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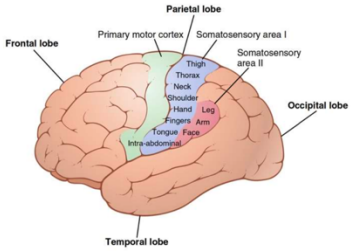
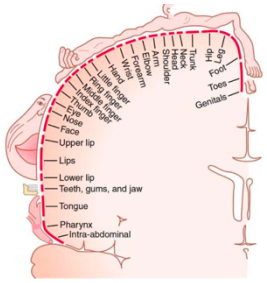
Somatosensory cortex



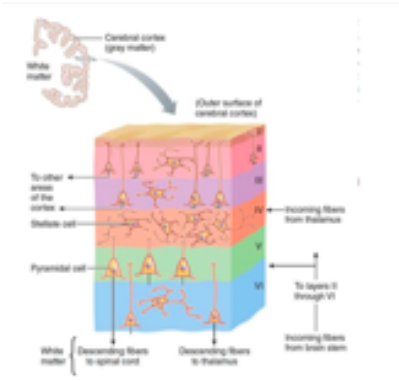
- As we said the **integration** of the **somatosensation** is **primarily** in the **primary somatosensory area** in the **precentral gyrus**
- **The cerebral cortex** can be **divided in to primary sensory areas ,primary motor areas and association areas**
    - The **primary sensory areas collects information** from the **PNS**
    - **The primary motor directly gives orders to the PNS**
- **Terminology**: When we say **primary somatosensory areas I mean somatosensory areas I**
- **Area II** is **small** and the **representation** is **not very localized just face**, **arm** and **legs** , when **excised** it **didn't have big different in the sensory function**
- We will talk mainly about area I



- We can see here that the **body parts** are **represented as homunculus** and **they're disproportionate** to the actual size for a reason

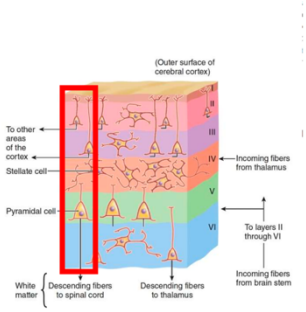
Somatosensory cortex

- The **cerebral cortex** is **organized into six well-defined layers** based on **varying distributions** of **several distinctive cell types**.
  - **Composed of 6 layers**, **layer one** is the **most superficial** while **layer 6** is the **most deep** which **then comes** the **white matter after it**
- **These layers** are **organized into functional vertical columns** that **extend perpendicularly about 2 mm** from the **cortical surface down through the thickness** of the **cortex** to the **underlying white matter**.
- The **functional differences between various areas** of the **cortex result** from **different layering patterns** within the **columns** and **from different input–output connections**
- In **somatosensory cortex**, **each** of **these columns serves** a **single specific sensory modality**.
  - Layer IV:
    - The **incoming sensory signal excites neuronal layer IV first**; the **signal then spreads toward** the **surface** of the **cortex** and **also toward deeper layers**.
  - Layers I & II:
    - Layers I and II **receive diffuse**, **nonspecific input signals** from **lower brain centers** that **facilitate specific regions** of the **cortex**.
      - The **neurons** in **layers II and III send axons** to **related portions** of the **cerebral cortex** on the **opposite side** of the **brain through** the **corpus callosum**.
  - Layers V & VI:
    - The **neurons** in **layers V and VI send axons** to the **deeper parts** of the **nervous system**.
    - **Those in layer V** are **generally larger** and **project** to **more distant areas**, **such** as to the **basal ganglia**, **brain stem**, and **spinal cord**, where they **control signal transmission**.
    - From **layer VI**, **especially large numbers of axons extend** to the **thalamus**, **providing signals** from the **cerebral cortex** that **interact** with **and help to control the excitatory levels** of **incoming sensory signals entering the thalamus**.
  - In the **most anterior part** of the **postcentral gyrus**, **located deep** in the **central fissure** in **Brodmann's area 3A**, an **especially large share** of the **vertical columns responds** to **muscle, tendon, and joint stretch receptors**.
    - The **thickness** of **each layer differs depending** on the **function**, so for **example** in the **somatosensory areas** the **most** imp layer is **layer 4 since** it's **the one** that **receives** the **information so the thickness of layer 4 is**



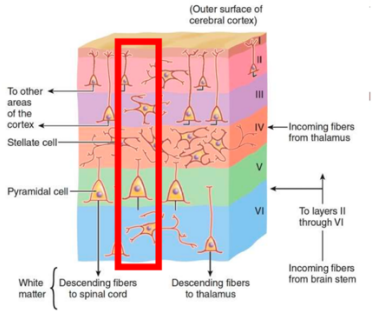
the highest here **while** in a **primary motor** area, **layers 5 and 6 would** be **thicker since theyre more important**

- **Many** of the **signals** from **these sensory columns** then **spread anteriorly**, **directly** to the **motor cortex located immediately forward of the central fissure.**
- These **signals play** a **major role** in **controlling** the **effluent motor signals** that **activate sequences** of **muscle contraction**.

