

Anatomy and Terminology of the Spine

The **spine**, also called the **spinal column**, **vertebral column** or **backbone**, consists of bones, intervertebral discs, ligaments, and joints. In addition, the spine serves as the attachment point for numerous muscles. The spine surrounds (and protects) the spinal cord and nerve roots.

In phylogenetic or evolutionary terms, the spine is the anatomical structure that links us to higher organisms, i.e. the Vertebrates (fish, amphibians, reptiles, birds and mammals). We share this structure with about 60,000 other species. A vertebral column differentiates us from the Invertebrates (e.g. insects, spiders, worms, sea creatures, etc.), which comprise 95% of all animal species.

Bones of the Spine (Vertebrae)

The human spine consists of 33 vertebrae (Figure 1):

- 7 **Cervical** vertebrae (C1-C7)
- 12 **Thoracic** vertebrae (T1-T12)
- 5 **Lumbar** vertebrae (L1-L5)
- 5 **Sacral** vertebrae - fused to make up the **sacrum**
- 4 **Coccygeal** vertebrae - fused to make up the **coccyx** (tailbone)

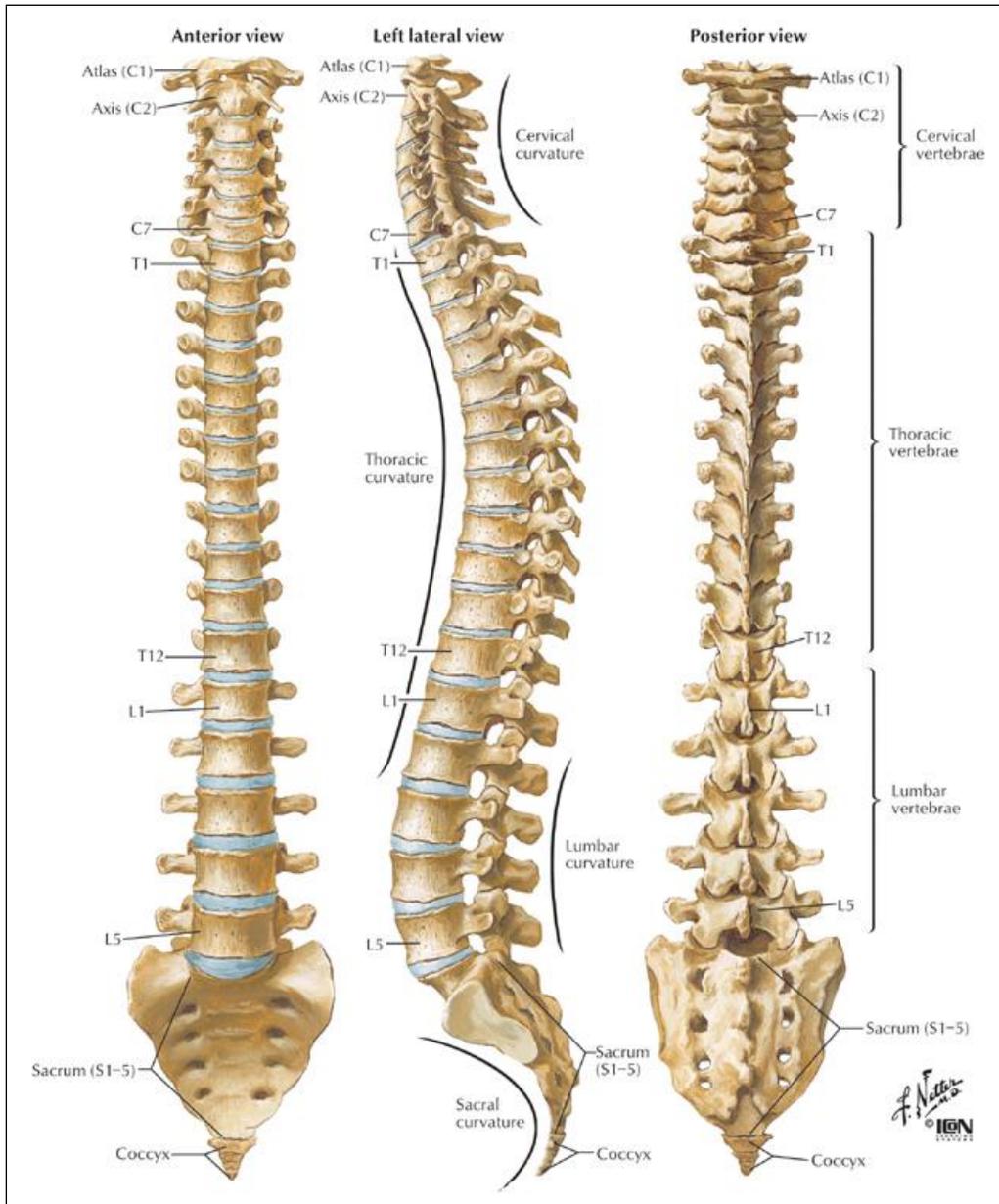


Figure 1: Views of the Spine

Shape of the Spine

Normally, the cervical and lumbar portions of the spine have smooth lordotic curves, while the thoracic spine and sacrum-coccyx have kyphotic curves (Figure 1).

Parts of a Vertebra

The various parts of a typical lumbar vertebra are seen in Figure 3. All vertebrae have the same parts. The various parts of the vertebrae vary in shape and proportion at different levels of the spine.

The basic parts of a vertebra include the **vertebral body** (a.k.a. corpus), **pedicles**, **transverse processes**, **lamina**, **superior and inferior facets** (a.k.a. **superior and inferior facet processes**, or **superior and inferior articular processes**) and **spinous processes**. The region between the superior and inferior articular facets is called the **pars interarticularis**, or **pars**. Bilateral pars fractures, known as **spondylolysis**, causes a separation between the pedicles/vertebral body/ superior articular facets and the lamina/spinous process/inferior articular facets. This is one cause of spondylolisthesis.

