

EXAMINATION OF SENSE OF TOUCH

Principle:

Sense of touch can be assessed by voluntary stimulation of tactile receptors in skin and noting the response.

Apparatus:

Fine touch aesthesiometer, crude touch aesthesiometer, cotton wool, weber's compass, key, pencil and subject.

Method of examination (procedure):

- Introduce yourself to the subject whose sensory system is to be examined.
- Explain the procedure to the subject and take consent.
- The part of skin to be examined should be adequately exposed.
- Ask the subject to close the eyes.
- To test fine touch, take a fine aesthesiometer or wisp of cotton and touch the identical parts of the body of the subject starting from face, lips, back of neck, fingertips, hand and forearm.
- The patient should be asked to reply "yes" or raise the index finger each time a stimulus is applied.
- Tactile localization can be tested by having the patient point to the area stimulated or to describe the area tested. And we can test all the dermatomes and the cutaneous innervation areas of all the nerves by this method.
- To test coarse or crude touch, coarse aesthesiometer is used to touch the same areas as we tested for fine touch.
- **Stereognosis:** this is ability to recognize and identify objects by feeling them. The absence of this ability is termed astereognosis. This is tested by putting an object e.g. key in the hand of patient when his eyes are closed and he is asked to reply what it is.

- **Graphesthesia:** this is ability to recognize symbols written on the skin. The absence of this ability is termed *graphanesthesia*. This is tested by making a circle or writing some digit on the palm of subject and asking him what has been drawn.
- **Two-point discrimination:** this is ability to recognize simultaneous stimulation by two blunt points. Measured by the distance between the points required for recognition. This is tested by using Weber's compass. Two pointed ends of this compass are separated apart gradually and are touched to the skin of patient simultaneously. The patient is asked whether he has felt two points or one. The minimum distance at which he can appreciate two points as two is called as minimal separable distance. This distance is very less on lips and finger tips (1-3mm) but much larger on the back (20-50mm) of our body. This distance is inversely proportional to the number of receptors present in some area of skin and also inversely proportional to the representation of that area in sensory cortex of brain.

Precautions and other important considerations:

1. Before starting the examination, the patient should be questioned as to whether abnormal sensations are experienced subjectively.
2. It must be performed carefully with optimal patient cooperation to achieve reliable results.
3. The patient should be physically and mentally relaxed and in comfortable surroundings.
4. Care must be taken to explain the patient what is expected of him or her and to assure anxious patients that the examination will not be painful.
5. Accurate results are difficult to obtain if the patient is distracted or exhausted. In such cases, the examination should be repeated when the patient is rested.
6. Areas of abnormal sensation should be outlined on the patient with a skin pencil.

TESTING THE FINE AND CRUDE TOUCH:

Part to be touched.	Number of times touched	Number of times felt (right).	Number of times felt (left).	Number of times felt (right).	Number of times felt (left).
Lips.	10	10	10	10	10
Fingertips.	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Hand.	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Forearm, hairy area	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Forearm, non-hairy area.	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>

TESTING THE TACTILE LOCALIZATION:

Part to be touched	Error or not
Lips.	Normal
Palm.	Normal
Fingertips.	Normal
Back of hand.	Normal
Forearm, hairy area.	Normal
Forearm, non-hairy area.	normal

Discussion:

The sensory system provides information that places the individual in relation to the environment. A sensation is any change in external or internal environment detected by receptors. Receptors may be located superficially in skin and mucous membranes or deeply in tendons, muscles, ligaments and joints. Sensations may be classified on the basis of location of receptors to *exteroceptive* and *proprioceptive* sensation. A third sensory modality requires cortical analysis to provide interpretation of sensory information. All three types of sensation should be evaluated in every patient examined.

A). Exteroceptive sensation: (also termed superficial sensation): receptors in skin and mucous membranes. These sensations are tactile or touch sensation, pain sensation, and temperature sensation.

