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Letter from the Desk of David Challinor
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We often identify poisonous animals as snakes even though no more than a quarter of these reptiles are considered venomous. Snakes have a particular problem that is ameliorated by venom. With nothing to hold its food while eating, a snake can only grab its prey with its open mouth and swallow it whole. Their jaws can unhinge which allows snakes to swallow prey larger in diameter than their own body. Clearly the inside of a snake's mouth and the tract to its stomach must be slippery enough for the prey animal to slide down whole, and saliva provides this lubricant.

When food first enters our mouths and we begin to chew, saliva and the enzymes it contains immediately start to break down the material for ease of swallowing. We are seldom aware of our saliva unless our mouths become dry, which triggers us to drink. When confronted with a chocolate sundae or other favorite dessert, humans salivate. The very image of such "mouth-watering" food and the anticipation of tasting it causes a reaction in our mouths which prepares us for a delightful experience. Humans are not the only animals that salivate to prepare for eating, and this fluid has achieved some remarkable adaptations in other creatures.

Scientists believe that snake venom evolved from saliva. Why it became toxic in certain snake species and not in others is unknown, but the ability to produce venom helps snakes capture their prey. A mere glancing bite from a poisonous snake is often adequate to immobilize its quarry. Snake venom is either hemo- or neurotoxic, depending on the snake species; that is the toxin can either attack red blood cells (hemotoxic), or it can attack nerve cells and cause paralysis (neurotoxic). The venom of some species, such as the Yellow-bellied sea snake, is both hemo- and neurotoxic, but its fangs are so short that it is seldom dangerous to humans; it would have to bite repeatedly a finger, for example, to release enough poison to be lethal.

Venom has another practical advantage for a snake. The red blood cells in a prey animal, bitten with hemotoxic venom, begin to break down, thus aiding the snake's digestive process. From the snake's point of view, therefore, venom is a useful and important component of its ability to survive in a hostile world.

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Despite the relative rarity of poisonous snake species, they have blackened the reputation of all snakes among most humans. Many people have a true snake phobia that has nothing to do with the reptile's size or venomousness, a fear of which I am acutely aware because I am married to such a person.

Snakes are also suspect, not just because some are venomous, but because they crawl on their stomachs. People seem to feel better about animals that can walk in an erect position or swim vertically -- hence the appeal of walking bears and penguins and swimming seahorses.

Actually there are probably more toxic marine species than terrestrial ones. Among the most notorious is the Japanese puffer fish called fugi, which must be prepared in a specific way before being eaten. Its taste is alleged to be exquisite, but the slightest error in its preparation can allow its potent toxin to enter the human digestive system with generally fatal results. There are many other poisonous fish and marine invertebrates such as jelly fish, corals, and even snails. Along the Mediterranean shore, for example, lives the beautifully patterned cone snail, which is much in demand by shell collectors. Extreme care must be used in handling them as they can release a very potent venom through two long, needle-sharp teeth which they use to paralyze prey.

In addition to reptiles (snakes), fish and invertebrates, there are venomous amphibians, including the well-known brightly-colored poison arrow frogs -- about the diameter of a silver dollar. These beautiful animals protect themselves from predators by excreting a strong skin toxin which is used by the Amazonians on their arrows and blow pipe darts to paralyze instantaneously the bird or animal they shoot. For some as yet unknown reason, these frogs lose their ability to produce skin toxin when raised in zoos. Perhaps they do not expend energy being poisonous if they do not need to, as in the lack of the threat of predation in the zoo, or maybe their inability to produce toxin is caused by a change in diet. The National Aquarium in Baltimore, which has a major collection of these frogs, is trying to understand why this loss of ability to make poison happens.

Last month a fascinating account appeared in SCIENCE of the first identified poisonous bird. Unlike the snake and the snail which use their poison to capture prey, but like the poison arrow frog, the pitahui bird of New Guinea makes itself unpalatable by concentrating toxins in its feathers and skin. Amazingly, an analysis of this bird's poison showed it to be chemically close to that of the Amazonian frog, which lives on the opposite side of the world. The discovery of this first poisonous bird is noteworthy because the production of toxins is rare in warm-blooded animals.

Beside the pitohui bird, the only other warm-blooded, poisonous beasts I know of are mammals. The best known of these is the adult male platypus, which has, on the inside of his ankles, a hollow spur connected to a small gland that he can use to inject venom into a predator. Keepers of these animals must handle them gingerly, usually lifting them by their furless, beaver-like tail. The other venomous mammal I am aware of is the common, but seldom seen short-tailed shrew; an active insectivore that lives on the forest floor of eastern North American woodlands. Its salivary glands produce neurotoxins that paralyze small prey. When humans are bitten by these shrews, it is painful, but normally not lethal.

Salivary glands in such different creatures as snakes, snails and shrews may have evolved as a potent venom source to assist in capturing prey, as well as an aid to help predigest it before consumption. Saliva thus appears to be an essential component for starting the digestive process in all vertebrates and probably for such invertebrates as snails. For still unknown reasons, saliva glands evolved to produce poison in some animals and anticoagulants in the saliva of others, such as leeches and vampire bats. The ability of both saliva glands and skin glands to produce toxins in certain animals gives them an important survival advantage; it either helps the animal to capture prey or to protect itself from being eaten -- two major activities of all wild animals.

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