

To better understand the trapezius muscle and the five cranial nerves necessary for social engagement



The fish can bend its spine from side to side. This side-to-side movement allows it to propel itself forward through the water efficiently by using its broad, powerful tail fin. The fish has other small fins like the one on its back and the other one on the underside of the body help to give it stability so that it does not roll from side to side. The small fins along the side of the head allow for fine control of steering and they also can be used to make small adjustments to keep the fish oriented in the water when it is not swimming forward..

There are some fish which for periods of time move out of the water and are able to travel over land or even climb trees before going back to the water.

Some wiggle and use pectoral fins to move about on the land. One lives in Southeast Asia from Malaysia to Northern Australia.
http://en.wikipedia.org/wiki/File:Periophthalmus_gracilis.jpg



Another species, The Climbing Gourami is often specifically referred to as a "walking fish." It does not actually "walk", but rather moves in a jerky way. It can support itself on the extended edges of its gill plates and push itself by its fins and tail. The Climbing Gourami is a fresh water fish and is found from Africa to India and the Philippines
http://en.wikipedia.org/wiki/Climbing_gourami



Moving up the evolutionary ladder from fish the next phylum is the amphibian.

Amphibians begin their life in the water. Then they crawl out of the water and live on the land. As an example, a tadpole develops from an egg. It swims in the pond in the first phase of its life. As the tadpole matures it develops into a frog and it leaves the water for a life on land.

<http://en.wikipedia.org/wiki/Frog>



Another major difference between the fish and the amphibians is that the fins of the fish have developed into arms and legs and hands and feet.

The frog has very long limbs and fingers in relationship to the size of its body. By contrast, in other species such as the salamander the arms and legs can be short and stumpy.



The arms and legs of a salamander are not so well developed in size when compared with a frog. But still, in the salamander, there are major developmental changes in the structure of the limbs compared with the fins of a fish.

Although structurally quite advanced from the fins of the fish, on the surface the short and stumpy legs and arms of the salamander resemble fins coming out from the sides of the body of a fish.

Amphibians such as frogs and salamanders have a spine similar to the fish.

There is no real movement into extension and flexion. Like a fish, the head of the frog and the salamander are extensions of their spine.

In the photo of the salamander skeleton to the right, we can see that the head of a salamander also resembles a specialized vertebra at the top of the spine.

The basic movement of the spine of the salamander is still side to side like a fish. It is also interesting to see just how much the body of the salamander can side-bend. Compared with a fish the spine of a salamander has better side-bending movement.



(The sources for the picture of the salamander¹)



The salamander moves forward by bending its spine in an undulating movement from side to side. Then it uses its stumpy legs to hold on to the ground as it bends in the other direction. Like the frog, the salamander does not have much movement of its spine in terms of flexing and extending.

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In other species of amphibians such as the frog, the arms and legs have developed even further away from the fins of a fish. Here in the photo to the right, you can see the skeleton of a bullfrog.



Unlike the salamander, the entire spine of the frog is more or less rigid. Like the salamander, the head of the frog is on the same plane as the vertebrae of the spine. Albeit specially formed in some respects its head looks like another vertebra on the top of the spine. <http://en.wikipedia.org/wiki/Frog>

This bullfrog skeleton shows elongated limbs and extra joints. Red marks indicate bones which have been substantially elongated in frogs and joints which have become highly mobile. Blue indicates joints and bones which have not been modified or only somewhat elongated.

Well developed leg muscles and a more or less rigid spine allow the frog to jump efficiently. In fact, the leg muscles are so large that frog's legs are eaten in some European countries. People who eat frog's legs say that they taste somewhat like chicken. Properly seasoned and prepared, they are considered a delicacy in some cuisines.

The frog jumps or springs using symmetrical movements of its arms and legs. It does not "walk" bringing one leg forward and the other backwards. Therefore there is very little rotational movement of the shoulder girdle or the hip girdle in relationship to the spine.

The next step up from amphibians – reptiles.

The legs of a reptile are not limited to the symmetrical movements of jumping and springing like in the frog. The legs of a reptile are no longer stumpy little things stuck out to the side of the body like in the salamander.

