



- **Examination of the Sensory System**

# The sensory system 1

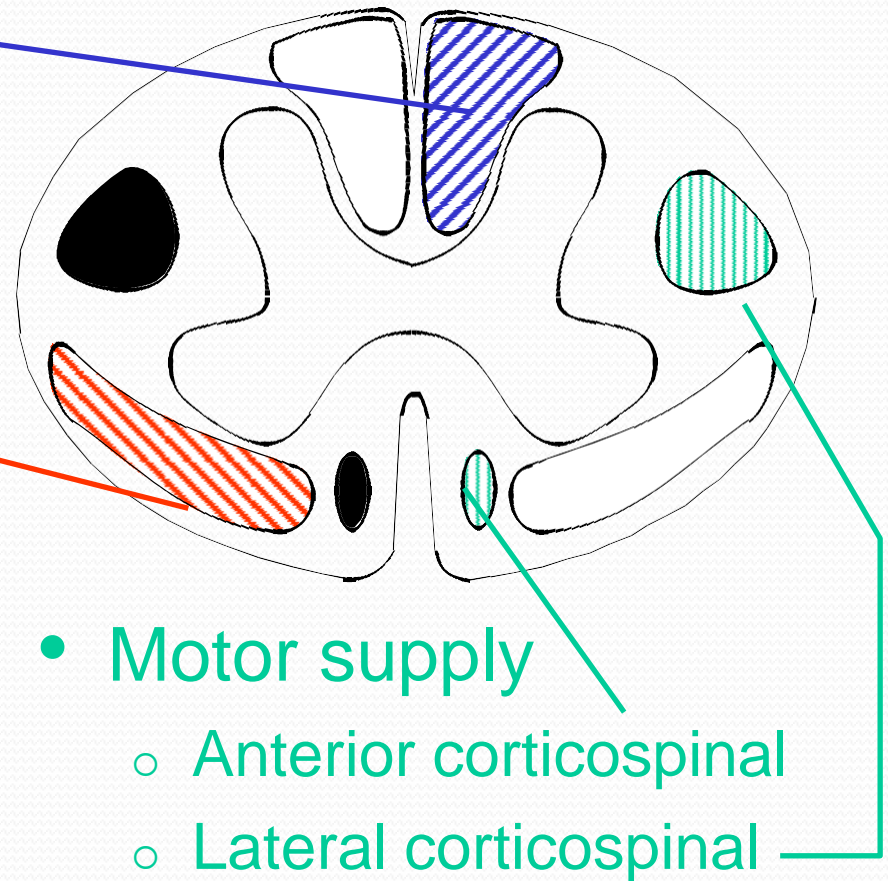
- Sensory information, detected at peripheral receptors, travels via peripheral nerves, nerve roots, spinal cord, brainstem and thalamus to sensory cortex
- **Pain and Temperature** sensation
  - carried by small unmyelinated fibres
- **Vibration and Proprioception** (joint position)
  - carried by large 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



