What's Inside a Turtle or Tortoise Shell?

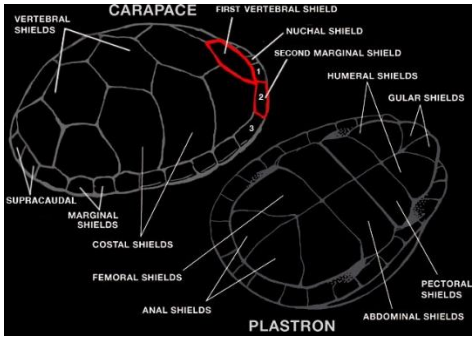
Turtles and tortoises, which are sometimes collectively referred to as the "chelonians" stemming from the formal name for which unites all members of the order Testudines, the turtles and tortoises, are one of the most unique groups of reptiles in that they are the only groups of reptiles with a (usually) hardened, outer shell when can oftentimes be used for protection and defense, as well as aiding in thermoregulation, locomotion, and movement. Just as with our hardened areas of our skin, such as our hair and nails, a turtle or tortoise's shell is comprised of a hard, bony material which is periodically shed off which is known a **keratin**. Some other turtles, however, such as softshell turtles, and a few other groups or genera found throughout the world, lack this hardened material in their shells, and are much softer and **cartilaginous**. This would be more akin to the softer areas of our body where there is no underlying bone, such as our ears and noses. The leatherback sea turtle takes it a step further, by having a shell nearly lacking in any bone structure at all, instead having a "shell" comprised of thick connective skin and tissue attached to an outer layer of thick, leathery skin.

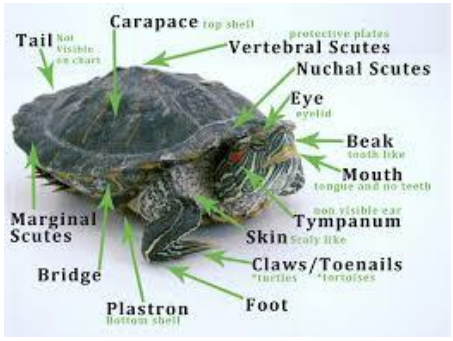
These shelled reptiles have existed and evolved over some-230 million years ago during the Triassic period, making them on of the oldest groups of reptiles. One popular misperception, however, which still sometimes persists to this day, is the notion that these reptiles can leave their shells, or the misconception that they periodically shed their shells in search of new homes. But is this really true? Do turtles and tortoises actually "walk out of their shells" like in the popular cartoons? Are they like hermit crabs or other crustaceans that will periodically find and use new shells as they grow? What actually is in a turtle or tortoise's shell?

Well, the answer to most of these questions is, not exactly! In this educational article, we will take a look at what is inside a turtle shell to better understand why these myths are outright false!

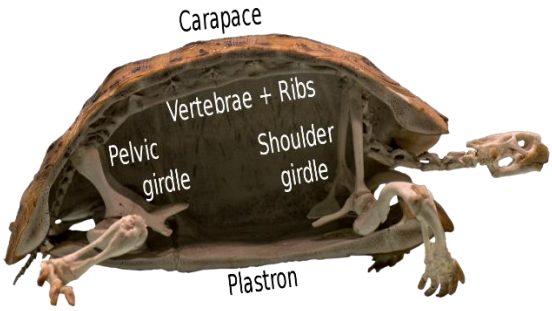
Starting on the outside, different parts, or areas of a turtle or tortoise's shell have different terminology. Each individual section, which is separated by the underlying layer of skin is called a **scute**, and the number of scutes, and their arrangements can vary significantly depending on each taxa. The upper, top, or dorsal part of a turtle or tortoise's shell is known as the **carapace**. The lower, bottom, or ventral half underneath is known as the **plastron**. The area of the shell connecting the carapace with the plastron, in-between the fore and hind-limbs along their sides is known as the **bridge**. And the scutes along the outer-most edges of the shell are simply known as the **marginals**, or marginal scutes.

Some groups of turtles (such as box turtles) also have a full or partial hinge located on about the forward third of their plastron which they can also use to withdraw the rest of their bodies into. However, a turtle's shell is not necessarily their temporary or permanent abodes of residences or "homes" as might be depicted in other folklore, but rather more of a means of defense against predators. But can turtles "feel" through their shells? Yes, they can! Millions of tiny, microscopic nerve endings which stem from the outer epidermal layer of the shell give them the same sense of "feel" that we do on the scalps ontop of our heads, for instance. These diagrams below, which includes more-in depth terminology than what will be covered here, is a good reference point to visually see the basic differences in these different parts of their shells.