It is first when we move up to the level of a reptile that we find the ability to move one leg at a time, or to move the two legs in opposition to each other, i.e. one in extension and the other in flexion. In the picture to the right, you can see the differentiation and asymmetry of movement of the right and left arms. Unlike the salamander, the arms and legs can also raise the body significantly from the earth allowing it to move more efficiently and more quickly.



The torso of the reptile is more or less stable. This allows the arms and legs to move in relationship to the torso with the help of well developed shoulder and hip girdles.

Reptiles also have the beginnings of rotational movement of the arms in the shoulder joint and the legs in the hip joint. The movement of their limbs starts to bear a resemblance to the movement patterns of 4-legged mammals, primates and human beings.

There is another major difference between the spine of the amphibians, and the spine of reptiles, mammals and human beings.

This occurs both at the top of the thorax and at the Atlanto-occipital joint.

The fish can more or less only see what is in front of it. A fish has no neck.

A fish can move its eyes to be able to look around in a limited way, but it cannot move its head on its body. In order to realign its head in space it more or less has to move its entire body. This is far less efficient than the possibilities of reptile, mammal or human being which can keep the body in one position and move their head around.

In reptiles, there is freedom of movement of the head in relationship to the neck.

This freedom of movement is possible because of the biomechanical structures of the joints between the base of the skull and the three vertebrae at the top of the neck.

There is also freedom of movement of the neck in relationship to the torso. Unlike the fish and salamander, the reptiles and mammals can not only move their heads in relation to the top of its neck but it can also be able to move its neck on top of the thorax. This movement of the neck on the body possible due to the biomechanics of the joints between the three vertebrae at the base of the neck and the first vertebra of the thoracic spine.

Combining the two movements – one at the top and at the other at the bottom of the neck – a reptile can move its heads around in almost all directions to better be able to see, smell, hear and taste with its tongue.

The cervical spine is arched into extension lifting the head up to a higher level than the shoulders and the rest of the spine. Arching of its neck allows the lizard to look around and to orient itself to its surroundings in a new way. The lizard orients its head in space to allow it to use other highly developed senses. It hears low frequency sounds. It smells with receptors which are located in its forked tongue.

Compared with amphibians, when we get up to the level of reptiles we see a functional change in the relationship between the skull, C1, C2 and the rest of the spine.

The head and neck of the reptile are arched back in a way that is similar to 4-legged mammals. Their legs are no longer just little things stuck out to the side of the body like salamanders.

Lizards can support themselves on their legs. They lift their head and body up from the earth. The lizard can move its head to look around in way that is profoundly different from the fish or the salamander.

The skeletal joint that gives the greatest freedom of movement is a ball in socket.

Ideally the joints between the head and neck and the neck and the body should be like balls in sockets.



Consider ball in the socket construction other joints in the body. We find one in the shoulder joint and another in the hip joint. In the drawing to the left, we see that the head of the femur is shaped like a ball.

The cup shaped socket in the hip bone is called the acetabulum. In the drawing to the right, you can see how the head of the femur fits perfectly into the acetabulum. (For the purposes of drawing, the two bones have been separated from each other.)



No animal living on the earth today has such a ball in socket joint at the head and neck junction or at the neck thorax junctions.

However, in the past, at least one dinosaur, the triceratops, had a ball and socket joint between its head and neck.

The triceratops was a vegetarian. It was not a hunter. It could not attack other dinosaurs in order to eat them. It did not have the teeth to be a flesh-eater.

However, it had to protect itself from other predators. It lived 68 to 65 million years ago in the same period as the tyrannosaurus rex.

Their most distinctive feature is their large skull, among the largest of all land animals. The largest known triceratops skull is estimated to have been 2.5 meters (8.2 ft) in length when complete.



This photo of the skeleton of a triceratops gives us an idea of the enormous head. Its head measured almost a third of the length of the entire animal.

Its head was also heavy due to the thick armored plates. The plates protected the soft organs of the face such as the eyes, nose and mouth. The large plate sweeping up from the front of the head made it almost impossible for another animal to grab the back of its neck in a frontal attack.

We have only the skeletal remains. At best we can guess about its movement and behavior. Traditionally the three horns have been viewed as defensive weapons against predators. The triceratops could counter-attack by swinging the enormous weight its head in order to be able to thrust with its three large horns.