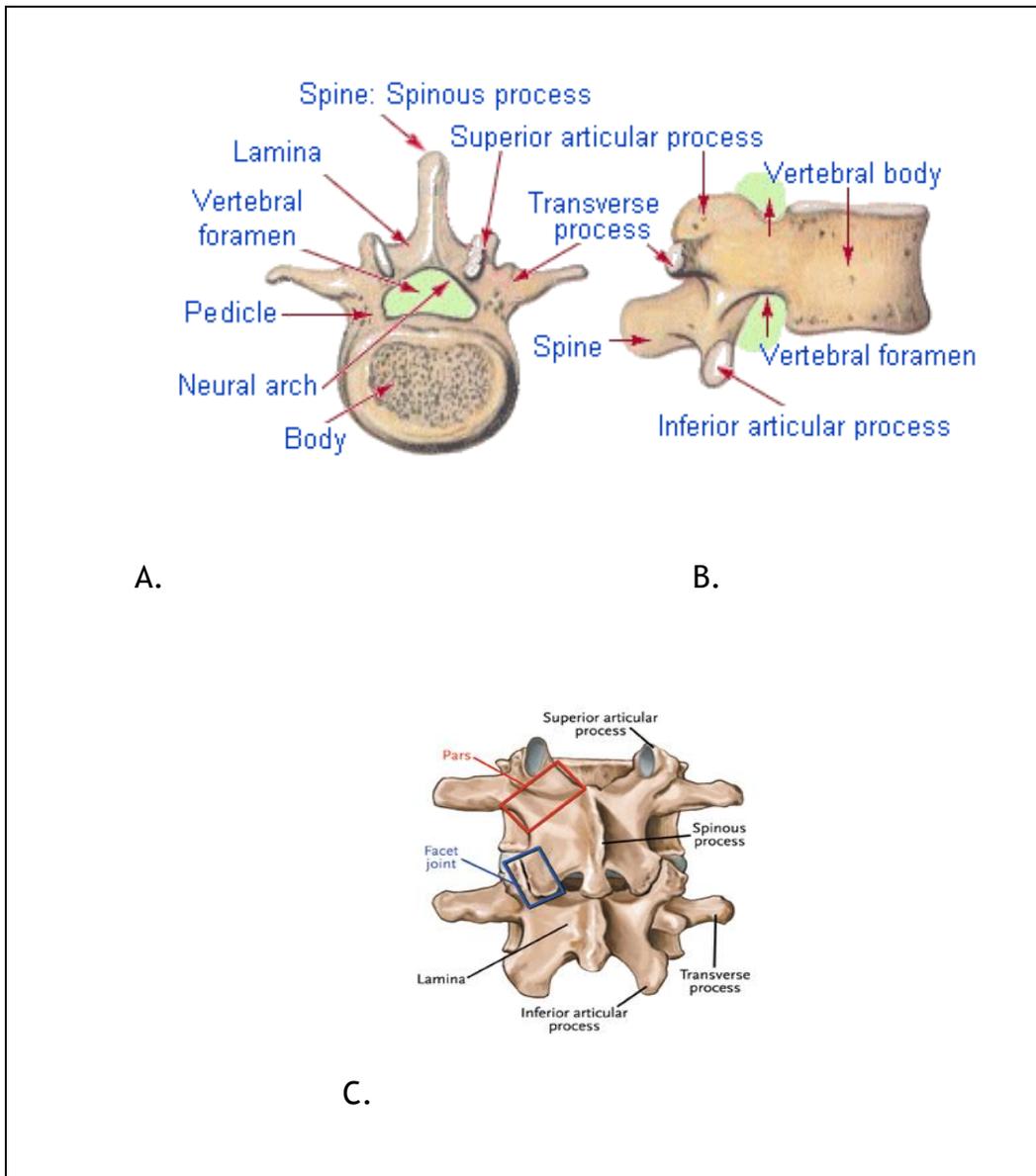


Figure 3: Parts of a Typical Lumbar Vertebra.

A: Superior view. Posterior is up, anterior is down.

B: Right lateral view.

C: Posterior View.

Intervertebral Discs

Between the vertebrae are the **intervertebral discs**, or simply, **discs**. The discs are named according to which two vertebrae they are between. For example, the disc between the 3rd and 4th cervical vertebrae is called the C3-4 disc. The disc between the 5th lumbar and 1st sacral vertebrae is called the L5-S1 disc.

Discs have two parts (Figures 5, 6). The outer part, called the **annulus fibrosus** or **annulus**, forms a ring or capsule around the disc. It is made of a type of cartilage called fibrocartilage. The annulus surrounds the inner portion of the disc that is called the **nucleus pulposus** or **nucleus**. The nucleus is also made of a type of cartilage called nuclear cartilage. Intervertebral discs act like cushions or shock absorbers between the vertebrae.

