**SOMATOSENSORY PATHWAYS**

The term somatosensory refers to bodily sensations of touch, pain, temperature, vibration, and proprioception (limb or joint position sense)

There are 4 types of sensory neuron fibres which are classified according to axon diameter. These different fibre types have specialized peripheral receptors that subseries different sensory modalities. Larger-diameter, myelinated axons conduct faster than smaller-diameter or unmyelinated axons. From largest to smallest diameter and conduction velocity, there are called A-alpha, A-beta, A-gamma, and unmyelinated C’s. They are detailed below along with their diameter, receptor type, and the sensory modality the serve.

The shoulder, arms, and hands are represented in C5 through T1. The L4

and L5 representation extends over the anteriomedian shin and foot to the big

toe. S1 and S2 innervate the back (dorsum) of the legs, and S3, S4, and S5

innervate the perineal area in a saddle-like distribution.

Posterior Column-Medial Lemnisci Pathway. Large-diameter,

myelinated axons carrying information about proprioception, vibration, and fine

touch enter the spinal cord via the dorsal root entry zone. Most of these axons

then enter the ipsilateral posterior columns to ascend all the way to the

posterior column nuclei in the medulla (see figure below). The most medial

posterior column is called the fasciculus gracilis which carries sensory

information from the legs and lower trunk. The more lateral fasciculus

cuneate carries information from the trunk above about T6, and from the arms

and neck.

The first order neurons travel from the sensory receptor in the periphery,

into the spinal cord, and then travel all the way up the cord in the posterior

columns (fasciculus gracilis and cuneatus) to synapse onto second-order

neurons in the nucleus gracilis and nucleus cuneatus located in the medulla

(see figure above).

Axons of these second-order neurons decussate as the internal arcuate

fibers and then form the medial lemniscus on the other side of the medulla.

The next major synapse occurs when the medial lemniscus axons terminate in

the ventral posterior lateral nucleus (VPL) of the thalamus. The neurons of

VPL then project through the posterior limb of the internal capsule in the

thalamic somatosensory radiations to reach the primary somatosensory

cortex in the postcentral gyrus (see figure above).

An analogous pathway called the trigeminal lemniscus conveys touch

and vibration sense for the face via the ventral posterior medial (VPM) nucleus

of the thalamus to the primary somatosensory cortex. Synaptic inputs to the

primary somatosensory cortex from both the face and body occur mainly in

cortical layer IV.

Spinothalamic Tract & Other Anterolateral Pathways. Smaller-

diameter and unmyelinated axons carrying information about pain and

temperature sense also enter the spinal cord via the dorsal root entry zone.

However, in contrast to the posterior columns, these axons make their first

synapses immediately in the gray matter of the spinal cord.

Second-order anterolateral sensory neurons in the central gray cross over

in the spinal cord anterior (ventral) commissure to ascend in the anterolateral

(ventrolateral) white matter (see figure below).

The next major synaptic relay is, again, in the thalamus which projects to

the primary somatosensory cortex (Bradman’s areas 3,1, 2) via the posterior

limb of the internal capsule (see figure above). Pain and temperature sensation

for the face is carried by an analogous pathway called the trigeminothalamic

tract.

The anterolateral pathways consist of three tracts: the spin thalamic,

spin reticular, and spin mesencephalic tracts. The spin thalamic tract is the

best known and mediates discriminative aspects of pain and temperature

sensation, such as location and intensity of the stimulus. Like the posterior

column-medial lemnisci pathway, the main relay for the spin thalamic tract is

the ventral posterior lateral nucleus (VPL) of the thalamus. There are also

some spin thalamic projections to other thalamic nuclei, including intralaminar

thalamic nuclei and dorsal-medial nucleus.

The spin reticular tract within the anterolateral pathways is a

phylogenetically older pain pathway responsible for conveying the emotional and