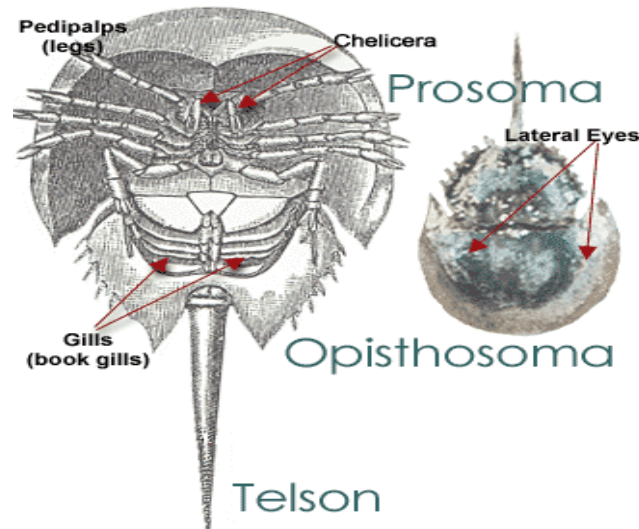


## Causing Species Deaths to Save Human Lives: The Harvest of the Horseshoe Crab Blood

### Horseshoe Crab Anatomy<sup>1</sup>



The exterior of the crab's body is divided into three sections. These three sections comprise the horseshoe crab's hardened exoskeleton. From a top view, it is shaped like a horse's shoe. The tail is attached to the abdomen at the terminal base. The horseshoe crab uses its telson to steer and right itself if it becomes inverted in the tidal zone. Horseshoe crabs have a total of 10 eyes used for finding mates and sensing light. Each compound eye has about 1,000 receptors or ommatidia. The ommatidia are adapted to change the way they function by day or night. At night, the lateral eyes are chemically stimulated to greatly increase the sensitivity of each receptor to light. Each of these eyes detects ultraviolet (UV) light from the sun and reflected light from the moon. They help the crab follow the lunar cycle. This is important to their spawning period that peaks on the new and full moon. A horseshoe crab absorbs oxygen from the water using gills that are divided into 5 distinct pairs located under the abdomen. Horseshoe crab blood is a bright shade of blue, and has remarkable antibacterial properties that have proved invaluable to the medical industry.

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<sup>1</sup> Maryland Department of Natural Resources. Horseshoe Crab Life History. Ed. July 24, 2024, <https://dnr.maryland.gov/ccs/Pages/horseshoecrab-anatomy.aspx>

## Horseshoe Crab Life History<sup>2</sup>

Horseshoe crabs “evolved in the shallow seas of the Paleozoic Era, 540-248 million years ago.” They predate the age of the dinosaurs, the Mesozoic Era, about 200 million years ago. During the Mesozoic era, dinosaurs dominated the landscape and most species of marine reptiles became extinct. In that period, the shallow seas around Europe were considered the dispersal point for ancestors of the modern-day horseshoe crab. When the major extinction of the dinosaurs and about half of the planet's marine invertebrates occurred, horseshoe crabs survived. Originally, there were several species of horseshoe crabs, but only four have survived to modern times. Three species live along the shores of Southeast Asia and nearby islands, and the fourth lives in America.

The horseshoe crab has played an important role in the food chain pyramid for over 360 million years. “People have harvested horseshoe crabs for centuries. Prior to the European colonization of North America, native tribes used the telson as spear tips and the shell as containers.” Today watermen use horseshoe crabs as bait to harvest other commercial fisheries species; birders visit spawning areas to view the migrating shorebirds; and horseshoe crabs are food for migrating shorebirds and juvenile Atlantic loggerhead turtles. Delaware Bay is the principal breeding location for horseshoe crabs, and the second largest staging area for shorebirds in North America. Shorebirds arrive in the Delaware-Chesapeake region at the peak of horseshoe crab mating in mid-May and June, and feed on horseshoe crab eggs to replenish their fat supply during trips to Canadian breeding grounds. Adult horseshoe crabs form a significant part of the diet of juvenile Atlantic loggerhead turtles, a threatened species. Horseshoe crab eggs and larvae are also a seasonally preferred food item of many invertebrates and finfish, including all crab species, whelks, striped bass, white perch, American eels, killifish, silver perch, weakfish, kingfish, silversides, summer flounder and winter flounder.” Almost every part of the horseshoe crab is integral to the food chain pyramid to sustain the lives of species, as well as in medical research, and fishing industries.

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<sup>2</sup>Ibid.

## **Horseshoe crab blood: the miracle vaccine ingredient that's saved millions of lives<sup>3</sup>**

“Nature plays a huge part in the medicines we rely on every day.” When it comes to vaccines, horseshoe crab blood has been used to test vaccines to insure their safety. “If you have ever had a vaccine, chances are that it was evaluated for safety using horseshoe crab blood.”

### **Horseshoe crabs and Covid**

When the world was rushing to find a safe vaccine to fight Covid-19, the viral lung disease that swept the planet in 2020, more than 100 different vaccines were being tested; horseshoe crab blood played an important part in that testing.

### **The Harvest and Alternative Cloning of Horseshoe Crab Blood<sup>4</sup>**

Pharmaceutical companies had not been able to find alternative ingredients as tests that were as sensitive as horseshoe crab blood until the late 1990s, “when biologists at the University of Singapore developed a synthetic alternative by cloning a molecule in the crab blood.” While several governments, including Japan and China, now use the genetically engineered protein called Recombinant Factor C, or rFC, for testing, many countries, including America, continue to remove horseshoe blood for medical testing. Below are examples of the alternative, humane removal of molecules from the blood of horseshoe crabs for cloning, and the inhumane “bloodletting” by pharmaceutical companies of horseshoe crabs.

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<sup>3</sup> Pavid, Kati. Horseshoe crab blood: the miracle vaccine ingredient that's saved millions of lives 15 January 2021. <https://www.nhm.ac.uk/discover/horseshoe-crab-blood-miracle-vaccine-ingredient.html>

<sup>4</sup> Ibid.



5



Synthetic alternatives to horseshoe crab blood have been developed. Image © Rattiya Thongdumhyu/Shutterstock.com



6

Each year, half a million horseshoe crabs are captured and bled alive by pharmaceutical companies to burst cells that contain the chemical called coagulogen. The coagulogen is used to detect contamination in any solution that might come into contact with blood, by detecting dangerous bacterial endotoxins in the liquid. “If there is no bacterial contamination, then the coagulation does not occur, and the solution can be considered free of bacteria. It’s a simple, nearly instantaneous test that goes by the name of the LAL, or Limulus amebocyte lysate, test (after the species name of the crab, *Limulus polyphemus*).” The horseshoe-blood test is a big business.<sup>7</sup> “Every drug certified by the FDA must be tested using LAL,” “as do surgical implants such as pacemakers and prosthetic devices.”<sup>8</sup> Approximately 30% or more horseshoe crabs die after they are bled for medical testing. Some females become lethargic from the bleeding, and

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<sup>5</sup> Ecological Research & Development Group. Alternative Endotoxin Testing. 27 July 2023. <https://www.horseshoecrab.org/med/alternatives.html>

<sup>6</sup> Eisner, Chiara. NPR.org. “Coastal biomedical labs are bleeding more horseshoe crabs with little accountability.” <https://www.npr.org/2023/06/10/1180761446/coastal-biomedical-labs-are-bleeding-more-horseshoe-crabs-with-little-accountabi>

<sup>7</sup> Madrigal, Alexis C. “The Blood Harvest.” <https://www.theatlantic.com/technology/archive/2014/02/the-blood-harvest/284078>

<sup>8</sup> PBS-Nature documentary. WABE-Passport. “The Benefits of Blue Blood.” June 10, 2008. <https://www.pbs.org/wnet/nature/crash-a-tale-of-two-species-the-benefits-of-blue-blood/595/>

after returning to their habitats, their ability to spawn (normally 88,000 eggs after breeding), has been shown to be dramatically reduced.<sup>9</sup>

Aldo Leopold's article "The Land Ethic" discusses ethical practices towards conservation. His focus is on the land and the bio community that make up the food chain pyramid. "All ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts....The land ethic simply enlarges the boundaries of the community to include soils, water, plants, and animals, or collectively the land" (pp. 203-204). I believe included in that community are birds and sea creatures because they are an integral part of the food chain pyramid. Leopold goes on to state, "The image commonly employed in conservation education is the 'balance of nature.'..." "A much truer image is the one employed in ecology: the biotic pyramid..." "The species of a layer are alike not in where they are from, or in what they look like, but rather in what they eat" (p. 215). He then declares that "man-made changes are of a different order than evolutionary changes, and have effects more comprehensive than is intended or foreseen" (p. 218). In the 2<sup>nd</sup> test, I focused on Both Bruno Latour and Isabelle Stengers advocating changes in how science and technology are used for conservation of species of the planet. Those changes do not mean that ecologists should ignore scientific breakthroughs in medicine that have been shown to save millions, if not billions of lives, but I believe it does call for alternative methods of scientific discoveries to be used if they will save the lives of a species, like the horseshoe crab, from becoming extinct from overharvesting their blood for medical tests. As shown in the above four pages, I have demonstrated the importance of the horseshoe crab in the food chain pyramid, and how the inhumane treatment of harvesting their blood has a dramatic effect on their ability to spawn and thrive. Prior to this class, while I considered myself respectful and supportive of nature and the food chain pyramid, after focusing on important issues related to preserving land, sea, and air non-human species in this class, I realize that I need to do more towards conservation to insure that the impact of industrial genocide of earths' species, as shown in the film "Blade Runner," will not become a reality.

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<sup>9</sup> Pavid, Kati. Horseshoe crab blood: the miracle vaccine ingredient that's saved millions of lives 15 January 2021. <https://www.nhm.ac.uk/discover/horseshoe-crab-blood-miracle-vaccine-ingredient.html>