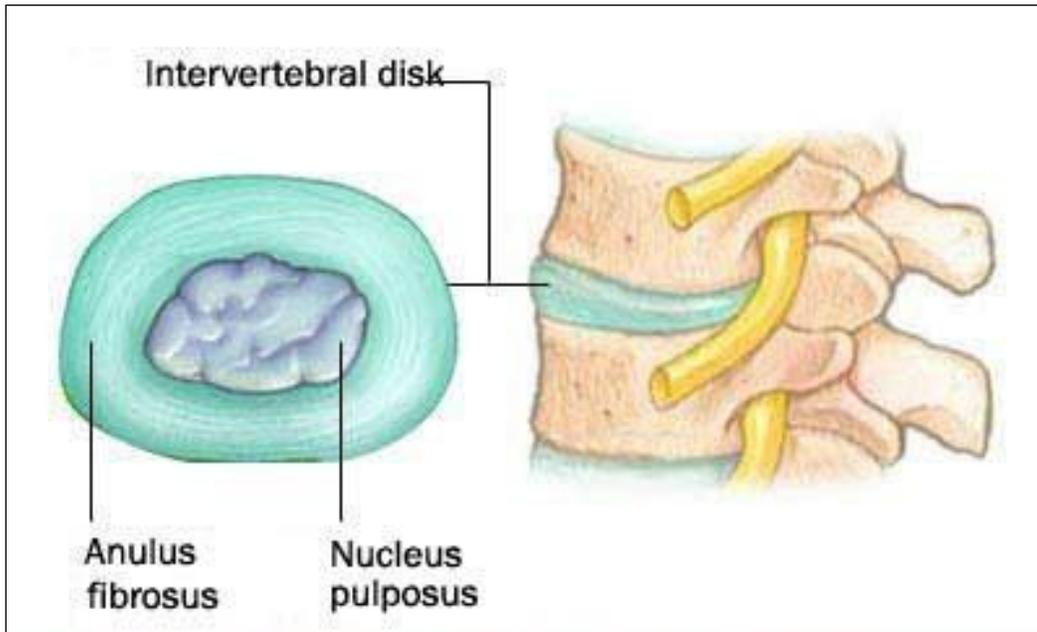


Figure 5: Intervertebral Disc and Nerve Roots

Spinal Nerves, Spinal Cord and Cauda Equina

The space that runs down the length of the vertebral column from the head to the tailbone is called the **spinal canal** or **vertebral foramen**. A large nerve bundle, the **spinal cord**, which is an extension of the brain, runs inside the spinal canal from C1 to L1. The spinal canal has openings called **neural foramens** for exiting **spinal nerves** (or entering, depending on your perspective) at each vertebral level (Figures 5-8).

The portion of each nerve (inside the spinal canal) from the spinal cord to the neural foramen is called the **nerve root**. The nerve roots are named according to which vertebral level they exit, e.g. the right C5 nerve root exits at the C5 level, the left L5 nerve root enters at the L5 level. The nerve roots in the cervical spine are short, those in the thoracic spine intermediate in length and those in the lumbar and sacral spine quite long. Outside the spine, the nerve roots combine with each other to form **peripheral nerves** that go to all parts of the body (Figures 5, 6, 7, 8).

The spinal cord ends at the bottom of L1. The last segment of the spinal cord tapers in the shape of a cone and is called the **conus medullaris**. From L1 to the coccyx the nerve roots run together in the spinal canal in a grouping known as the **cauda equina** (Latin, “horse’s tail,”) because the nerve roots as a group resemble a horse’s tail (Figure 7).

Surrounding the nerves and spinal cord, within the spinal canal, are a series of three membranes called the **meninges**. From outside to in, these are the **dura mater** or **dura**, **arachnoid mater** or **arachnoid**, and **pia mater** or **pia**. The arachnoid itself is a web of tissue in which flows a fluid known as **cerebrospinal fluid**. The thin space outside dura but within the spinal canal is called the **epidural space** (Figure 8).