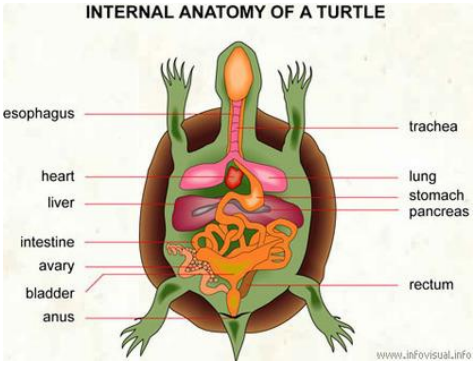


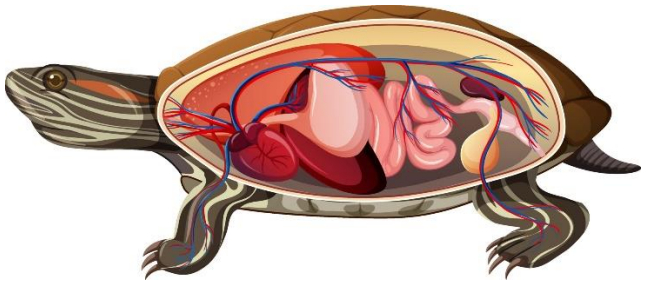


But what if you look inside an empty turtle shell? What can you see? You might be able to see their **vertebrae**, or spine, their **ribcage**, and/or maybe their **pelvic or pectoral girdles** where their shoulders and pelvis are attached. These are all components which make up their overall **skeletal structure**! The carapace, or upper shell is fused with their vertebrae and ribs, while the plastron, or underside, is formed from bones from their shoulder and pelvic girdles, sternums, and abdominal ribs. During development, the ribs grow sideways into a carapacial ridge, which are unique to these reptiles, and enter into the inner skin or **dermis** of the back. This is how their shell's are physically supported. So just as how we humans aren't actually able to walk out of our own skeletons, a turtle or tortoise's shell is part of their overall skeletal structure! This means that an empty turtle shell are simply the remains of a turtle which has died at some point, and where the rest of their body either decomposed over time, or perhaps were eaten by another animal.



So as with all reptiles, turtles and tortoises must periodically shed their skin and scutes in order to grow, which is known as **ecdysis**. This is dependent upon a number of different environmental factors, the turtle's age, species, and overall health and physical condition. While snakes might be able to shed their skins in one large, or a few large pieces, chelonians shed in a bit of a different way in that it is usually the large scutes of their carapace and/or plastron that we see periodically being shed, while the shedding of the rest of their bodies and skin tends to be much less perceptible to the naked eye, somewhat similar as in how fish shed their skin and finer scales. In many species, this shedding then leaves behind rings on the carapace scutes. However, it is another common misconception that these rings can determine the age of a turtle by how many times they have shed their scutes, as they all may be able to shed up to several times every year depending on the above described factors. Thus, a turtle's shell ***is not*** akin to the growth rings of the inner wood of a tree, as might also be commonly believed.





But what about the rest of their organs, and organ systems? Well, it turns out those systems are also all located internally inside of their shells as well! Turtles and tortoises have many of the same organs, organ systems, and functions that we do as humans, with only a few exceptions. Just like us, in addition to their above mentioned skeletal system, these reptiles have a circulatory system, as well as a respiratory system.

Other organ systems that they have in common with us include their nervous system, digestive system, an excretory system, and their reproductive system. That's a lot to pack into a more compact body or space, evolutionarily, but not all of their organs are as well-developed, are attached to one another, or function in all the same ways that our organs do in humans. Some of these organs, and organ systems may also function differently among different species or taxa as well, depending on whether the tend to be terrestrial or aquatic. As one could imagine, we could easily spend another article covering all of the more minute differences and functions in a chelonian's organs, and how they are similar to, and how they differ from ours; however, the main takeaway here is, yes, they have many of the same organs that we do! And, just like our skeletal systems, we can't leave our organs behind, either!

Sometimes, while hiking out in the woods, a prairie, or fields, one might find an empty turtle shell such as this that is white, or in the process of becoming white. What causes this? Are turtle shells normally "white"? Well, in living turtles, this can be caused by a number of different things; dietary or nutritional deficiencies (seen particularly in captive, pet turtles), fungal infections, or exposure to harsh chemicals, pollutants, or other environmental factors. In much rarer instances, some turtles may be white due to albinism or leucism, which are genetic traits, although this tends to be much less likely. However, in the case of an empty remains of a turtle shell, the cause is usually caused by environmental conditions over time. Exposure to heat and sunlight, or perhaps exposure to chemicals or other environmental factors tend to cause the shell's more natural colors and patterns to degrade and become lost over time, thus why it becomes white.

So there we have it! Everything that is inside a turtle or tortoise's shell!