

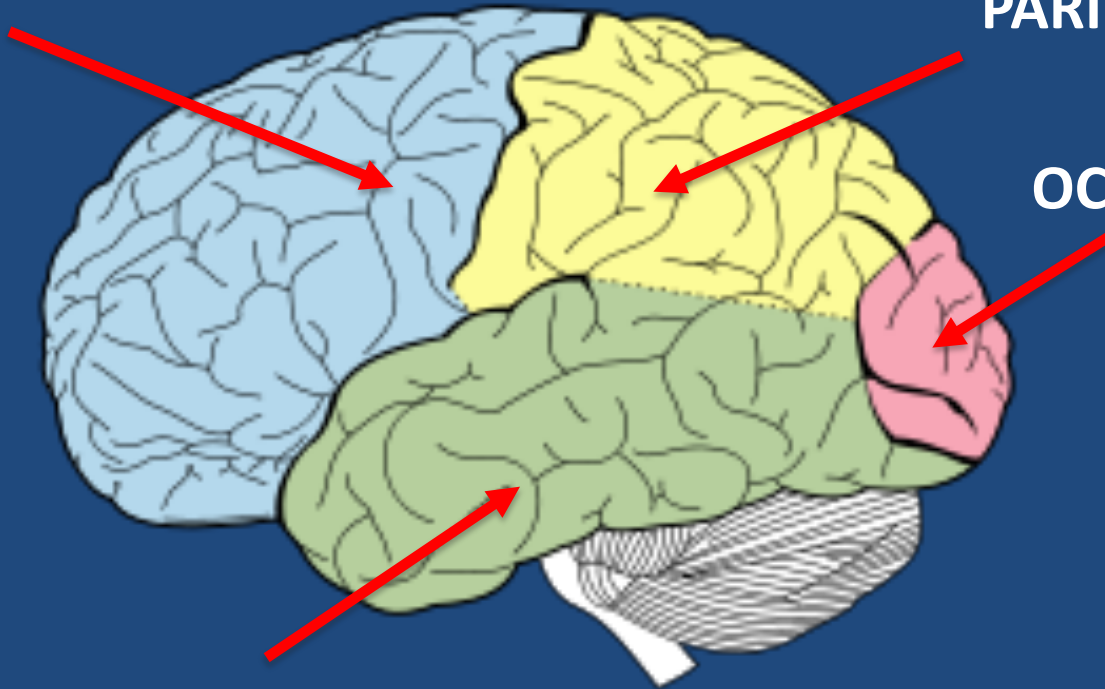
# Four lobes of the cerebral cortex

FRONTAL LOBE

PARIETAL LOBE

OCCIPITAL LOBE

TEMPORAL LOBE

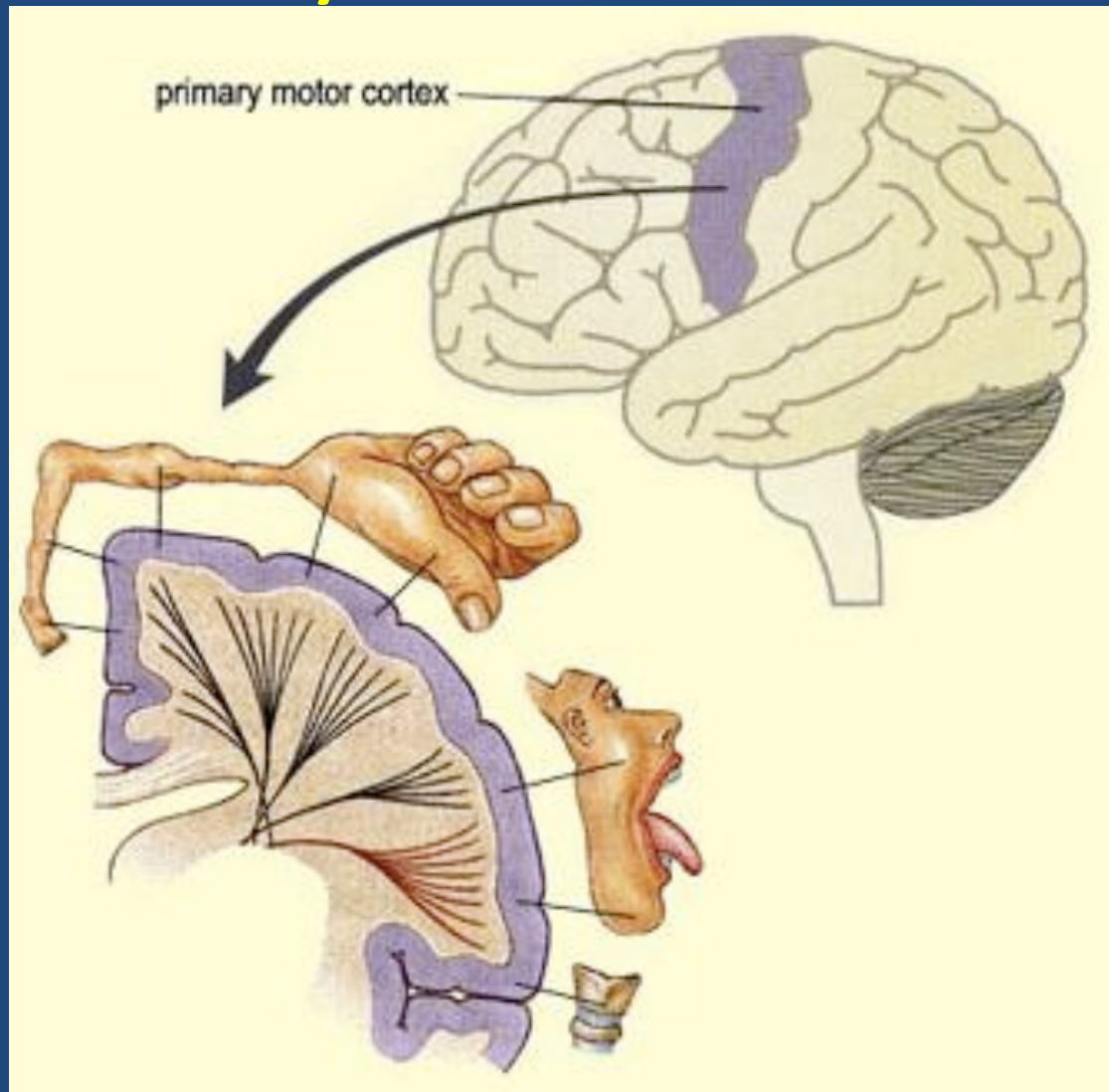


- Each cortical area (lobe) is associated with different structures and functions
- Named after the bone in the skull they lie beneath
- Each lobe contains:
  - Sensory areas and/or
  - Motor areas
  - Association areas

# FRONTAL LOBES

- Largest lobe, located in the upper forward section of **EACH** cerebral hemisphere
- Contains the **primary motor cortex**
  - Runs laterally (across) the top of the brain at the rear of the lobe
- primary motor cortex is characterised by:
  - 1. Contra-lateral organisation** – left motor cortex controls voluntary movements on the right side of the body and vice versa
  - 2. Topographically** (how they are mapped out) - The size of the motor cortex devoted to body parts reflects the dexterity of the part.