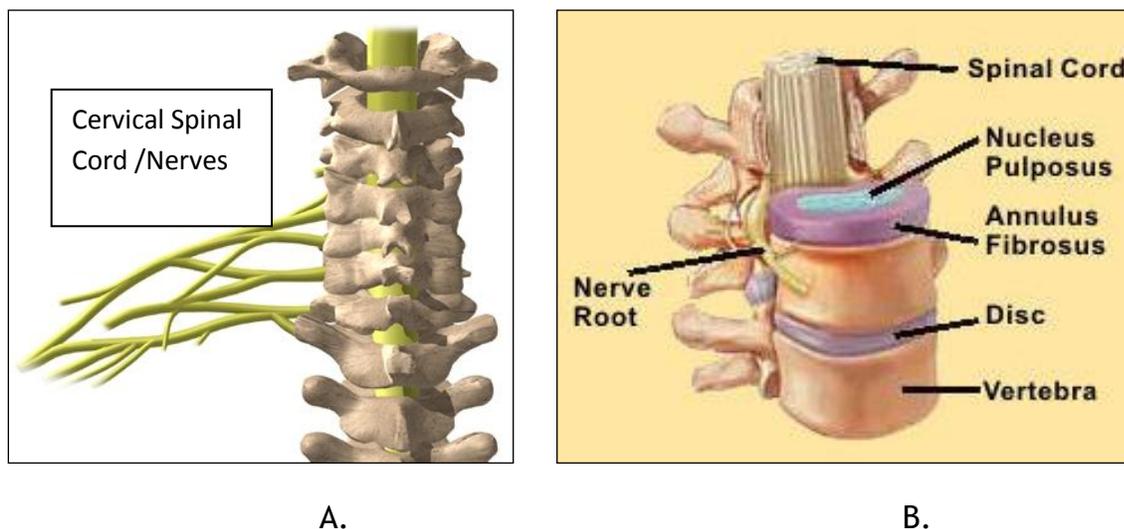


Figure 6: Spinal Cord and Nerves. A: Posterior (back) view of the cervical spine to show the spinal cord and nerves to the left arm. B: Right anterior (front) view of the spine to show anatomy of disc, spinal cord and nerve roots.

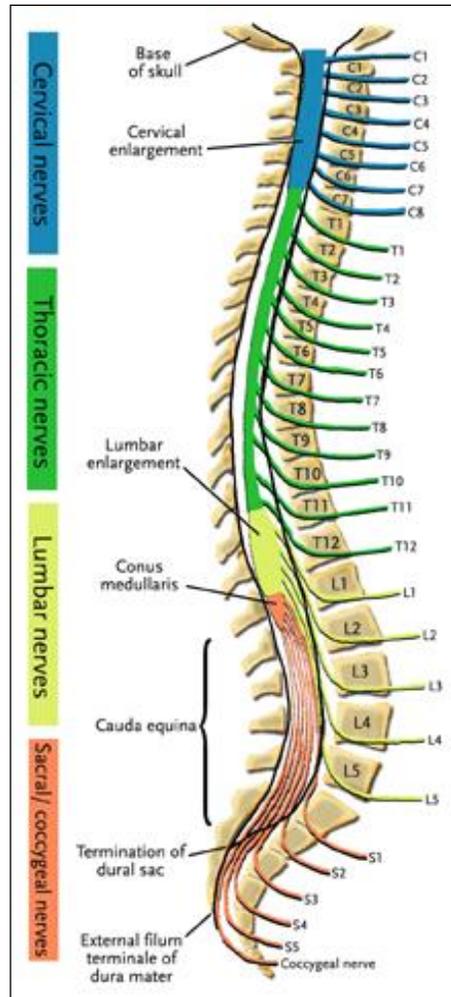
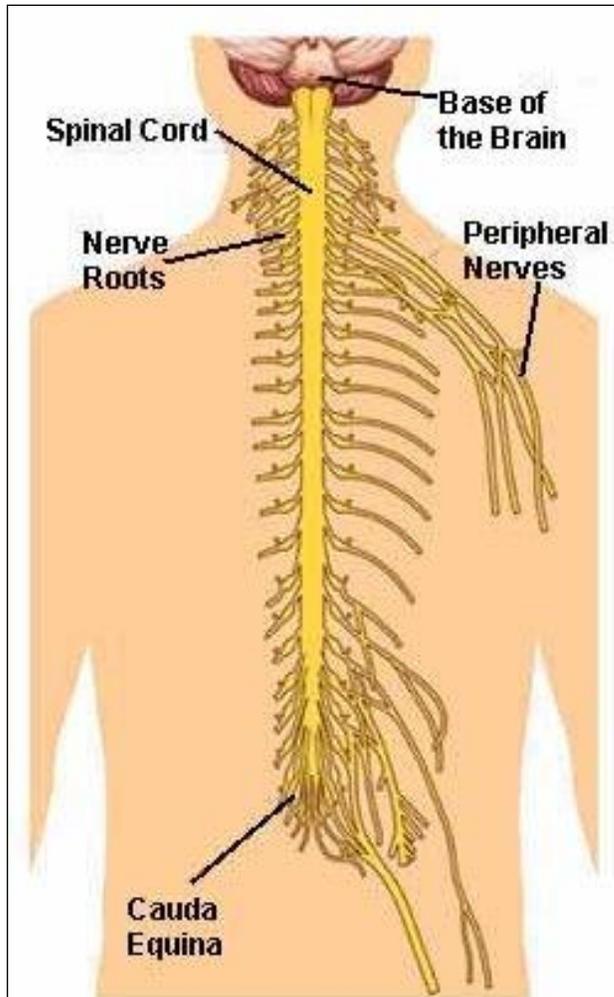


Figure 7: Spinal Cord, Nerve Roots, Peripheral Nerves and Cauda Equina.

