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Sensory information from the periphery of the humans ascends through the [spinal cord](https://en.wikivet.net/Spinal_Cord_-_Anatomy_%26_Physiology) and enters the higher levels of the brain. There are numerous pathways which allow different types of information to be passed to the brain. Types of general somatic sensation include pain, touch, temperature and kinaesthesia (conscious proprioception). This sensory information is sent to one of two destinations; the [cerebral cortex](https://en.wikivet.net/Forebrain_-_Anatomy_%26_Physiology#Cerebral_Coretex) or the [cerebellum](https://en.wikivet.net/Hindbrain_-_Anatomy_%26_Physiology#Cerebellum).

When sensory information is relayed to the [cerebral cortex](https://en.wikivet.net/Forebrain_-_Anatomy_%26_Physiology#Cerebral_Cortex), information first passes via the [thalamus](https://en.wikivet.net/Forebrain_-_Anatomy_%26_Physiology#Thalamus). The signal may be relayed one or more times by the [thalamus](https://en.wikivet.net/Forebrain_-_Anatomy_%26_Physiology#Thalamus) en route to the [cortex](https://en.wikivet.net/Forebrain_-_Anatomy_%26_Physiology#Cerebral_Cortex). This sensory information reaches higher levels within the brain and therefore consciousness. The [cerebellum](https://en.wikivet.net/Hindbrain_-_Anatomy_%26_Physiology#Cerebellum) is involved in co-ordination and this sensory information does not reach consciousness.

Sensory information enters the [spinal cord](https://en.wikivet.net/Spinal_Cord_-_Anatomy_%26_Physiology) on the same side of the body as the stimulus. Ascending tracts cross over the midline of the body to the contralateral side of the [thalamus](https://en.wikivet.net/Forebrain_-_Anatomy_%26_Physiology#Thalamus). The [thalamus](https://en.wikivet.net/Forebrain_-_Anatomy_%26_Physiology#Thalamus) directs the signal to the [cerebral cortex](https://en.wikivet.net/Forebrain_-_Anatomy_%26_Physiology#Cerebral_Cortex) for conscious perception. The pathway is direct with very few [neurones](https://en.wikivet.net/PNS_Structure_-_Anatomy_%26_Physiology#Nerve_Fibre) involved.

#### 1. Dorsal Columns

Dorsal columns transmit information from touch and kinaesthesia; these are both classified as low threshold information. There are two major dorsal columns; the *gracile fasiculus* situated medially which conveys information from the hindlimbs and caudal trunk and the *cuneate fasciculus* which is situated more laterally and conveys information from the forelimbs and cranial trunk.

#### 2. Spinothalamic Tracts

Spinothalamic tracts transmit information from temperature and "pin prick" pain; these senses are classified as fast, initial pain sensations. These tracts compare with the [ascending reticular formation](https://en.wikivet.net/Sensory_Pathways_-_Anatomy_%26_Physiology#Ascending_Reticular_Formation).

#### 3. Spinocervicothalamic Tracts

The spinocervicothalamic tracts transmit information from touch and kinaesthesia, although these are absent in man.

### Spinocerebellar Tracts

These tracts transmit information from proprioception receptors, including information from muscle receptors, joint receptors and golgi tendon organs. Most sensory information enters the [spinal cord](https://en.wikivet.net/Spinal_Cord_-_Anatomy_%26_Physiology) on the ipsilateral side to the stimulus but some do cross to the contralateral side of the body. Contralateral signals pass back to the ipsilateral side of the body in the brain. Information is processed in the [cerebellum](https://en.wikivet.net/Hindbrain_-_Anatomy_%26_Physiology#Cerebellum) and is therefore processed unconsciously.

#### Dorsal Spinocerebellar Tract

The dorsal spinocerebellar tract relays muscle spindle and golgi tendon organ information from the hindlimbs to the [cerebellum](https://en.wikivet.net/Hindbrain_-_Anatomy_%26_Physiology#Cerebellum).

#### Cuneo-cerebellar Tract

The cuneo-cerebellar tract serves the same purpose for the forelimbs as the dorsal spinocerebellar tract does for the hind limbs, but is much smaller.

