

# HORSESHOE CRABS AND MODERN MEDICINE

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If one was to walk along the shoreline and come upon a horseshoe crab like many their instinct would be to get away from it as fast as possible. But what most people do not know is that this animal is helping them everyday.



The horseshoe crab is a marine arthropod. Despite its name, it is more closely related to spiders, ticks, and scorpions than to crabs. Horseshoe crabs are most commonly found in the Gulf of Mexico and along the northern Atlantic coast of North America.

These animals help mankind everyday by the special property of their blood. The blood of horseshoe crabs contains the copper-containing protein hemocyanin. Hemocyanin is colorless when deoxygenated and dark blue when oxygenated. But it's not the color of the blood that helps us, it is the fact that their blood will quickly clot when it comes into contact with even the minutest impurities.

The blood of horseshoe crabs contains one type of blood cell, the amebocytes. These play an important role in the defense against pathogens. Amebocytes contain granules with a clotting factor known as coagulogen; this is released outside the cell when bacterial endotoxin is encountered. The resulting coagulation is thought to contain bacterial infections in the animal's semi-closed circulatory system.

A scientist named Frederick Bang first discovered this clotting quality of the horseshoe crab's blood in the 1950s. Bang isolated the

chemical in the horseshoe crab's blood that caused the clotting and called it "Limulus amoebocyte lysate" or LAL.

Before the discovery of LAL the method of detecting impurities in drugs was rather crude. It consisted simply of injecting the drug being tested into a rabbit. If the rabbit got sick or died then the drug was discarded. This was hardly an effective test and contaminated drugs often went undetected and caused harm in patients receiving such drugs. Because LAL is so effective in detecting these impurities in drugs that since 1987 the FDA requires it for testing all drugs to be used by humans. One interesting thing about LAL is that despite intensive efforts to make it synthetically, the only source for this vital product is still the blue blood of the horseshoe crab.

The extract of the horseshoe crab's blood is used by the pharmaceutical and medical device industries to ensure that their products such as intravenous drugs, vaccines, and medical devices, are free of bacterial contamination. The reason for this test is because bacteria that are generally considered non-pathogenic, can cause disease if they enter parts of our body that are usually bacteria-free, such as the bloodstream. In this case, even the ordinary bacterium *E. coli* can cause sepsis and death.

Horseshoe crabs are returned to the ocean after bleeding. Studies show that blood volume returns to normal in about a week, though blood cell count can take two to three months to fully rebound. A single horseshoe crab can be worth \$2,500 over its lifetime for periodic blood extractions.

## WORKS CITED

Gladnick, P.J. "The horseshoe crab's miracle blood." ESSORTMENT. 17 Nov. 2008  
<[http://www.essortment.com/all/horseshoecrab\\_raie.htm](http://www.essortment.com/all/horseshoecrab_raie.htm)>.

"Horseshoe crab." Wikipedia, The Free Encyclopedia. 19 Nov 2008, 17:40 UTC. 25 Nov 2008  
<[http://en.wikipedia.org/w/index.php?title=Horseshoe\\_crab&oldid=252813669](http://en.wikipedia.org/w/index.php?title=Horseshoe_crab&oldid=252813669)>.

Novitsky, Ph.D, Thomas J. "Medical Uses." The Horseshoe Crab. Ecological Research and Development Group. 17 Nov. 2008 <<http://www.horseshoecrab.org/med/med.html>>.