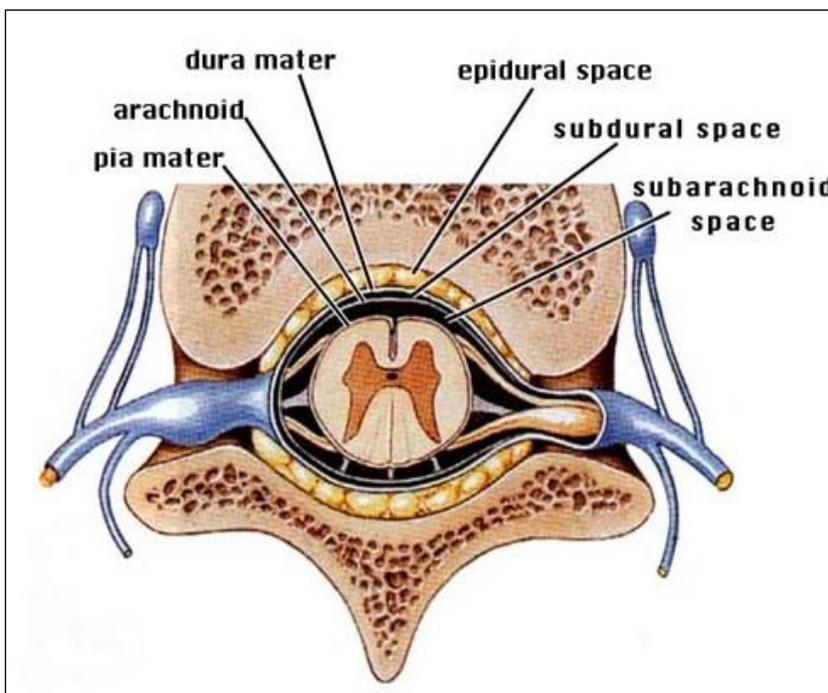


Figure 8: Cross section through the spine. Down is posterior, up is anterior.

Ligaments and Joints of the Spine

There are moveable joints that connect each vertebra to the next (and to the skull or sacrum). These are called **facet joints**. There are also ligaments between the vertebrae (**anterior longitudinal ligament**, **posterior longitudinal ligament**, **ligamentum flavum**, **interspinous ligament**, **supraspinous ligament** and **facet joint capsules** (Figure 9).