# 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

# sensory pathway

Peripheral receptor



peripheral nerves



nerve roots



spinal cord



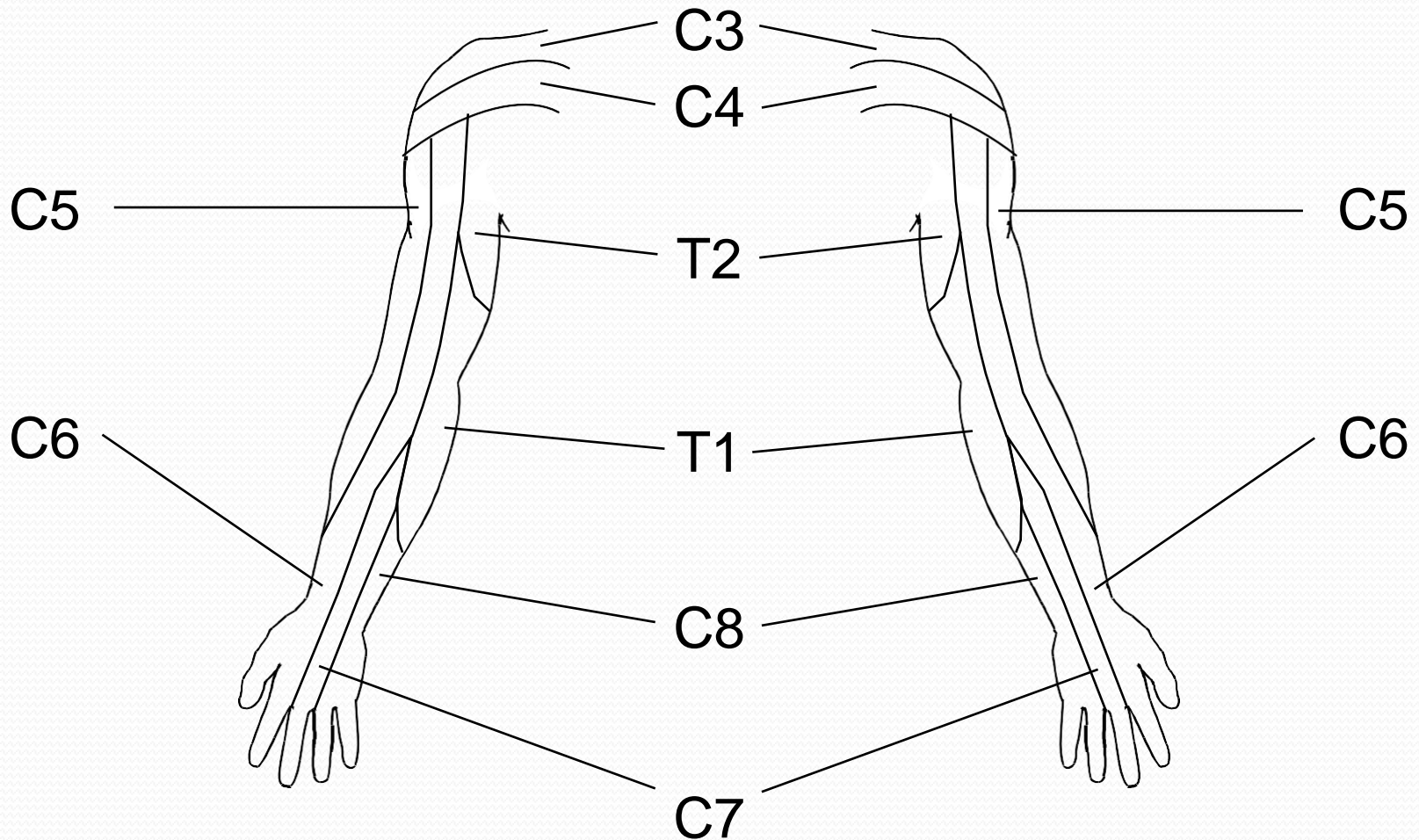
thalamus



