

General Neural Pathways

Spinal Nerve -

Dorsal Root of the Spinal Nerve -

Dorsal Root Ganglion -

Ventral Root -

Gray “H” -

Posterior Dorsal Horn -

Anterior Ventral Horn -

Columns -

1° neuron -

2° neuron -

3° neuron -

General Neural Pathways

Spinal Nerve – A mixed nerve

Dorsal Root of the Spinal Nerve - sensory neurons going from the body to the brain

Dorsal Root Ganglion – The cell bodies of the sensory nerves are located here

Ventral Root – motor neurons from the brain to the body

Gray “H” - The unmyelinated cell bodies in the spinal cord.

Posterior Dorsal Horn - Carry mostly sensory neurons

Anterior Ventral Horn – Carry mostly motor neurons

Columns - A posterior, lateral, and anterior portion of the spinal column that is mostly white due to the myelinated axons found here.

1° neuron – receptors in the body are stimulated and the impulse travels down the 1° neuron. It synapses with the 2° neuron in the gray “H”.

2° neuron – travels up the spinal cord, generally to the thalamus and synapses with the 3° neuron.

3° neuron – travels from the thalamus to the the post central gyrus of the cerebrum

Pain and Temperature Pathway

Contralateral –

Ipsilateral –

1° neuron -

2° neuron -

3° neuron -

Lateralspinothalamic tract –

internuclear neuron -

Reflex –

Pain and Temperature Pathway

Contralateral – the opposite side

Ipsilateral – the same side

1° neuron - enter the spine via the dorsal spinal root. The 1° neuron synapses with a 2° neuron in the dorsal horn (at the spinal level where it enters the cord (mostly)).

2° neuron - The axon of this 2° neuron moves to the contralateral side of the cord which means the opposite side. The axon now runs superiorly up the spinal cord in the lateral column on the opposite side of the cord to side of the body from which the 1° neuron started. This is important because it explains why the opposite side of the brain controls the opposite side of the body.

3° neuron – Synapses with the 2° neuron in the thalamus and travels to the post central gyrus. The post central gyrus is the major sensory receptive area of the cerebrum/cortex and is located in the parietal lobe.

Lateralspinothalamic tract – pain and temperature travel up the lateral white columns of the spine to the thalamus. - in the lateral column.

internuclear neuron - The function of the internuclear neuron is to act as a reflex neuron (stimulates a motor neuron to move the body part out of harms way).

Reflex – an involuntary motor response. In a painful sensory situation, the stimulus “jumps” the the internuclear neuron which will trigger the motor neuron to move the muscle at a sub-conscious level as a protective action.

Sensory Input Definitions

Dermatome –

Pressure –

Crude touch –

Fine Touch –

Two point discrimination –

Stereognosis –

Proprioception –

Vibratory sense –

Bifurcate –

Decussate –

Sensory Input Definitions

Dermatome – an area of the body served by the sensory portion of one spinal nerve. Sensory input from the body comes from a very specific region known as a dermatome. Dermatome level examples:

- x T4 - chest area around the nipples

- x T-10 – the umbilicus area

Pressure – any degree of sustained force on the body. (it can be experienced as pressure and something else (vibration/pain/etc...))

Crude touch – widely separated two point discrimination. You just know you are being touched.

Fine Touch – implies the touch point discrimination is much finer.

Two point discrimination – how near (or far apart) two objects can be to one another when they touch the body and still be able to distinguish between two objects or one object. (Fingers and tongue have the highest degree of two point discrimination. The upper back has very poor two point discrimination.)

Stereognosis – “feeling in three dimensions” Being able to identify by feel what you are touching. (fine touch to the extent that you can identify structures by touch)

Proprioception – Being able to tell where your body is at without looking at it. The sensors are found in muscles, joints, and tendons. What your brain uses to tell where the body is. (located deep in the body)

Vibratory sense – there are sense receptors in the skin that detect vibration. (Like pain and other things it can be associated with other things...)

Bifurcate – split into two.

Decussate – to move to the contralateral side.

Pressure and Crude Touch

1° neuron -

2° neuron –

Ventralspinalthalamic tract -

3° neuron -

Pressure and Crude Touch

1° neuron - With pressure and crude touch the 1 order neuron is located somewhere in the body outside of the spinal cord. It's cell body is located in the dorsal root ganglion. When it enters the cord it bifurcates which means it splits into two. Half enters the dorsal horn right where it enters, the other goes up (or sometimes down) and enters at a different level of the spinal cord.

2° neuron – With both 1° synapses, the 2nd order neuron that decussates and heads up the ventral column. These axons travel to and synapse with a 3^o neural in the thalamus.

Ventralspinalthalamic tract - this is in the ventral column.

3° neuron - The 3rd order neurons now runs up to the post central gyrus of the cortex.

Pathway for proprioception, fine touch, and vibratory sense

1° neuron –
Fasciculus gracilis –
Fasciculus cuneatus –
2° neuron -
3° neuron -
Proprioception –

Pathway for proprioception, fine touch, and vibratory sense

1° neuron – The neurons enter the spinal column and travel ipsilaterally (making up the entire dorsal columns) all the way up to the medulla. The posterior columns are divided into a left and right Fasciculus gracilis (medially) and left and right Fasciculus cuneatus (laterally) Cell bodies are in the dorsal root ganglion.
Fasciculus gracilis – carries the 1° neuron from the lower part of the body.
Fasciculus cuneatus – carries the 1° neuron from the upper part of the body.
2° neuron - decussate and head to the thalamus, and there, synapse with a 3° neuron
3° neuron - go to the post central gyrus.
Proprioception – the receptors are located within muscles, joints, tendons and are considered deep within the body.

Sensory pathways from the face and related areas

Trigeminal nerve –

General senses –

Special Senses –

Spinal nerves are always –

Cranial nerves can be –

The cell bodies of the 1^o neurons of CN V –

Pain and temperature –

Pressure and crude touch –

Proprioception & fine touch –

Sensory pathways from the face and related areas

Trigeminal nerve – Ophthalmic division, maxillary division, and mandibular division. (V1, V2, and V3)

General senses – pain, temperature, proprioception, temperature, not specific

Special Senses – hearing, taste, smell, vision, balance

Spinal nerves are always mixed nerves. They never carry special senses.

Cranial nerves can be mixed, all motor, or all sensory. It can also carry all special senses, all general senses, or a combination.

The cell bodies of the 1^o neurons of CN V are found in the semilunar ganglion or trigeminal ganglion.

Pain and temperature – Nucleus of the descending tract. 1st order neurons enter the brain stem (at the pons) and synapse with 2nd order neurons and synapse in the nucleus of the descending tract of cranial nerve V that is in the medulla..

The 2nd order neurons decussate and go to the thalamus and these synapse with the 3rd order neurons which in turn head to the post central gyrus.

Pressure and crude touch – have their own ganglion the main sensory nucleus in the pons. 1st order neurons synapse with the 2nd order neurons synapse in the pons at the main sensory nucleus of Cranial nerve V. Only half of the second order neurons decussate and head to the thalamus. The rest stay ipsilateral and head to the thalamus. The clinical significance of this is that if you have damage to one side of the cortex only, you'll lose pain and temperature to the opposite side of the face, but since pressure and crude touch doesn't all decussate, you don't lose all pressure and crude touch to both sides of the face.

Proprioception & fine touch – Not really understood well here. There are receptors in the (medial and lateral-(opens the mouth) pterygoid, masseter, temporalis) muscles of mastication and the temporal mandibular joint.