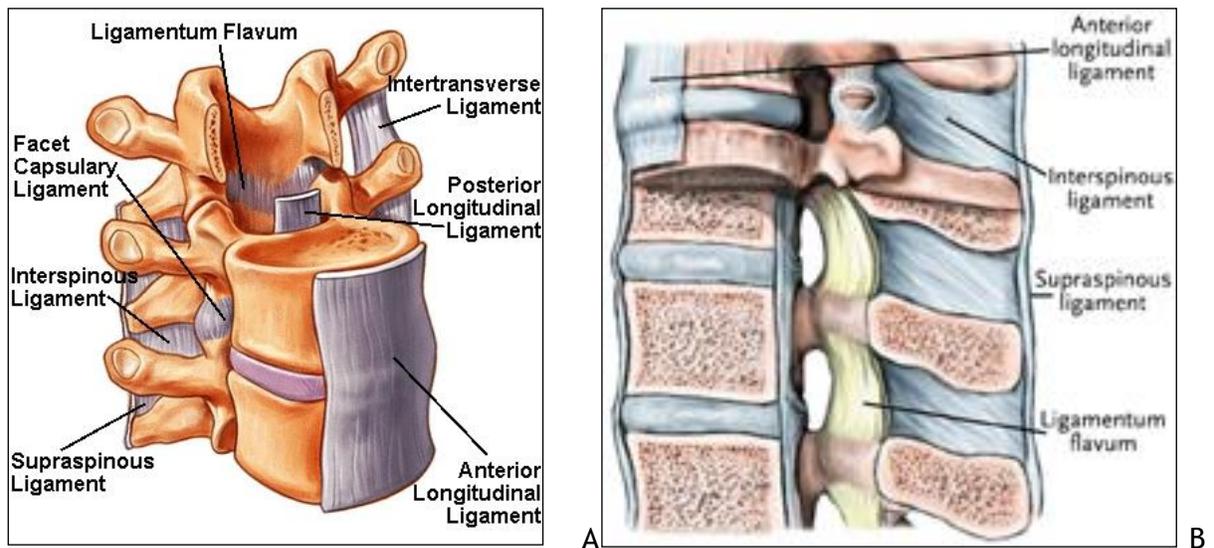


Figure 9: Ligaments of the Spine.

A: Right and anterior (front) view of the spine. B: Cutaway view of the spine from the left.

Muscles of the Spine

The muscles of the spine, which produce movement and heat, are numerous. Collectively they can be called the **paraspinous muscles** (Latin, para - adjacent to) (Figure 10).

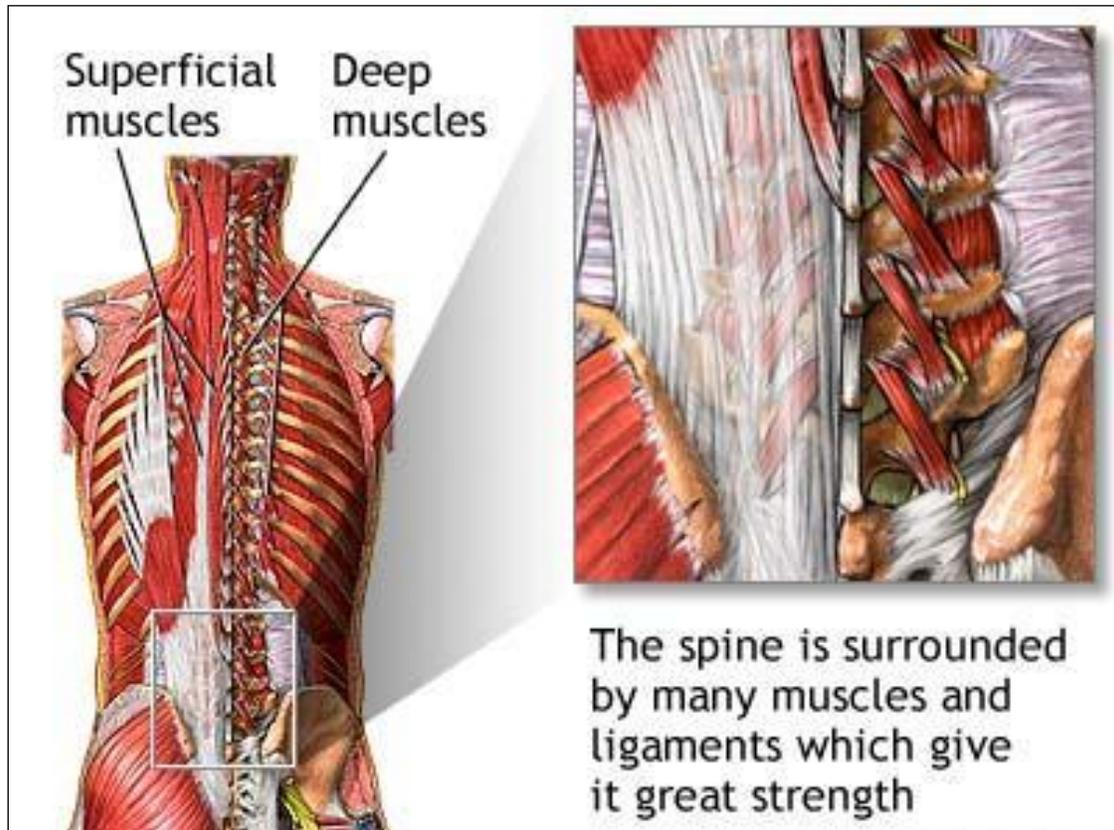


Figure 10: Muscles of the Spine.