

Poster: Chemical Defence

Region

North Coast, Gascoyne Coast, West Coast, South Coast, Indian Ocean Territories

Summary


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CHEMICAL DEFENCE

With the existence of many predators in the environment, aquatic animals have developed an amazing variety of defence mechanisms. These include hard exteriors, disguise and camouflage, schooling behaviour, hiding or escaping, and body shapes that are difficult to attack. Spines and barbs are also very common, and many species have taken this form of protection one step further by including venom within the spines – making chemical defence another safeguard against attack.


ARMED AND DANGEROUS

Most nudibranchs or sea slugs have the remarkable ability to absorb the toxins and nematocysts (stinging cells) of their prey and transfer them harmlessly to the tips of their own tentacles. These assimilated poisons and 'harpoons' are then used to defend the nudibranch from its own predators. This is why many sea slugs are so brightly coloured – a warning that they are unsafe to eat.



SLEEP TIGHT

Fish have a keen sense of smell and can detect minute changes in water chemistry. Some members of the parrotfish family secrete a mucous 'cocoon' around themselves when they rest or sleep. This cocoon acts as a chemical shield, masking any scent that they give off and preventing predators like moray eels from finding the parrotfish by smell. Gaudichin grouper are thought to use this same defence mechanism.



VENOM VS POISON

Venomous fish (such as scorpionfish, stonefish, stingrays and cobblers) deliver their venom by means of a bite or sting, often through injection. Venom is typically produced in organs specialized for the purpose.


Poisonous fish (such as pufferfish and boxfish) are harmful when eaten or touched, with the poison usually absorbed internally or via the skin. The poison tends to be distributed over a large part of the body of the fish producing it.

Toxins describe a biologically-produced poison or venom, that is, the harmful substance is produced by the living cells of the organism.

BITING OFF MORE THAN YOU CAN CHEW


Pufferfish have a surprise for predators – they can inflate themselves to a size that is too big to swallow. On top of this, they produce a highly lethal toxin called 'tetrodotoxin' – present in the fishes' skin, flesh and internal organs – that is approximately 1,200 times deadlier than cyanide! Pets have died from eating blowfish (a type of pufferfish) washed up on beaches or left behind by fishers.

In Japan, fish from the family Tetraodontidae (which includes well over 100 species of boxfish and pufferfish) are known as 'fugu' and are considered a delicacy. Young chefs spend years learning how to prepare fugu. However, each year, a few people still die from eating poorly-prepared fugu dishes.



THE STAYPUT STONEFISH

A master of disguise, the stone fish is a very inactive predator – lying still on the bottom, looking like an algae-covered rock, waiting to gulp prey into its huge mouth. But if disturbed, frightened or provoked, it will erect the spines along its back to jab enemies with what is the most deadly venom of any fish in the world! Stonefish have control over whether to shoot its venom, unlike other species (such as the lionfish) that can't release venom unless something pushes against their spines.




YOU ARE WHAT YOU EAT

Close behind the stonefish in 'poison-power' is the lionfish (also called butterfly cod, fire cod or red firefish), with its long, colourful, fine and fin spines. This decoration may be used for camouflage or possibly to advertise the lionfish's deadly poison, which is injected by the spines. The toxin is based upon the lionfish's diet, much in the same way as nudibranchs use the toxic compounds produced by their prey as part of their own defence.



GOING OFF LIKE A NEUTRON BOMB


Boxfish are also known as 'Neutron Bomb' fish. This fish usually gives off its business undisturbed by predators because of its bright colours, which act as a warning, and its scales that have developed into an extremely rigid armour. But if those defences fail, the boxfish secretes a toxin through its pores that can wipe out anything in close proximity to it. To protect itself from its own toxin, the boxfish releases the toxin as it quickly leaves the area.



WHAT'S IN VENOM?

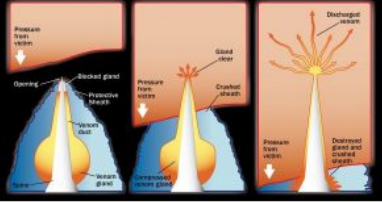
Venom consists of a mixture of proteins that play with critical bodily functions (such as blood pressure, heartbeat, nerve and muscle activity, and blood clotting), and can cause pain, blisters, fever, convulsions, breathing difficulties and even death in humans. For example, stingray venom contains enzymes which breakdown and kill cells, as well as the neurotransmitter serotonin, which causes muscle contractions. Should you be unlucky enough to be stung by a venomous fish, immerse or wash the sting area in hot water to 'denature' (break down) the proteins and seek medical assistance.

Photo: Clay Bryon




Stone fish venom delivery mechanism:

A protective sheath blocks the opening. As pressure is applied, the venom seal breaks and a spine is bared. The sheath is punctured, freeing the opening, and the venom is released. The gland is destroyed by the pressure, but will regenerate and be recharged with venom within a couple of weeks.



There have been anecdotal reports of osteoarthritis sufferers experiencing improved mobility and reduction in joint pain following 'venomotherapy' from stonefish. The responsible agent has not yet been identified.



SYMBIOTIC DEFENCE

Anemonefish have a 'symbiotic' or mutually beneficial relationship with anemones – they use the anemone for protection against predators and in return keep away intruders and keep the anemone free from parasites. Anemonefish can survive amongst the anemone's stinging tentacles – which paralyse other fish – by producing a mucus that helps to resist the anemone's venom. Then over a period of time, which can be several minutes to a few hours, the fish performs a 'dance' that involves more and more contact with the anemone, until it becomes immune to the stings.

Some anemones release a chemical 'perfume' to attract anemonefish to them.



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