Some important clinical definition related to Tactile or touch sensation:

- *Anesthesia*: absence of touch appreciation
- *Hypoesthesia*: decrease of touch appreciation
- *Hyperesthesia*: exaggeration of touch sensation, which is often unpleasant
- (Terms above are unfortunately used indiscriminately to apply to losses of all types of sensation. They are not specific for loss of tactile sensation.)

Some important clinical definition related to Pain sensation (algisia):

- *Analgesia*: absence of pain appreciation
- *Hypoalgesia*: decrease of pain appreciation
- *Hyperalgesia*: exaggeration of pain appreciation, which is often unpleasant

Some important clinical definition related to Temperature sensation, both hot and cold (thermesthesia):

- *Thermanalgesia*: absence of temperature appreciation
- *Thermhypesthesia*: decrease of temperature appreciation
- *Thermhyperesthesia*: exaggeration of temperature sensation, which is often unpleasant

Some Sensory perversions:

- *Paresthesia*: abnormal sensations perceived without specific stimulation. They may be tactile, thermal or painful; episodic or constant.
- *Dysesthesia*: painful sensations elicited by a non-painful cutaneous stimulus such as a light touch or gentle stroking over affected areas of the body. Sometimes referred to as hyperpathia or hyperalgesia. Often perceived as an intense burning, dyesthesias may outlast the stimulus by several seconds.

B). Proprioceptive sensation: (also termed deep sensation): receptors located in muscles, tendons, ligaments and joints

- Joint position sense (arthresthesia): Absence is described as such
- Vibratory sense (pallesthesia): Absence is described as such
- Kinesthesia: perception of muscular motion. Usually not measured in routine clinical evaluation.

C). Cortical sensory functions: interpretative sensory functions that require analysis of individual sensory modalities by the parietal lobes to provide discrimination. Individual sensory modalities must be intact to measure cortical sensation.

- Stereognosis: ability to recognize and identify objects by feeling them. The absence of this ability is termed *astereognosis*.
- Graphesthesia: ability to recognize symbols written on the skin. The absence of this ability is termed *graphanesthesia*.
- Two-point discrimination: ability to recognize simultaneous stimulation by two blunt points. Measured by the distance between the points required for recognition. Absence is described as such.
- Touch localization (topognosis): ability to localize stimuli to parts of the body. *Topagnosia* is the absence of this ability.
- Double simultaneous stimulation: ability to perceive a sensory stimulus when corresponding areas on the opposite side of the body are stimulated simultaneously. Loss of this ability is termed *sensory extinction*.

Another way to classify the sensations:

A). SPECIAL SENSATIONS: visual sensation (vision), auditory sensation (hearing), olfactory sensation (sense of smell) and gustatory sensation (sense of taste).

B). SOMATIC SENSATIONS:

1. mechanoreceptive sensations:
 - Tactile sensation (fine and crude touch, pressure, tickle, itch and vibration).
 - Sense of position (proprioception).
2. Thermal sensation (heat and cold sensation).
3. Pain sensation (fast and slow pain).

Various pathways of the fibers and the sensations carried by them:

a). Spinothalamic system (or anterolateral system):

- Anterior or ventral spinothalamic tract carries: crude touch, tickle, itch, pressure and sexual stimulation.
- Lateral spinothalamic tract carries: pain and temperature sensation.

b). Dorsal column medial lemniscus pathway "conscious" proprioception:

Joint position (proprioception), vibration, deep pressure, two point tactile discrimination, graphaesthesia and stereognosis.

c). Dorsal and ventral spinocerebellar pathway

"unconscious" proprioception

Afferent fibers that carry tactile sensation:

- Myelinated fibers: A- beta fibers (velocity of conduction= 30-70 m/sec), A- delta fibers (velocity = 5-30 m/sec.)
 - Unmyelinated fibers: Type C fibers (velocity of conduction= 0.5- 2 m/sec).
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Touch sensitivity:

- Varies from part to part.
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- Depends on number of receptors.
 - Maximum sensitivity: at tip of tongue, lips, finger tips, then hands, forearm and arm.
 - Minimum sensitivity: on the back of body
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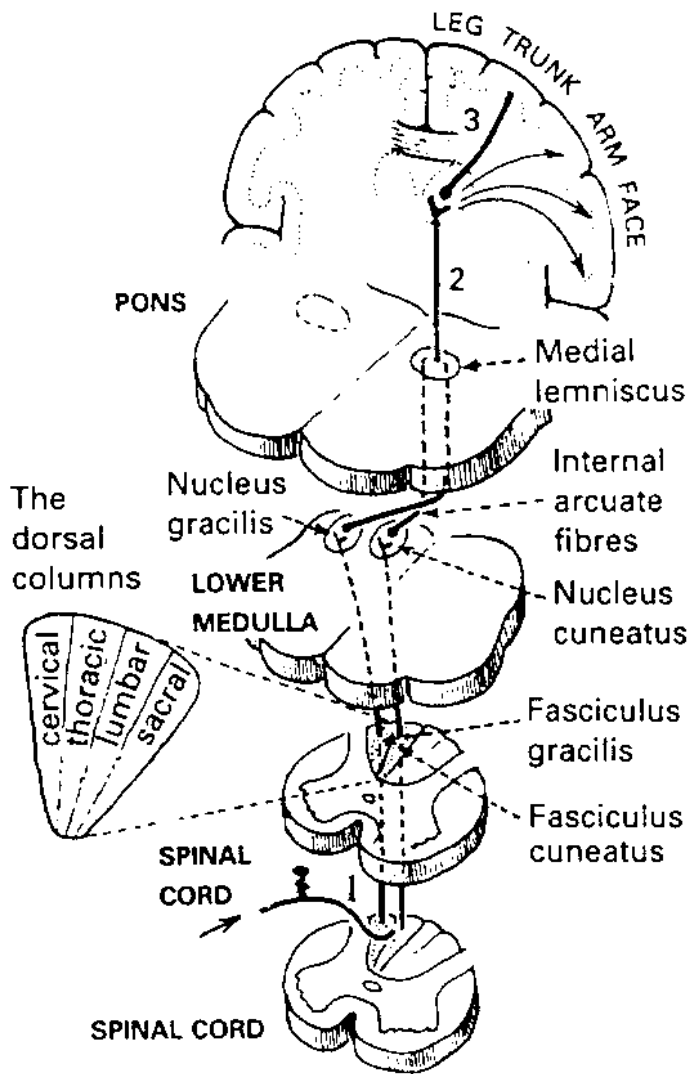
Sensory pathway of Fine touch:

Touch receptors are present in large numbers in the skin of fingers and lips and less number in the skin of trunk. The first order of neurons carrying the fine touch sensation enters the spinal cord via posterior root and then ascend in the ipsilateral dorsal column of the spinal cord. They terminate in the nucleus gracilis and cuneatus of medulla. The second order neurons arise from the nuclei, cross to the opposite side in medulla and ascend up in the contralateral medial lemniscus, to terminate in the ventral posterior nucleus and related specific sensory nuclei of the thalamus. The third order of the neurons arises from the thalamus and reach the sensory cortex via thalamic radiations. The sensations that are carried in the posterior column of the spinal cord are fine touch, proprioception, and sense of vibration, tactile localization, two point discrimination and stereognosis.