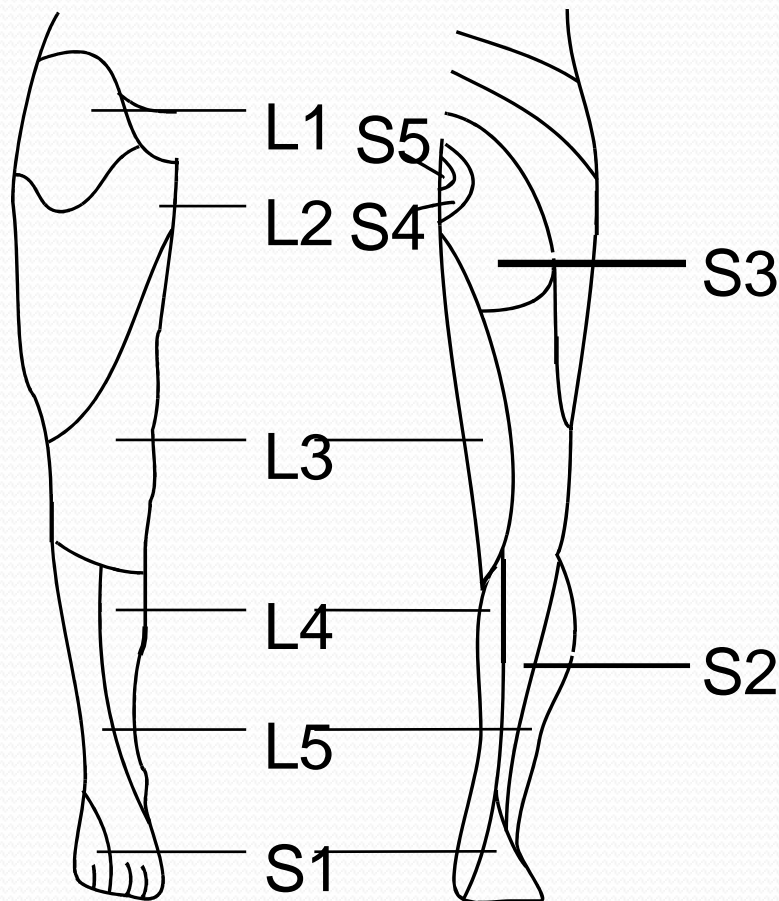
sensory cortex

- 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



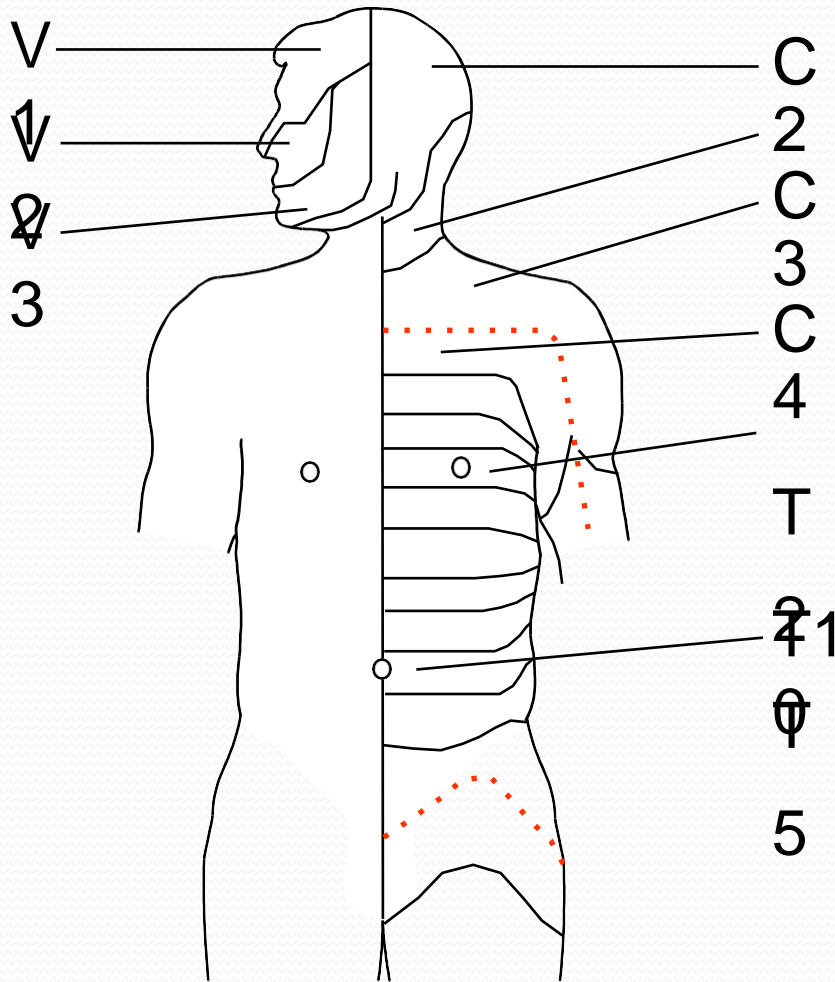
# Dermatomes of the lower limb



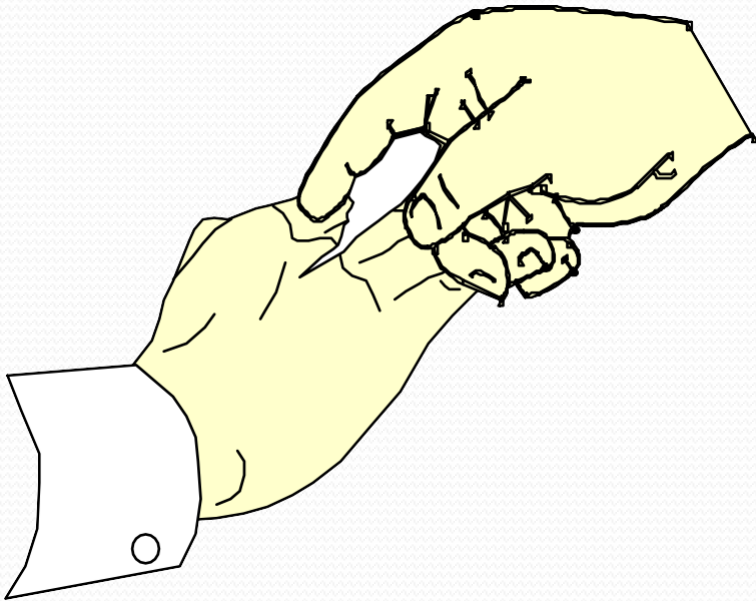
A dermatome is an area of skin supplied by a single spinal nerve for the modalities of sensation. A knowledge of the dermatomes can help to localise problems involving the spinal cord or nerves



# 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

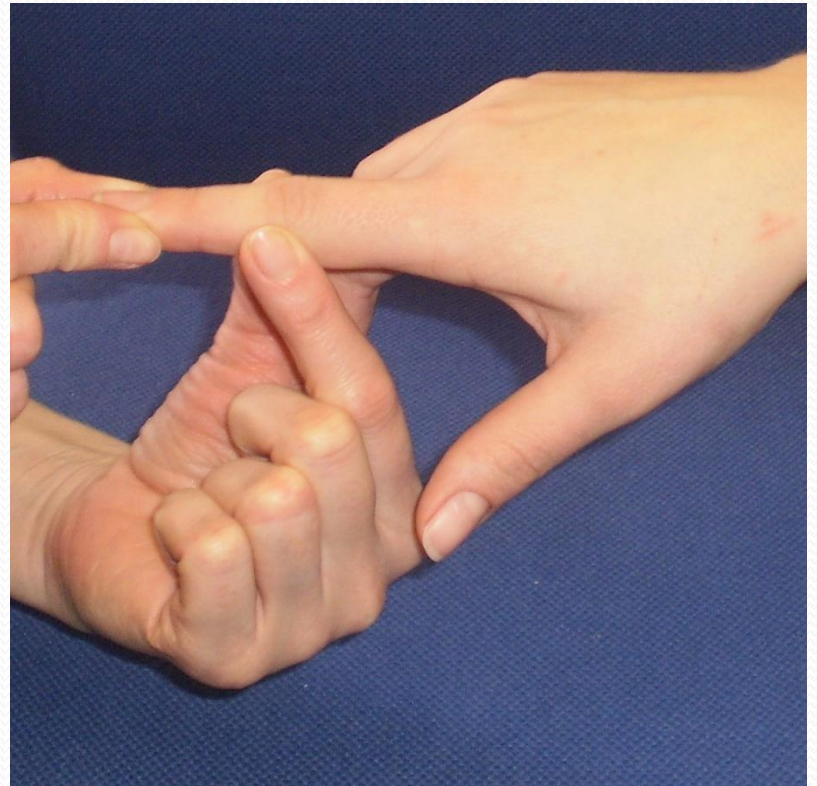
# In Clinical Practice

- 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 1

- 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



# Proprioception 2

- 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 –

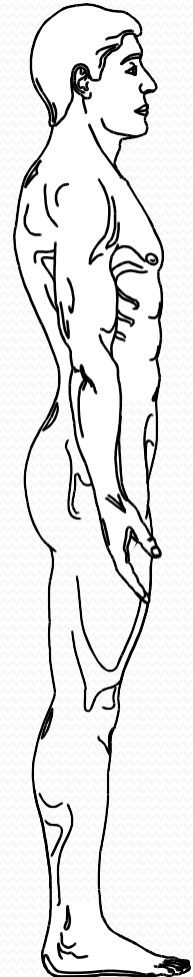
- interphalangeal joint of the hallux,
- metatarsophalangeal joint,
- ankle
- knee
- hip

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.20cm 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 1

- With a 128 Hz tuning fork create vibration by either tapping 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)

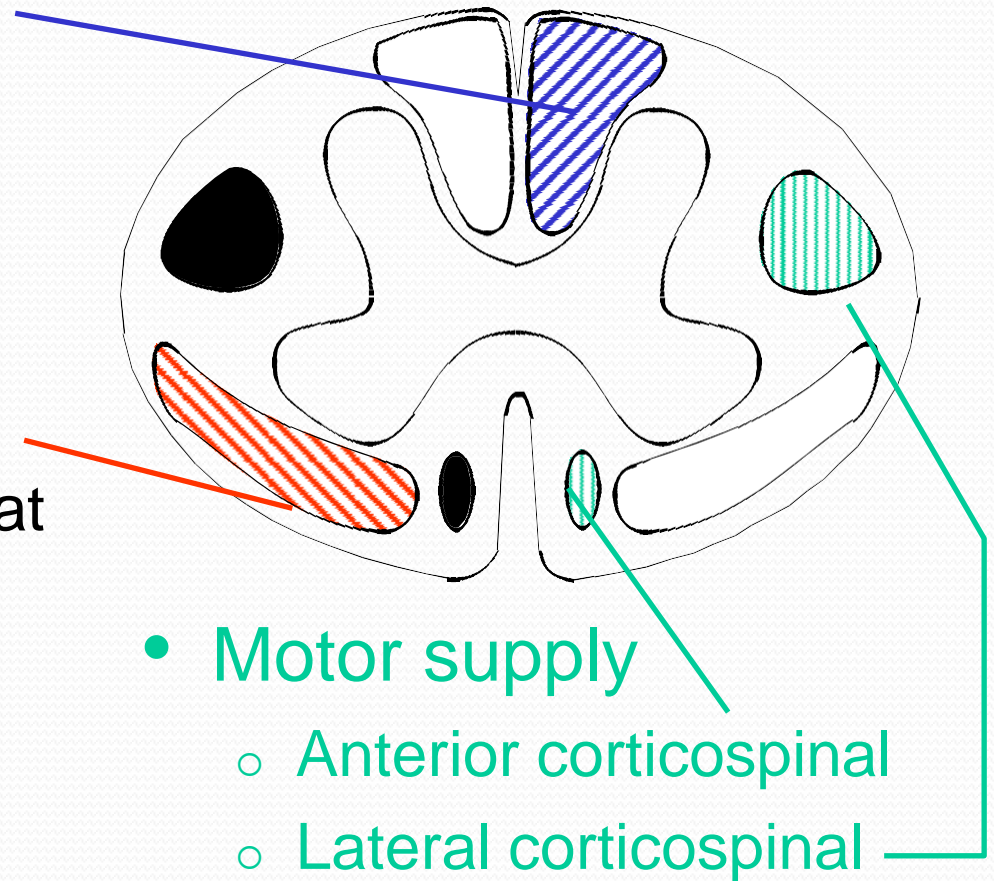
# Spinal Cord Lesion

- 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

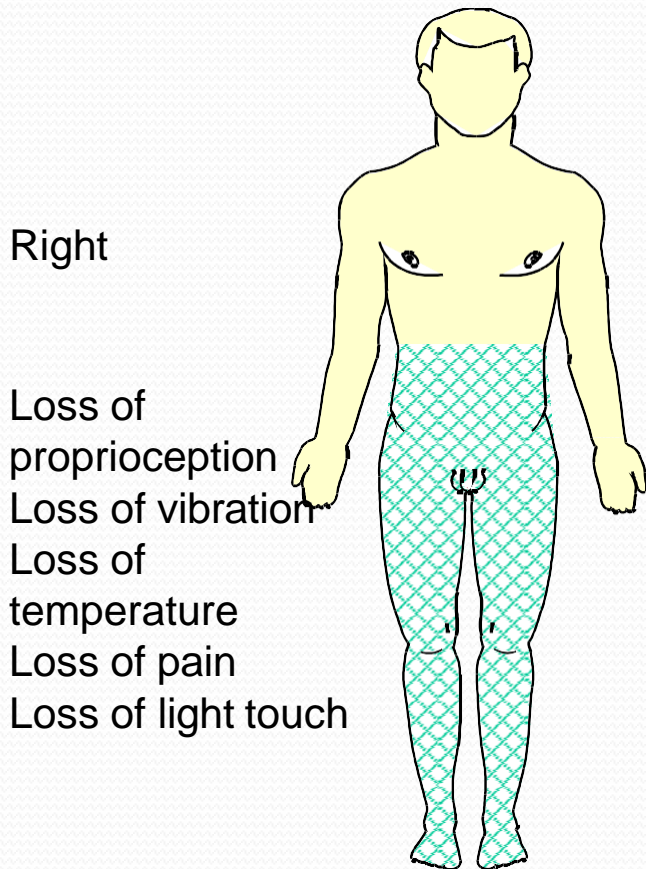
Familiarity with cross-sections of the cord and sites of where the main tracts decussate (cross over) will enable you to understand the detail of the pattern of sensory loss.

# Spinal cord section

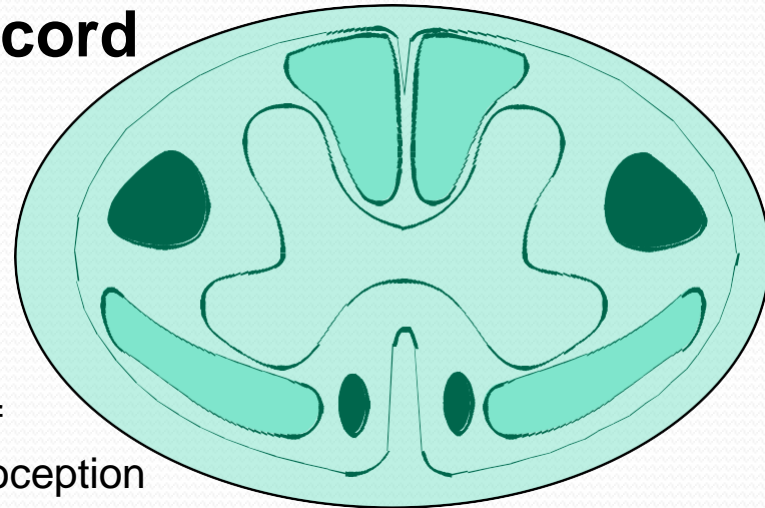
- **Posterior (dorsal) column ipsilateral** (crosses at medulla)
  - proprioception
  - vibration
- **Spinothalamic tract** contralateral (crosses at spinal level)
  - pain
  - light touch
  - temperature



# Patterns of sensory loss



## Complete transverse lesion of the cord



# 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.