

All afferent touch/vibration info ascends the spinal cord via the posterior (dorsal) column–medial lemniscus pathway via gracilis (T7 and below) or cuneatus (T6 and above). Cuneatus sends signals to the cochlear nucleus indirectly via spinal grey matter, this info is used in determining if a perceived sound is just villi noise/irritation. All fibers cross (left becomes right) in the medulla.

A somatosensory pathway will typically have three neurons: first–order, second–order, and third–order.

1. The **first–order neuron** is a type of pseudounipolar neuron and always has its cell body in the dorsal root ganglion of the spinal nerve with a peripheral axon innervating touch mechanoreceptors and a central axon synapsing on the second–order neuron. If the somatosensory pathway is in parts of the head or neck not covered by the cervical nerves, the first–order neuron will be the trigeminal nerve ganglia or the ganglia of other sensory cranial nerves).
2. The **second–order neuron** has its cell body either in the spinal cord or in the brainstem. This neuron's ascending axons will cross (decussate) to the opposite side either in the spinal cord or in the brainstem.
3. In the case of touch and certain types of pain, the **third–order neuron** has its cell body in the ventral posterior nucleus of the thalamus and ends in the postcentral gyrus of the parietal lobe in the primary somatosensory cortex (or S1).

Photoreceptors, similar to those found in the retina of the eye, detect potentially damaging ultraviolet radiation (ultraviolet A specifically), inducing increased production of melanin by melanocytes. Thus tanning potentially offers the skin rapid protection from DNA damage and sunburn caused by ultraviolet radiation (DNA damage caused by ultraviolet B). However, whether this offers protection is debatable, because the amount of melanin released by this process is modest in comparison to the amounts released in response to DNA damage caused by ultraviolet B radiation.

Tactile feedback

The tactile feedback from proprioception is derived from the proprioceptors in the skin, muscles, and joints.

BalanceEdit

The receptor for the sense of balance resides in the vestibular system in the ear (for the three-dimensional orientation of the head, and by inference, the rest of the body). Balance is also mediated by the kinesthetic reflex fed by proprioception (which senses the relative location of the rest of the body to the head). In addition, proprioception estimates the location of objects which are sensed by the visual system (which provides confirmation of the place of those objects relative to the body), as input to the mechanical reflexes of the body.

Fine touch and crude touch

Fine touch (or discriminative touch) is a sensory modality that allows a subject to sense and localize touch. The form of touch where localization is not possible is known as crude touch. The posterior column—medial lemniscus pathway is the pathway responsible for the sending of fine touch information to the cerebral cortex of the brain.

Crude touch (or non-discriminative touch) is a sensory modality that allows the subject to sense that something has touched them, without being able to localize where they were touched (contrasting "fine touch"). Its fibres are carried in the spinothalamic tract, unlike the fine touch, which is carried in the dorsal column. As fine touch normally works in parallel to crude touch, a person will be able to localize touch until fibres carrying fine touch (Posterior column—medial lemniscus pathway) have been disrupted. Then the subject will feel the touch, but be unable to identify where they were touched.

Neural processing of social touchEdit

The somatosensory cortex encodes incoming sensory information from receptors all over the body. Affective touch is a type of sensory information that elicits an emotional reaction and is usually social in nature, such as a physical human touch. This type of information is actually coded differently than other sensory information. Intensity of affective touch is still encoded in the primary somatosensory cortex and is processed in a similar way to emotions invoked by sight and sound, as exemplified by the increase of adrenaline caused by the social touch of a loved one, as opposed to the physical inability to touch someone you don't love.

Meanwhile, the feeling of pleasantness associated with affective touch activates the anterior cingulate cortex more than the primary somatosensory

cortex. Functional magnetic resonance imaging (fMRI) data shows that increased blood–oxygen–level contrast (BOLD) signal in the anterior cingulate cortex as well as the prefrontal cortex is highly correlated with pleasantness scores of an affective touch. Inhibitory transcranial magnetic stimulation (TMS) of the primary somatosensory cortex inhibits the perception of affective touch intensity, but not affective touch pleasantness. Therefore, the S1 is not directly involved in processing socially affective touch pleasantness, but still plays a role in discriminating touch location and intensity.

Individual variation[Edit](#)

A variety of studies have measured and investigated the causes for differences between individuals in the sense of fine touch. One well–studied area is passive tactile spatial acuity, the ability to resolve the fine spatial details of an object pressed against the stationary skin. A variety of methods have been used to measure passive tactile spatial acuity, perhaps the most rigorous being the grating orientation task. In this task subjects identify the orientation of a grooved surface presented in two different orientations, which can be applied manually or with automated equipment. Many studies have shown a decline in passive tactile spatial acuity with age; the reasons for this decline are unknown, but may include loss of tactile receptors during normal aging. Remarkably, index finger passive tactile spatial acuity is better among adults with smaller index fingertips; this effect of finger size has been shown to underlie the better passive tactile spatial acuity of women, on average, compared to men. The density of tactile corpuscles, a type of mechanoreceptor that detects low–frequency vibrations, is greater in smaller fingers; the same may hold for Merkel cells, which detect the static indentations important for fine spatial acuity. Among children of the same age, those with smaller fingers also tend to have better tactile acuity. Many studies have shown that passive tactile spatial acuity is enhanced among blind individuals compared to sighted individuals of the same age, possibly because of cross modal plasticity in the cerebral cortex of blind individuals. Perhaps also due to cortical plasticity, individuals who have been blind since birth reportedly consolidate tactile information more rapidly than sighted people.