

### What makes a horseshoe crabs' blood so special?

Horseshoe crab blood carries factors that react to antigens found on and in gram-negative bacteria walls by forming a clot around it. The clot isolates the bacteria, and protects the crab from infection. The blood also begins a healing process similar to ours where we form a clot, a scab, and eventually wounds heal.

### What makes LAL so important?

The LAL test is the most sensitive, accurate and cost-effective test on the market today to detect contaminating endotoxins. This test was first licensed by the FDA in the 1970s, and is now the gold standard. It can detect endotoxin in the parts per billion. That's like finding a grain of sand in an Olympic swimming pool. Prior to LAL, rabbits were used to test for endotoxins by injecting the rabbit with sample of the product being manufactured and waiting two or three days to see if the rabbit developed a fever. Hundreds of thousands of rabbits were required to be held and utilized this way. LAL based assays replaced this test with one that is more humane, more accurate, cost effective and can give results in a test tube, in about an hour. There are very few people you are likely to meet in your lifetime who have not benefited from a bacterial endotoxins test.

### What types of things are tested with the blood?

The FDA has mandated (it is the law) that all injectable or indwelling materials must be tested for endotoxin contamination before being released for sale. This is to protect the public from products that are not sufficiently free of materials that can make a patient ill from exposure to gram-negative cell wall material. If endotoxin enters your blood stream it can make you sick and possibly even kill you. So the test we manufacture is used for medical devices, such as knee replacements, stents, heart valves, intravenous solutions; and drugs and vaccines like childhood immunizations, insulin, flu vaccine and chemotherapy drugs to name a few. Anything injected or implanted into the human body must be free of endotoxin.

### I have read somewhere crab blood is worth \$15,000 a quart? Is that true?

Absolutely not. This is a myth sensationalized by some media. Manufacturing LAL which is made from the white blood cells of horseshoe crabs, is a complex process that is regulated by the FDA and must be done under extremely clean conditions. A typical LAL test costs less than \$20. In terms of the impact it has had on human health and safety, it is safe to say it has saved many lives and is therefore priceless.

### Where do the crabs you bleed come from?

Most of the crabs that come to our facility are from Massachusetts waters, Vineyard Sound, Nantucket Sound, and Buzzards Bay. Fisherman catch them a number of different ways but must follow strict regulations on size, number of crabs harvested, and quota management.

### What can I do?

Water quality and human development are major threats to all fragile ecosystems such as the embayments where horseshoe crabs reproduce and grow. Do your part in mitigating the impact humans have on water quality and beach erosion. If you ever see a crab upside down on the beach, gently roll it over and return it to the water. And remember, the next time you or a loved one receives an injection, IV or implant, be sure to thank a horseshoe crab!

### How does the process of bleeding the crabs work?

The process is very similar to when people donate blood. The crabs are checked for good health, placed in a very clean laboratory where we disinfect a portion of the shell, and carefully insert a sterile needle. We collect excess blood from a sinus in the dorsal aspect of the crab's body, just under the shell. The way the crabs are held limits the blood that can be harvested to the dorsal sinus. The majority of the blood which is in the gill areas is untouched. Studies have shown that the crabs tolerate this process very well and the overwhelming majority survives.

### What threats face the horseshoe crabs today? Are they endangered?

Like any sea creature, horseshoe crabs are dependent on a suitable environment in which to live and reproduce. Water quality is an important factor as is having suitable beaches in which to lay their eggs. Fertilizers, septic systems, and other forms of pollution can greatly reduce the quality of water on which the crabs depend. Sea walls, rip-rap and jetties can manipulate the natural movement of sand on beaches and affect spawning habitat. Beach nourishment, the practice of bringing in truckloads of sand to beaches to replenish what's lost, or make them look nice, can bury millions of eggs before they hatch if not carefully timed. Crabs are also used as bait for conch and eels which is another source of man-made mortality. Crabs in the United States are regulated and monitored carefully. They are not endangered, in fact, in many areas populations are growing considerably. In other parts of the world, they are victims of pollution and humankind's development of coastal areas and are not so closely monitored.

### What does ACC do to support conservation?

ACC has always promoted and practiced a catch and release fishery where the overwhelming majority of crabs survive the process of blood extraction. We work closely with fishermen and regulators to minimize the impact we may have on crab populations. ACC was instrumental in creating a minimum size limit for crabs to ensure only mature crabs are collected, and helps to keep a biomedical only fishery in Pleasant Bay, MA where all the crabs collected are released. We have supported conservation efforts that include the use of bait bags, decreased catch limits and a prohibition on fishing for crabs around peak spawning periods. We also participate in the Massachusetts "rent a crab program" where crabs destined for use as bait are brought to our facility first. This helps to limit the overall impact on crabs, and is unique to Massachusetts. ACC takes part in the Atlantic States Marine Fisheries Commission (ASMFC) Horseshoe Crab advisory board where we helped develop the Best Management Practices (BMPs) for the industry. We also collect data for the regulators from every crab that enters our facility, which is invaluable to understanding population dynamics. Most recently ACC has implemented a one-of-a-kind sustainability project where we can create juvenile crabs *in-vitro* and release them to the wild.

### What information should more people know about horseshoe crabs?

Horseshoe crabs and their ancestors have been on this planet for somewhere around 400 million years, and have survived mass extinctions. They are not harmful, don't sting, bite or try to do us any harm. Remember when you see a horseshoe crab shell washed up on the beach it is likely a molt, and not a dead crab. Crabs can only grow by shedding their shells and growing larger ones. Old shells are discarded and many beachcombers worry crabs are dying when they are really just growing up. Even as recently as the 1950s crabs were destroyed by the tens of thousands by people on Cape Cod and elsewhere fearing they were harmful to shellfish beds or for use as fertilizer and pig food. In fact, they are useful for shell fisherman by helping to till and keep sediment aerated. They are an important part of the international ecosystem.