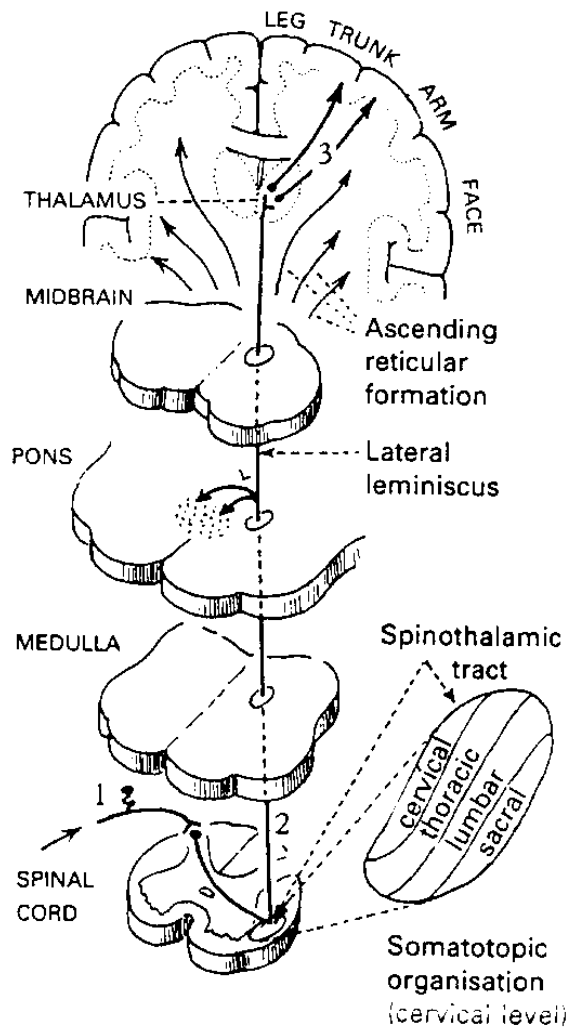
Sensory pathway of Crude touch:

The first order neurons after entering the spinal cord synapse with the second order neurons in the dorsal horn of spinal cord. the second order neurons cross to the opposite side at that spinal segment and ascend up in the contralateral ventral spinothalamic tract to terminate in the specific sensory relay neurons of the thalamus. the third order neurons arise in the thalamus and end in the sensory cortex through thalamic radiations.

Appendix no 1: Dorsal column pathway/medial lemniscus pathway:



Appendix no 2: Spinothalamic pathway:



Pain perception

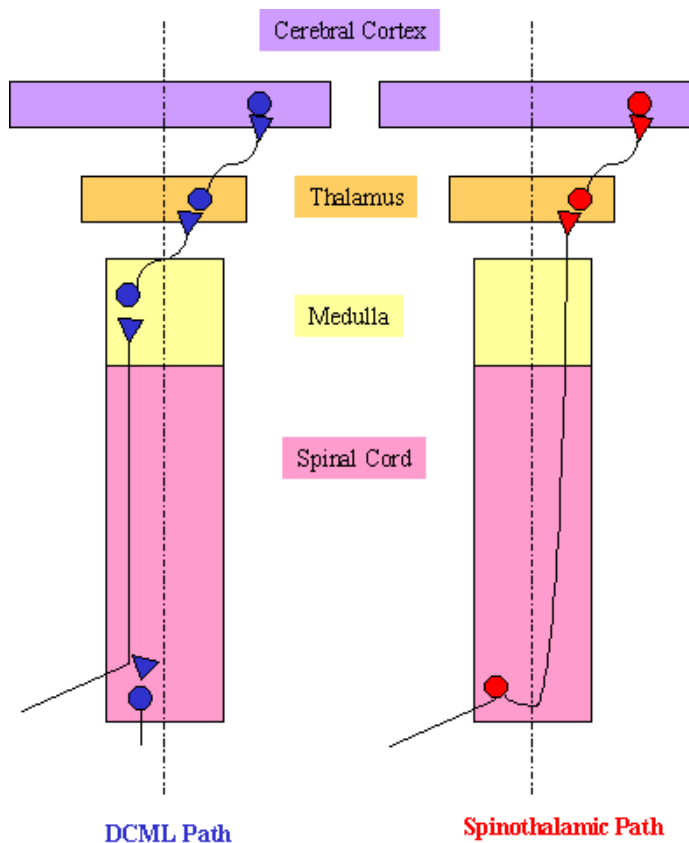
C fibers: thin, unmyelinated

A delta: thinly myelinated

Temperature

A delta: thinly myelinated

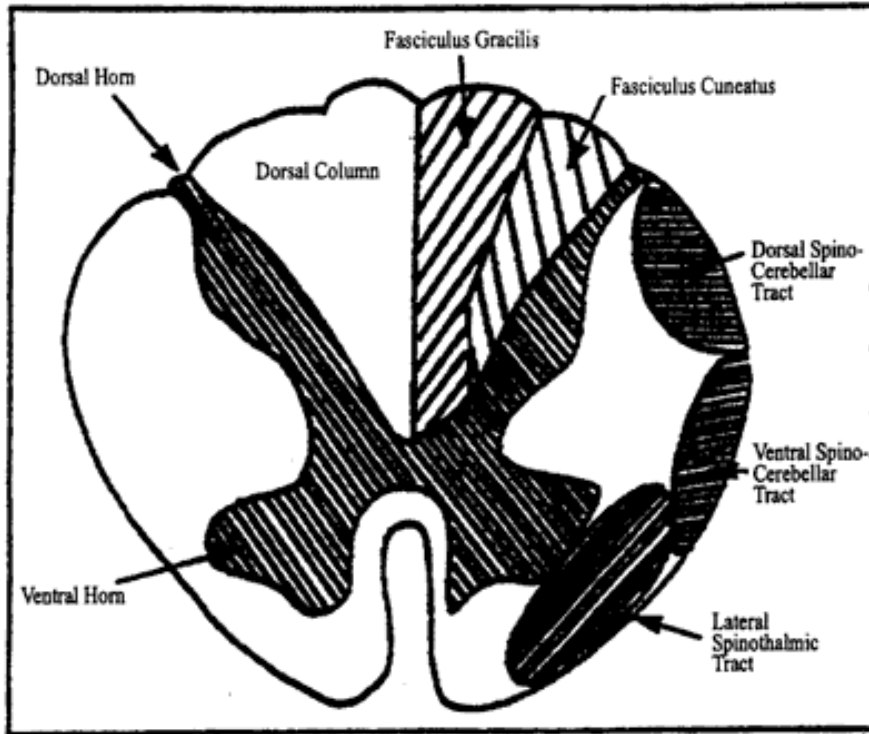
Appendix no 3:



The type of sensations which are characteristically conveyed in these 2 systems are tabled below:

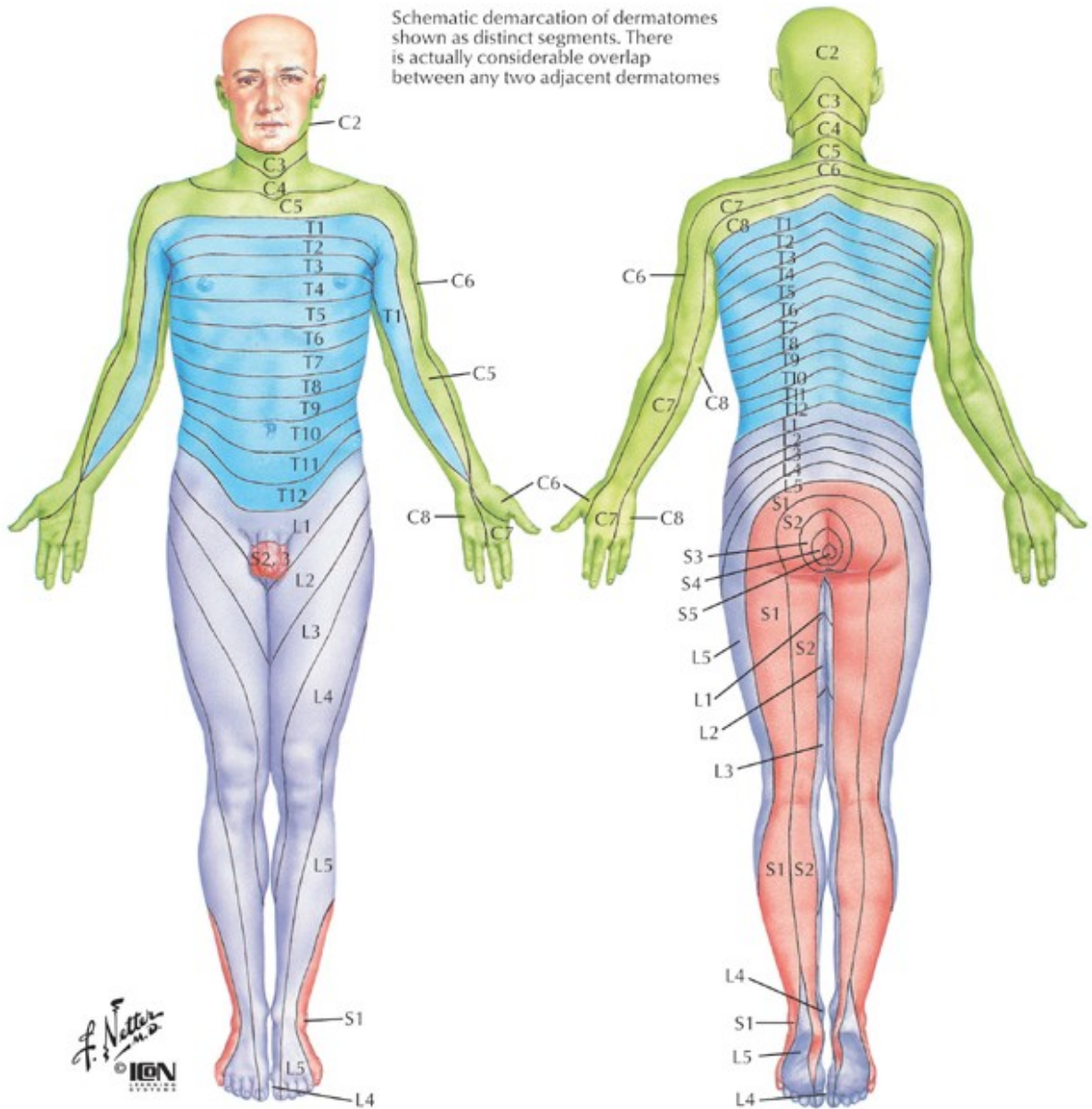
Dorsal Lemniscal System	Anterolateral Spinothalamic System
<ul style="list-style-type: none"> • Touch sensations: <ul style="list-style-type: none"> ◦ High degree of localization of stimulus. ◦ Fine graduations in intensity of stimulus. • Phasic sensations (vibrations). • Sensations of movement against the skin. • Fine positional and pressure sensations. 	<ul style="list-style-type: none"> • Thermal sensations: <ul style="list-style-type: none"> ◦ Cold ◦ warm • Pain sensations • Crude pressure and touch sensations • Tickle and itch sensations • Sexual sensations

Appendix no 4: Spinal cord – various important sensory tract



Appendix no 5:

Dermatome Map of the Body



Levels of principal dermatomes

- C5 Clavicles
- C5, 6, 7 Lateral parts of upper limbs
- C8, T1 Medial sides of upper limbs
- C6 Thumb
- C6, 7, 8 Hand
- C8 Ring and little fingers
- T4 Level of nipples

- T10 Level of umbilicus
- T12 Inguinal or groin regions
- L1, 2, 3, 4 Anterior and inner surfaces of lower limbs
- L4, 5, S1 Foot
- L4 Medial side of great toe
- S1, 2, L5 Posterior and outer surfaces of lower limbs
- S1 Lateral margin of foot and little toe
- S2, 3, 4 Perineum

Appendix no 6: Sensory homunculus:

