Examination of the Sensory System
The sensory system

- Sensory information, detected at peripheral receptors, travels via peripheral nerves, nerve roots, spinal cord, brainstem and thalamus to sensory cortex.

- **Pain** and **Temperature** sensation
  - carried by small unmyelinated fibres

- **Vibration** and **Proprioception** (joint position)
  - carried by large myelinated fibres
The sensory system 2

- **Pain** and **Temperature** sensation
  - carried in the **spinothalamic tract**
  - decussates (crosses over) immediately in the spinal cord

- **Vibration** and **Proprioception** (joint position)
  - are carried in the dorsal columns
  - Ascend on the same side of spinal cord
  - cross over in the brain stem
Spinal cord section

- Posterior column
  - Ipsilateral (crosses at medulla)
    - Proprioception
    - Vibration

- Spinothalamic tract
  - Contralateral (crosses at spinal level)
    - Pain
    - Light touch
    - Temperature

- Motor supply
  - Anterior corticospinal
  - Lateral corticospinal
Normal sensory examination

- Normal sensation allows a patient to detect
  - **pain** (pinprick) and **temperature**
    - in whichever area is tested,
  - **vibration**
    - at tips of fingers and toes
  - **joint position** (i.e. small amplitude movements)
    - at distal joints

- In order to identify abnormality, it is important to know what normal means

- In someone with no sensory symptoms, it is not essential to examine the sensory system
Localisation of problems can be determined by knowledge of area of skin supplied by peripheral nerves, sensory dermatomes, decussation of spinothalamic tract and dorsal columns.
Dermatomes of the upper limb

C3
C4
C5
C6
C7
C8
T1
T2
C5
C6
C5
A dermatome is an area of skin supplied by a single spinal nerve for the modalities of sensation. A knowledge of the dermatomes can help to localise problems involving the spinal cord or nerves.
Dermatomes of the trunk
Testing light touch

- Use a wisp of Cotton wool or a fine paint brush
- Ask the patient to respond when stimulus is detected
- Dab the skin and then withdraw the stimulus - do not drag the cotton wool across the skin
- Compare one side with the other
Pain (superficial)

- Use a disposable neurotip, pin or unfolded paper clip
- Do NOT use a hypodermic needle
- Always dispose of “sharp” safely
- Explain and show the touching with “sharp” and “blunt” on an unaffected area
- Test by randomly using sharp and blunt (negative stimulus) noting patient’s response in each dermatome (always try to apply same pressure)
- Start distally and move proximally
In Clinical Practice

- Allow the patient to describe the distribution of altered sensation
- Demonstrate the nature of test sensation in an area of skin the patient perceives to be normal
- Test sensation within the area reported to be abnormal
- Map the extent of altered sensation
- Decide if this area makes anatomical sense (relates to or associated with a spinal, dermatomal or peripheral /cutaneous nerve pattern of altered sensation.)
Testing Proprioception

- Hold distal interphalangeal joint of patient's great toe/thumb or finger between thumb and index finger of your left hand.

- Make a small amplitude movement of the joint using your right hand to demonstrate up and down.

Repeat with patient's eyes closed.
If patient cannot detect small amplitude movements, or makes errors, increase the amplitude of movement.

If patient cannot detect larger amplitude movements, test proprioception at a more proximal joint (see next slide).
Proprioception - order of testing

Upper limb
- distal interphalangeal joint
- proximal interphalangeal joint,
- metocarpophalangeal joint
- Wrist
- Elbow
- shoulder

Lower limb –
- interphalangeal joint of the hallux,
- metatarsophalangeal joint,
- ankle
- knee
- hip

Proprioceptive sense tends to decline with age
Testing proprioception 3
(Also see coordination)

- Ask patient to close eyes and stretch arms, then to touch tip of their nose with their index finger.
  - If proprioception is normal this will be done accurately
- With patient standing, feet approx. 20 cm apart, and eyes closed, gently push them on chest.
  - If proprioception is intact balance is maintained.
  - This is a negative Romberg's test
Testing vibration sense

- With a 128 Hz tuning fork create vibration by either taping it gently against your hand or by pushing the prongs towards one another.
- To avoid reducing the vibration hold at the round thumb rest just under the fork, the flat rest at the base is held against the patient.

Demonstrate on a boney prominence away from the affected area (forehead or sternum for example)
Testing vibration sense 2

- Place base of 128 Hz tuning fork on tip of a finger or toe
- Ask patient “Can you feel that buzzing?”
- If they can not, move proximally, testing vibration sense at bony prominences (hallux, medial malleolus … clavicle) until the vibration is detected
Patterns of sensory loss

- As with motor examination, the pattern of sensory loss helps to localise a lesion to specific parts of the nervous system
- The initial distinction is whether the lesion is in the central or peripheral nervous system
- A good way of achieving this is to recognise patterns of sensory loss caused by
  - spinal cord lesions (central)
  - peripheral neuropathy (peripheral)
Spinal Cord Lesion

- Sensation is lost or altered below the level of the lesion
  - this is called a **sensory level**
- The extent of the lesion determines whether the loss of sensation is uni- or bi-lateral

Familiarity with cross-sections of the cord and sites of where the main tracts decussate (cross over) will enable you to understand the detail of the pattern of sensory loss.
**Spinal cord section**

- **Posterior (dorsal) column** ipsilateral (crosses at medulla)
  - proprioception
  - vibration

- **Spinothalamic tract** contralateral (crosses at spinal level)
  - pain
  - light touch
  - temperature

- **Motor supply**
  - Anterior corticospinal
  - Lateral corticospinal
Patterns of sensory loss

Complete transverse lesion of the cord

Right
Loss of proprioception
Loss of vibration
Loss of temperature
Loss of pain
Loss of light touch

Left
Loss of proprioception
Loss of vibration
Loss of temperature
Loss of pain
Loss of light touch
Peripheral Neuropathy

- Loss, or altered, sensation starts at the end of the longest nerves; i.e. in the toes and spreads proximally
- The fingers are affected after the toes/feet
- This produces a “glove and stocking” pattern of sensory loss
- The type of nerve fibre affected (myelinated, unmyelinated or both) determines which modalities are lost.