BIOLOGY AND IMPORTANCE OF HORSESHOE CRABS

Submitted By

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Content:-

Introduction:-

Horseshoe crabs are among the world's oldest and most fascinating creatures. The earliest horseshoe crab species had already inhabited Earth at least 200 million years before the dinosaurs arrived or about 400 million years ago. Horseshoe crabs are animals of the temperate seas. Horseshoe crabs are considered both ecological and behavioral generalists, tolerant of a broad range of conditions, and capable of reacting to their environment in many ways. Horseshoe crabs are benthic (or bottom-dwelling) arthropods that use both estuarine and continental shelf habitats. Although it is called a "crab," it is neither a decopod or crustacean, rather horseshoe crabs are grouped in their own class (Merostomata), which is more closely related to the arachnids. Horseshoe crabs, ranging from the Yucatan peninsula to northern Maine, are most abundant between Virginia and New Jersey, with the largest population of spawning horseshoe crabs in the world found in the Delaware Bay. Thanks to the horseshoe crab, medical science has made great advances. Much of what we know about the human eye and how we see began 50 years ago with studies of the horseshoe crab's large compound eye. The horseshoe's shell, made of chitin, has been instrumental in the development of surgical sutures and wound dressings, and its blood provides an extract that helps detect bacterial contamination in drugs.

Back ground

The horseshoe crab has been on earth for over 500 million years leading many people to consider this animal a "living fossil." Today only four species of horseshoe crab remain and even they are not widely distributed worldwide. Limulus polyphemus is one of the four and we are fortunate to be able to find it living on the Jersey Shore (including Delaware Bay) since its range is narrow (from Maine to the Gulf of Mexico).

True crabs classified as decapod crustaceans, have five pairs of legs, which include a pair of claws. Horseshoe crabs have seven pairs of legs under their helmet like shells; five of these seven pairs of legs are equipped with claws. True crabs have two pairs of antennae and a pair of mandibles, or jaws; horseshoe crabs lack these structures. In adult males, the second pair of claws (pedipalps) has a "boxing-glove" appearance and is used to grasp females during spawning. Horseshoe crabs also have four simple eyes on the top of their carapace instead of two as with the true crab. Our North American species has been named Limulus Polyphemus – Limulus meaning "a little askew or odd" and Polyphemus after the giant Cyclops in Greek mythology.

Horseshoe crab " Limulus polyphemus "

Habitat

The horseshoe crab belongs to the benthic community. They prefer calm seas or estuaries with muddy sandy bottoms for their biogenic activities. When the horseshoe crab is hungry, the search for prey begins. To find food, the horseshoe crab pushes its way along the bottom, digging little furrows along the way. They use their first set of appendages, chelicerae, as feelers to determine the presence of prey. They migrate to the shore from the deeper waters specifically for

breeding purposes. During this shoreward migration the animal is subjected to a wide range of environmental conditions including salinity and temperature. Although detailed knowledge of the complete life cycle of the animal is not yet known, it is generally believed that the animal inhabits the deeper zone of the sea for most parts of its life. The fluctuating habitats encountered by the horseshoe crab during their different stages of life reflect their amazing ability to tolerate and adapt to different environmental conditions.

Horseshoe crab on sandy shore

Horseshoe crabs in the deeper water

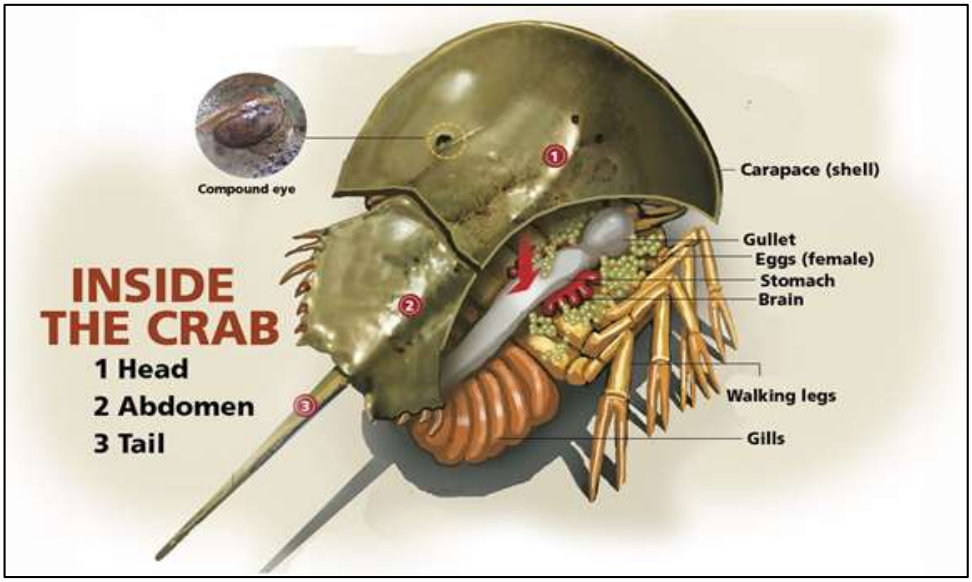


Diagram of horseshoe crab anatomy

Medical importance

Thanks to the horseshoe crab, medical science has made great advances. Much of what we know about the human eye and how we see began 50 years ago with studies of the horseshoe crab's large compound eye. The horseshoe's shell, made of chitin, has been instrumental in the development of surgical sutures and wound dressings, and its blood provides an extract that helps detect bacterial contamination in drugs.

Horseshoe crabs'Blood

horseshoe crabs' blood from species in the United States and Asia is synthesized to become a lysate test. In the 1960s, scientists discovered that horseshoe crab blood had great capacity for clotting, understood as part of their protective mechanism to avoid bacterial infection and sustain their epic survival.

Through clinical trials, the crab's blood-clotting capacity essentially is used as a test to detect if harmful endotoxins exist on or in medical devices. If toxins exist

and the device is deemed contaminated, a solution of blood will coagulate or firm up.

