

# *Limulus polyphemus* anatomy guide - dorsal features

## median (simple) eyes

sit on each side of the front-most spine of the HSC shell; these eyes detect ultraviolet light reflected from the moon and stars - information the HSC brain uses to instruct the compound eyes to adjust their sensitivity to light up to a million times at night, enabling them to see and find their mates as well on a dark new moon night as in bright daylight

## lateral (compound) eyes

like the eyes of a fly, contain hundreds of image-forming facets, providing a wide field of visual data for the HSC to assess its surroundings - which the HSC brain interprets into one somewhat fuzzy (compared to what we see) view of the world; the seeing cells inside the HSC eye are 100x larger than those of humans, making it a great model for studying how vision works (3 Nobel prizes have been awarded for research done on HSC eyes)

## prosoma

large front circular shield of the HSC three-part body plan; provides strength & protection to all the body parts below it.

## carapace

term applied to the entire shell, comprised of a material called **chitin**; the surface of the HSC carapace hold over a million touch-sensitive receptors

## hinge

strong muscles across this area enable HSC to flex its opisthosoma up to 90° when disturbed; also the area where a needle is inserted for biomedical bleeding

## heart sinus area

this raised area of the HSC shell encompasses the heart sinus, which holds about 30% of the HSC's blood volume, including that which is taken during biomedical bleeding

## opisthosoma

also called the mid-piece, this vital body section holds and protects the gills underneath and also is the part of the body that flexes when disturbed

## channel

this space is where currents of water - generated by beating of the gills and operculum - are brought into and over the gills; it's also the preferred place for satellite males to position over females in spawning

## pits (entapophyseal pits to be precise)

there are 6 of these hollow areas along each side of the opisthosoma, representing remnants of the body segments of ancient HSC ancestors, as well as points of attachment to the shell for the book gill plates beneath

## moveable spines

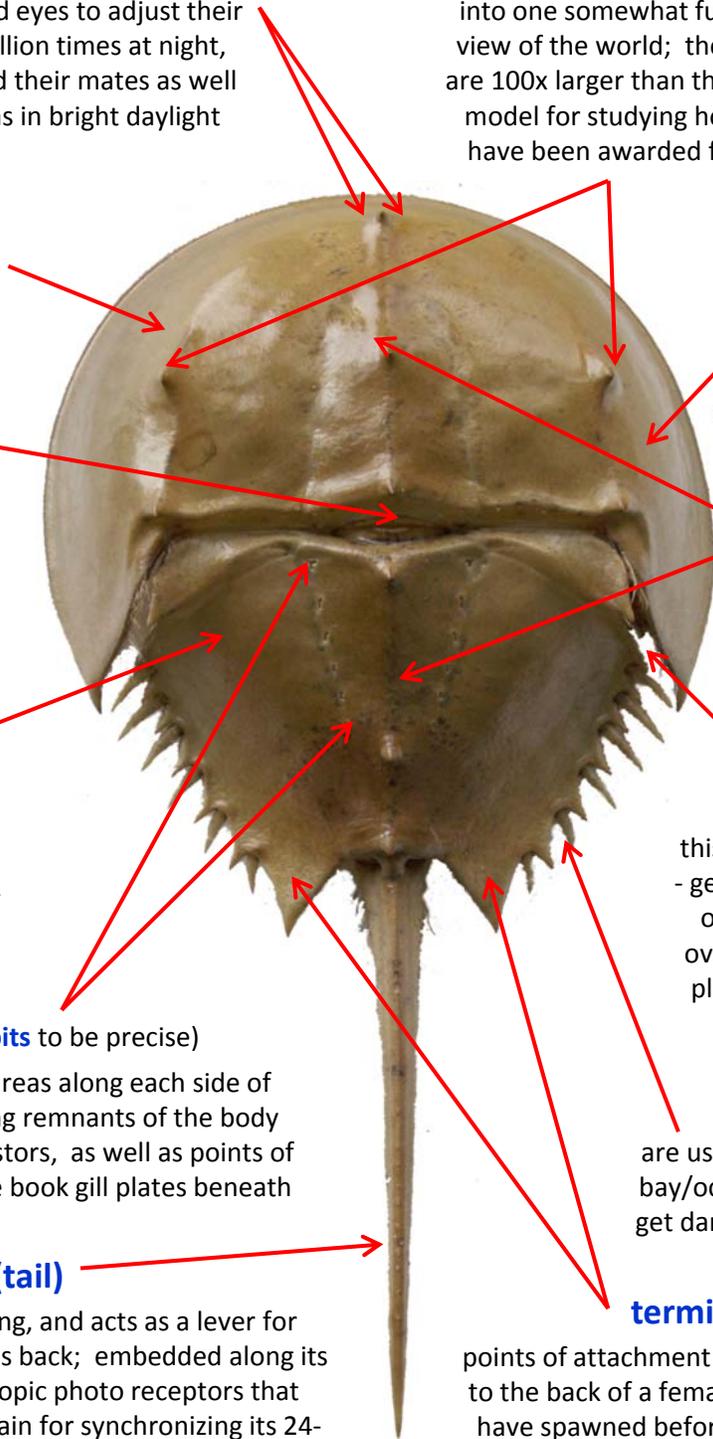
are used for "feeling" its way along the bay/ocean bottom; some of these may get damaged or broken in older animals