It bore a pair of horns approximately 1 m (3 ft) long, with one above each eye. It also had a single horn on the snout, above the nostrils. The photo does not do justice to the horn coming from just above the snout. The

third horn of this specimen had been broken off and was not found with the other bones.

<http://en.wikipedia.org/wiki/Triceratops>

It most likely used its horns and armored head to defend itself against carnivorous predators. More recent theories suggest that it is probable that these features were also used in identification, courtship and dominance displays, much like the antlers and horns of modern reindeer, mountain goats, or rhinoceros beetles.

The triceratops had to keep its faced turned towards an attacking predator at all times. It had little way of protecting itself if an attacker came in from the side or from behind. It is postulated that a group of adult triceratops would form a circle with the young triceratops in the middle. In that way they would not only protect each other, but they also could protect the young.

For the individual triceratops it was crucial for its survival to have the greatest possible freedom of movement of its head on its neck. Its strong neck muscles had to be precise in the steering the movements of its head to keep itself exactly facing the predator in front of it. For the triceratops, the ball and socket joint of its head/neck relationship was the perfect skeletal solution.

Compared with amphibians, when we get up to the level of a reptile that we see a change in the relationship between the skull, C1, C2 and the rest of the spine.

The head and neck of the reptile are arched back in a way that is similar to 4-legged mammals. Their legs are no longer little things stuck out to the side of the body useful primarily to hold the body in relationship to the ground while the undulating movement of the body moves it forward. In lizards, the arms and legs are used for locomotion while the body is more or less stable.

Lizards also can raise their head and body from the earth. The lizard can move its head in order to look around in way that is profoundly different then what is possible for the fish or the salamander.

When we get to C1 and C2 in a lizard, we have a totally different kind of biomechanical construction that in some ways allows movements that resemble that of 4-legged mammals.

Movement of the head/neck in mammals.

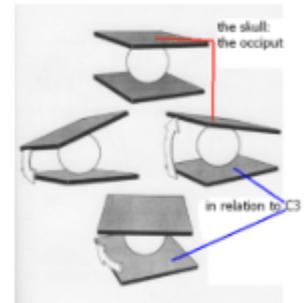
We usually move our head without thinking about the movement. We turn our head to be able to see or hear better what is going on around us.

We can tip our head up and down. We can rotate it to the right and to the left. We can also side-bend our head like the cat in the photo at the right. We can move in one of these directions at a time, but we generally combine all three vectors as we move our head from one position to another.



Human beings and other mammals do not have true ball and socket joints between the head and neck or between the neck and the thorax like the triceratops. Regardless, the head should be free to move in all directions like a swivel.

If we combine the biomechanical properties of the occiput, C1, C2, and C3, taken as a whole, we have a skeletal structure that is almost as good as the triceratops in terms of allowing us to move our head freely.



The same goes for the bottom of the neck, if we consider C5, C6, C7 and T1 to be an integrated, biomechanical unit, then we have the possibility to have a well functioning swivel-like movement.

If we want to improve the relationship at the top of the cervical spine in order to improve the function of the five cranial nerves whose function is necessary for social engagement, then it is crucial to improve the relationship at the base of the cervical spine.

All too often in our traditional understanding of the biomechanics of the spine, we overlook the interdependence of the movement of the two swivels – the one at the top of the neck and the other at the bottom of the neck. We often treat the top of the neck and neglect the base of the neck.

This applies to both people doing manipulation (high velocity short thrust techniques) and most massage therapists. It takes long training and great skill for a chiropractor or an osteopath to do an effective, successful manipulation of the top of the neck.

The technique to adjust the atlas gave such good results that Daniel Donald Palmer, the founder of chiropractic, called it “the hole in one”.

No one can argue with success. Perhaps the reason that patients keep coming back for adjustments is that there is more to the story – the bottom of the neck.

The same goes for massage therapists. It is easier to dig deeply into the muscles at the top of the neck and harder to have a clear picture of what is going on at a skeletal level at the base of the neck.

Also, most exercises for the neck have the same shortcoming. This is true even for the movement tests by doctors and physical therapists who ask the person to move their head and then not the range of movement.

We will come back to exercises and manual treatments that take account of this often overlooked, important biomechanical relationship between the neck and the thorax. You will be presented for two exercises: the salamander and the lion which work on the top of the neck and the base of the neck simultaneously. You will also learn how you can use your hands to help someone else.