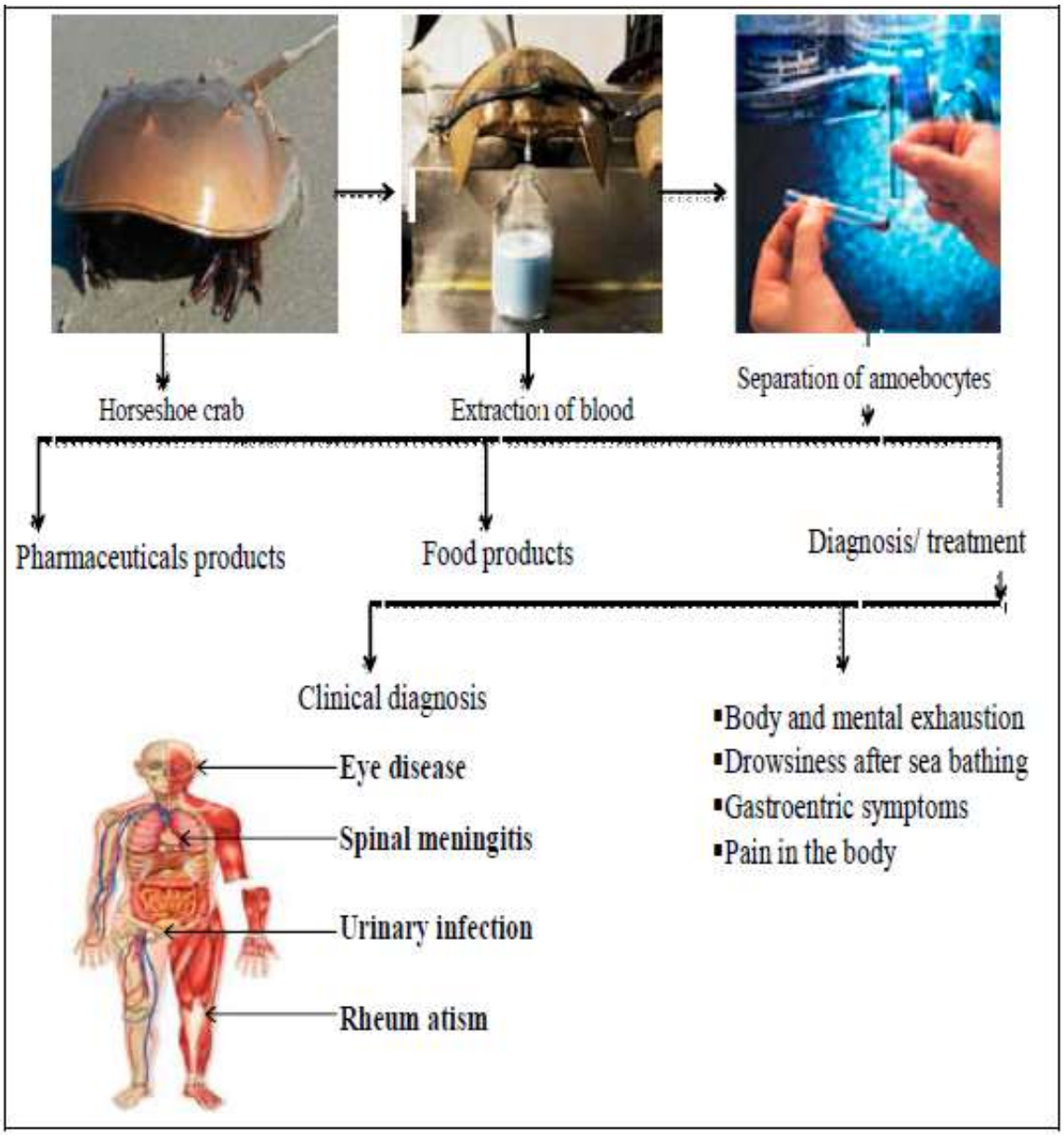
In order to get FDA approval on a human pharmaceutical, injectable, or biological/medical device, a Limulus amebocyte lysate (LAL) test must be conducted. The species blood is used to create LAL through a process of bleeding the animal in laboratories in Cape Cod and North Carolina.

Extraction of horseshoe blood

Harvesting horseshoe crab blood involves collecting and bleeding the animals, and then releasing them back into the sea. Most of the animals survive the process; mortality is correlated with both the amount of blood extracted from an individual animal, and the stress experienced during handling and transportation. Estimates of mortality rates following blood harvesting vary from 3-15% to 10-30% .

The LAL test represents one of a number of pharmacological significant, chemical constituents found in marine flora and fauna. The discovery, commercialization, and use of LAL have been an important improvement in the pharmaceutical industry. Prior to the use of LAL, compounds were tested for the presence of endotoxins in a variety of ways that involved living animals or

living parts of animals. Thus, LAL provides a means to detect endotoxins without having to kill or disable animals .



Uses of Limulus amebocyte lysate (LAL)

Threat of extinction

The eggs of the horseshoe crab are reported to be eaten by striped bass, striped killi fish, silver perch, northern king fish, Atlantic silverside and flounders. The appendages and gill hooks of the young limuli are sought after by the puffer and cat fish. Plovers, sand pipers and gulls are also considered to be regular predators of the horseshoe crab eggs and larvae in the beach nest. The other predators causing considerable damage to the horseshoe crab population are tiger sharks, leopard sharks, loggerhead turtles, rays and sword fish. The horseshoe crab also has a great fear of mosquitoes and will die if bitten by a mosquito.

The decrease in the population of the horseshoe crab in several places is also the result of the degradation and destruction of their habitat, especially their breeding ground,.