (sea wasp).
- Latin: *Chironex fleckeri*.
- Venom: Myospastic, neurotoxic.
- Antidote: Sheep-derived antivenin (Australia).
- Diagnosis: Immediate linear wheals and blisters (tentacle tracks); then myospasm, respiratory paralysis, hypotension, cardiac arrest.
- Treatment: CPR, antivenin, tetanus prophylaxis.

**Jellyfish**
- Common name: Portuguese man-of-war, tentacles trail up to 30 meters.
- Latin: *Physalia physalis*.
- Venom: Neurotoxic.
- Antidote: None.
- Diagnosis: Painful linear papules/welts (tentacle tracks), nausea, vomiting, headache, myalgias, chills, respiratory distress, cardiovascular collapse.
- Treatment: Vinegar soak, papain meat tenderizer, skin shave, tetanus prophylaxis, antihistamines.
Miscellaneous Venomous Hydroids and Jellyfish

- Stinging hydroid: *Aglanophenia* spp.; polyp colonies of feathery, tree-like ferns growing on rocks and dead coral. Local inflammatory reactions on skin contact best managed with topical antihistamines and corticosteroids.
- Sea nettle: *Chrysaora quinquecirrha*; pink jellyfish with complex venom of esterases, proteases, hyaluronidase. Severe pain, then blistering tentacle tracks may be followed by skip areas of skin necrosis. Topical baking soda paste can inactivate venom.
- Mauve stinger: *Pelagia noctiluca* yellow-to-luminescent pink jellyfish; contact causes initial blisters that heal slowly with hyperpigmentation. Systemic toxicity with weakness, headache, nausea, vomiting possible. Topical-like anesthetics more effective for pain than topical antihistamines and corticosteroids.

Larval Jellyfish

- Common name: Sea lice — larval jellyfish.
- Latin: *Linuche unguiculata*.
- Venom: Histamine, kinins.
- Antidote: None.
- Diagnosis: Sea bather’s eruption-blisters and hives oriented in a bathing suit distribution, especially under waistbands and straps, with nausea, vomiting, headache common co-morbidities.
- Treatment: Seawater wash, vinegar soak, topical-systemic antihistamines and corticosteroids.

Mollusks

**Cone Shells**

- Name: Cone shells.
- Latin: *Conus* spp.
- Venom: Conotoxins are neurotoxic venoms that inactivate Na and Ca channels and are injected by a venom tooth on the tip of the cone shells proboscis.
- Antidote: None.

- Common name: Blue-ringed octopus.
- Latin: *Hapalochlaena maculosus*.
- Venom: Parrot-like beak, two venom-glands, neurotoxic venoms (maculotoxin, cephalotoxin), tetrodotoxin (as in puffer fish and Oregon rough-skinned newt).
- Antidote: None.
- Diagnosis: Burning-numbness, ischemia, paresthesia, aphonia, dysphagia, diplopia, cardiovascular collapse, respiratory failure, coma, death.
- Treatment: Inotropic support, ventilatory support, hot water soak, tetanus prophylaxis.

**Octopuses**

Figure 17.1 Blue-ringed octopus (*Hapalochlaena maculosus*). The blue-ringed octopus (*Hapalochlaena maculosus*) can inflict a painful bite and inject a tetrodotoxin-containing, paralyzing venom. (With permission from Dietrich Mebs, Venomous and Poisonous Animals, CRC Press, Boca Raton, FL, page 72, Figure 2.34.)
Marine Tetrodotoxins

Figure 17.2 Masked pufferfish, *Arothron diadematus*, Red Sea. The meat of the pufferfish is often consumed raw as “fugu” fish in Japan. The pufferfish and marine sunfish contain high concentrations of paralyzing tetrodotoxin in the skin, liver, bile, ovaries, and roe, and must be filleted precisely in order to be eaten raw or cooked without risk of tetrodotoxin poisoning. (With permission from Dietrich Mebs, Venomous and Poisonous Animals, CRC Press, Boca Raton, FL, page 139, Figure 2.91.)
Toxic Vertebrates

Chondrichthyes — Stingrays

- Common name: Southern stingray.
- Latin: *Dasyatis americana*.
- Venom: Serotonin, 5'-nucleotidase, and phosphodiesterase-venom injected by tail barb into deep, jagged lacerations, usually of the leg or foot, and caused by long, serrated spines on the dorsum of the tail.
- Antidote: None.
- Diagnosis: Intensifying burning pain often in cyanotic deep wounds, muscle cramping, weakness, tremor, syncope, hypotension, cardiovascular collapse, seizures, paralysis, secondary marine *Vibrio* infections common — *ecthyma gangrenosa* (*V. vulnificus*) and osteomyelitis.
- Treatment: Hot water immersion to inactivate heat-labile toxins, third-generation cephalosporin, antibiotic prophylaxis, tetanus prophylaxis, debridement, analgesics.