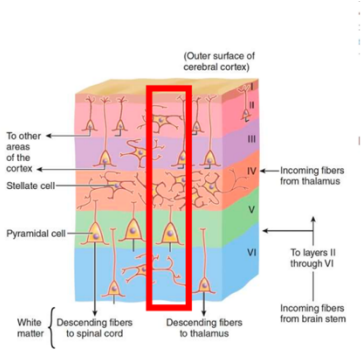


In this **specific region** this **column all these cells** will **integrate** to **process one type of sensory modality**

And **here since** it the **most anterior** it **would** be **for** the **proprioception** like the **muscle stretch**



Here we are going **more posterior** so it **will process different modalities** like **superficial** or **light touch**



Somatosensory cortex function

- If there is an **excision/injury** in the **primary somatosensory area I** there **would be impaired localization** to the **sensory information** which is a **little severe** in the **beginning then it will get taken over by the subcortical region**, so there is **crude localization** (so if you hold a penny you would know which hand its on but not where on the hand it is), not **precise localization**
- Its **important** to **take over** since **perception of localization is very important**
- The **different gradation** of **pressure** and **weight**, **texture** and **shapes of** the **object would also be affected**
- **Widespread bilateral excision** of **somatosensory area I causes loss** of the **following types of sensory judgment:**
  - 1. The person is **unable** to **localize discretely** the **different sensations** in the **different** parts of the **body**.
    - However, he or she **can localize these sensations** crudely.
  - 2. The person is **unable** to **judge critical degrees** of **pressure against the body**.
  - 3. The person is **unable** to **judge** the **weights of objects.**
  - 4. The person is **unable** to **judge shapes** or **forms of objects**.
    - This condition is called **astereognosis**
  - 5. The person is **unable** to **judge texture** of **materials**.
- In the **specific absence of only somatosensory area I**, **appreciation** of **pain** and **temperature sensory modalities** is **still preserved both in quality and intensity**.
- However, the **sensations** are **poorly localized**, indicating that **pain** and **temperature localization depend greatly on the topographic map** of the **body** in **somatosensory area I to localize the source.**

Thalamus

- We said before that the **thalamus** is a **major relay station** for **sensory station** most of the **sensory information** is **relayed here then transmitted** to **different areas** of the **cerebral cortex**
- A **lesion** can **occur** in the **thalamus affecting** the **sensation** by **causing sensory impairment** and **can cause problems** with the **pain** in **which** if **they** have **thalamic pain** they **have** a **very bad experience** they **describe it with bad word and its hard to manage**
- When the **somatosensory cortex** of a **human being** is **destroyed**, that **person loses** most **critical tactile sensibilities**, but a **slight degree** of **crude tactile sensibility does return.**

- Therefore, it **must** be **assumed that** the **thalamus** (and **other lower centers**) has a **slight ability to discriminate tactile sensation**, even though the thalamus normally functions mainly to relay this type of information to the cortex.

Somatosensory association area

- So the **association area** would **tell me exactly what it is give me info form the visual**, **auditory sensation** and **from** the **memory**, all **together it forms this holistic picture**
- So **impairment here cause problems** in **recognition** of the **object complex** and **forms** and the **body parts** on the **opposite parts of the body**, its **hard to sense or feel or remember** the **other side** of the **body** (the other side due to decussation that occurs) this is called **amorphosynthesis**
- When the **somatosensory association** area is **removed** on **one side of the brain**, the **person loses the ability to recognize complex objects and complex forms felt on the opposite side of the body.**
- In addition, the **person loses most** of the **sense** of **form** of his or her own body or body parts on the **opposite side**.
- When **feeling objects**, the **person tends** to **recognize only one side** of the **object** and **forgets** that the **other side even exists**.
- This **complex sensory deficit** is called **amorphosynthesis**.

Physical examination of sensory function

Introduce yourself.
Take permission.
Privacy and chaperon.
Wash your hands before and after.
Explain the procedure.
Sternum as a reference.
Close eyes.
Distal to proximal.
Compare both sides.
Light touch.
Pain.
Vibration (on bony prominences).
Position sense.
Two point discrimination.
Stereognosis and graphaesthesia.
Sensory inattention.