#### Ventral Spinocerebellar Tract

The ventral spinocerebellar tract is similar to the dorsal spinocerebellar tract but it takes a less direct route to the [cerebellum](https://en.wikivet.net/Hindbrain_-_Anatomy_%26_Physiology#Cerebellum). The forelimb equivalent is called the rostral spinocerebellar tract.

### Ascending Reticular Formation (Spinoreticular Tract)

The ascending reticular formation is thought of as the true pain sensation as the pain lasts longer. Sensory information enters the [spinal cord](https://en.wikivet.net/Spinal_Column_-_Anatomy_%26_Physiology) on the ipsilateral side of the stimulus. Some signals cross to the contralateral side of the body. The tract consists of several [short neurones](https://en.wikivet.net/PNS_Structure_-_Anatomy_%26_Physiology#Nerve_Fibre). Therefore the ascending reticular formation is *bilateral* and *multineuronal*, although this pain pathway is thought to be more primitive than the [spinothalmic tract](https://en.wikivet.net/Sensory_Pathways_-_Anatomy_%26_Physiology%22%20%5Cl%20%22Spinothalamic_Tract%22%20%5Co%20%22Sensory%20Pathways%20-%20Anatomy%20%26%20Physiology). In humans, the ascending reticular formation is superceded by the [spinothalamic tract](https://en.wikivet.net/Sensory_Pathways_-_Anatomy_%26_Physiology%22%20%5Cl%20%22Spinothalamic_Tract%22%20%5Co%20%22Sensory%20Pathways%20-%20Anatomy%20%26%20Physiology). In animals, the ascending reticular formation is the main pathway for pain to reach the [cerebral cortex](https://en.wikivet.net/Forebrain_-_Anatomy_%26_Physiology#Cerebral_Cortex).

## Pain

Pain is not a sensory modality. The sensory modality that is checked in a neurologic exam is Nociception which is the patients response to a noxious stimuli. Pain is a subjective cerebral response. Noxious stimuli can result in responses ranging from itches, to nausea, to simply being in agony. Noxious stimuli may be transmitted to the brain by one of two pathways: the [Spinothalamic Tract](https://en.wikivet.net/Sensory_Pathways_-_Anatomy_%26_Physiology%22%20%5Cl%20%22Spinothalamic_Tract%22%20%5Co%20%22Sensory%20Pathways%20-%20Anatomy%20%26%20Physiology) or the [Ascending Reticular Formation](https://en.wikivet.net/Sensory_Pathways_-_Anatomy_%26_Physiology#Ascending_Reticular_Formation).

### Spinothalamic Tract

This fast, initial pinprick is detected by free [nerve](https://en.wikivet.net/PNS_Structure_-_Anatomy_%26_Physiology#Nerve_Fibres) endings and causes an impulse along large, myelinated fibres. The pain sensation is **localised, and ends quickly**.

### Ascending Reticular Formation

This pain sensation is detected by free [nerve](https://en.wikivet.net/PNS_Structure_-_Anatomy_%26_Physiology#Nerve_Fibres) endings which causes an impulse along small, unmyelinated fibres. This results in a delayed perception of the sensation of pain, and that pain is often **less localised but more persistent**.

**Clinical Relevance** During trauma the small unmyelinated fibres are the last fibres to fail as they are close to the [spinal cord](https://en.wikivet.net/Spinal_Cord_-_Anatomy_%26_Physiology). If deep pain sensation is lost in a case of trauma, then the prognosis is poor.
*Hyperalgesia* is an increased pain sensation. This occurs when tissue is damaged because chemicals are released which increase the sensitivity of nociceptors, so that even light pressure can cause pain. Hyperalgesia may have evolved to aid the healing of injuries.

### Visceral Pain

Visceral pain refers to pain related to the internal organs. Pain may be extreme, especially with distension, but the body's ability to localise the pain is poor. Skeletal muscle spasms may be observed during visceral pain. Commonly, the pain is referred to a different part of the body that is unharmed. This is because the areas are served by the same part of the [spinal cord](https://en.wikivet.net/Spinal_Cord_-_Anatomy_%26_Physiology) e.g. in angina (pain in the heart), pain can be felt in the inner left arm or jaw. This is called *referred pain*.