Figure 17.3 Southern stingray (*Dasyatis americana*).
Injuries: Diagnosis and Treatment. Southern stingrays (*Dasyatis americana*) are commonly found in shallow waters off the U.S. Atlantic and Gulf of Mexico coasts and can inflict serious penetrating injuries with sharp spines on their long, whip-like tails.

Figure 17.4 Southern stingray (*Dasyatis americana*). Southern stingray (*Dasyatis americana*)-inflicted human injuries usually occur on the feet and shins when the stingrays are stepped upon in shallow water and whip their barbed tails over their bodies. (Courtesy of Charles P. Sea, Department of Emergency Medicine, Ochsner Clinic Foundation Hospital, New Orleans, LA. Original Source: U.S. Government Document, Information Bulletin #12, 1980, “Toxic Fish and Mollusks.”)

Figure 17.5 Barbed tail spine, southern stingray (*Dasyatis americana*). The hollow barbed spine on the dorsal aspect of the stingray's tail can cause jagged lacerations and inject a heat-labile toxin. (Courtesy of Charles P. Sea, Department of Emergency Medicine, Ochsner Clinic Foundation Hospital, New Orleans, LA. Original Source: U.S. Government Document, Information Bulletin #12, 1980, “Toxic Fish and Mollusks.”)
Scorpaenids — Lionfish

- Common name: Lionfish.
- Latin: *Pterois volitans*.
- Venom: PGF$_2$α, PGE$_2$, thromboxane B$_2$ (TXB$_2$) injected by long, curved dorsal spines with separate venom glands.
- Antidote: Scorpaenid polyvalent antivenin (available CDC and major aquariums), reserve for stonefish envenoming.
- Diagnosis: Local severe pain/edema.
- Treatment: Hot water soak, digital block, analgesics, tetanus prophylaxis.

Figure 17.6 Lionfish (*Pterois volitans*). The lionfish (*Pterois volitans*) has dorsal fins tipped with sharp spines attached to separate venom glands, which can inflict painful envenoming injuries in divers and saltwater aquaria enthusiasts. A polyvalent Scorpaenid antivenom is available for the management of moderate to severe envenomings caused by lionfish, scorpionfish, and stonefish. (Courtesy of Charles P. Sea, Department of Emergency Medicine, Ochsner Clinic Foundation Hospital, New Orleans, LA. Original Source: U.S. Government Document, Information Bulletin #12, 1980, "Toxic Fish and Mollusks.")

Figure 17.7 Stonefish (*Synanceja* spp.). Stonefish are flattened dorsoventrally, lie camouflaged by sand on the ocean floor, and can inflict painful envenoming injuries with dorsal spines when stepped on by swimmers or divers. (Courtesy of Charles P. Sea, Department of Emergency Medicine, Ochsner Clinic Foundation Hospital, New Orleans, LA. Original Source: U.S. Government Document, Information Bulletin #12, 1980, "Toxic Fish and Mollusks.")

Scorpaenids — Stonefish

- Common name: Stonefish.
- Latin: *Synanceja horrida*.
- Venom: Myotoxic heat-labile, high-MW proteins injected through sharp spines on dorsal pectoral, and anal fins.
- Antidote: Contact major aquariums.
- Diagnosis: Intensifying local pain, erythema, ecchymoses, induration, hyperesthesia/dysesthesia, nausea, vomiting, diaphoresis, later lymphadenopathy, syncope, hypotension, dysrhythmias.
- Treatment: Hot water immersion (110–115°F), digital block with 0.25% bupivacaine plain, antivenin not universally available — contact CDC and local major aquariums; oral analgesics — NSAIDs + opioids, parenteral opioids often required, drain and unroof blisters filled with venom.

Trachinidae — Weeverfish

- Common name: Weeverfish — small bottom-feeders that burrow into muddy/sandy-bottomed bays of eastern Atlantic, with sharp dorsal and single opercular spines surrounded by venom-containing glandular tissue that will penetrate thick boots.
- Latin: *Trachinus* spp.
- Venom: Ichthyoacanthotoxin composed of high-MW proteins, serotonin, epinephrine, norepinephrine, histamine.
- Antidote: None.
- Diagnosis: Pain, edema, headache, fever, chills, nausea, vomiting, diaphoresis, hypotension, sei-
Zures, dysrhythmias, respiratory paralysis. Initial local edema may be followed by induration involving entire extremity and may persist for months.

- Treatment: Analgesics, digital block, tetanus prophylaxis, supportive care.

Reptilia — Sea Snakes

- Common name: Sea snakes and sea kraits.
- Venom: Neurotoxin alters Na/Cl permeability, but has no effect on Na-K ATPase pump — also hemolytic and myotoxic (olive sea snake).
- Antidote: Equine-derived bivalent antivenin used for all envenomings.
- Diagnosis: No local reaction, peripheral and cranial nerve (CN) neuropathies within 3–6 hours, paralysis, respiratory failure, myonecrosis and myoglobinuria (esp. olive sea snake), renal failure.
- Treatment: Supportive, antivenin, analgesics, tetanus prophylaxis.