## telson (tail)

serves as a rudder in swimming, and acts as a lever for righting itself when flipped on its back; embedded along its length are a series of microscopic photo receptors that transmit signals to the HSC's brain for synchronizing its 24-hour biological clock to night/day cycles; the observable side-to-side sweeping motion of the telson probably serves to keep sediments away from fouling its sensors

## terminal projections

points of attachment where male clasper claws lock on to the back of a female during spawning; females that have spawned before show blackened "mating scar" markings in these areas (and on opisthosoma above it) where the rubbing of male claspers and shell have eroded the outer surface of the carapace



# *Limulus polyphemus* anatomy guide - ventral features

## chelicerae

pair of small feeding claws located just above the mouth, which serve to direct food into the mouth; one of the features that makes the HSC more like a spider than a true (crustacean) crab

## mouth

the HSC's unusual mouth sits between its legs; at the base of those legs surrounding the mouth are bunches of bristle-like spines, which the HSC uses to soften the food as it works it into its mouth

## pusher leg

among the neatest functional features of the HSC anatomy are the hind legs, ending in spatulate appendages, which they use for digging, pushing off the bottom (in scuttling) and (in females) for molding eggs into clusters; the broad strong spine at the base of the pusher is put to good use in opening clam shells (a favored food of HSCs); another key pusher leg structure is the **flabellum (F)**, which plays a key role in directing and assessing movement of water over the book gills (through hundreds of thousands of sensory receptors found on it)



## book gills

5 pairs of plate-like gills occupy this deeply-vaulted area of the HSC abdomen, with each plate bearing numerous thin sheets of tissue (appearing like pages in a book), allowing optimal surface area for respiration; in addition to their role in gas exchange, the book gill surfaces are loaded with sensory receptors for assessing the condition of the water; rapid flapping of the gills and operculum help propel the HSC in swimming & scuttling movements

## ventral eyes

microscopic photoreceptors embedded in the HSC shell in this area provide light information to the HSC when it's flipped over on its back

## flange (molting suture)

front rim of the HSC shell, where the shell splits in molting (typically appears yellow prior to molting)

## walking legs

on each side of the HSC are 4 sets of legs; in addition to aiding in moving and feeding, the tips of these legs are loaded with chemosensory receptors, enabling the HSC to "smell with its feet"; in adult male *Limulus*, the claws on the front pair of legs are modified into special structures used for clasp to a spawning female

male  
clasper  
claw



## chilaria

paired paddle-shaped structures in this area function in pushing food forward towards the mouth.

## sensory hairs

fine hairs along the surface of the carapace and channel help the HSC sense currents and other cues from the water around them

## anus

the end of the HSC digestive system - where it excretes its wastes

## operculum

this large strong flap of tissue protects the gills; it also works with the gills in helping propel the HSC in swimming and scuttling movements; on its underside are the gonopores, through which eggs (in females) and sperm (in males) are released during spawning

## tail muscle

a large muscle connects the telson to the rest of the shell; it is critical to an HSC's ability to right itself when flipped over; **NEVER** pick up a live HSC by its telson, as this can damage the muscle and hinder its survival; Note: the anus of the HSC is located just above this muscle