  - 3. Inverse representation** of body – feet at top and face at bottom

# Primary motor cortex...



# Homonculus of the motor cortex

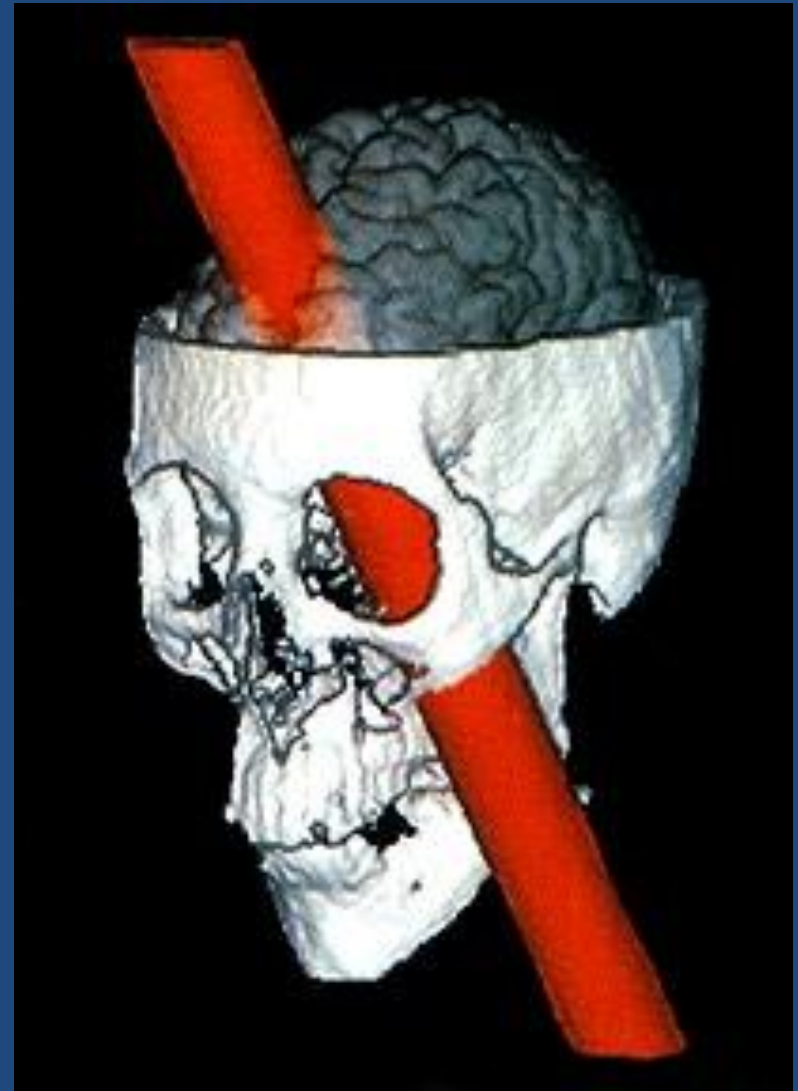


## *Frontal lobe continued...*

- Association areas:
  - Higher mental functioning such as reasoning, planning, judging and using initiative
- Also involved in personality and emotional behaviour
- EG Phineas Gage – change of personality

# Example - Phineas Gage

- Railway construction supervisor, 1848.
- After an accidental explosion, an iron rod (3.5cm diameter, 1m long & 6kg) was shot through his skull, damaging his frontal lobes
- His personality, social behaviour and temperament changed after the incident.
- Phineas lived for a further 12 years



# Phineas Gage Skull





# Broca's Area

- Located in **left frontal** lobe
  - Near face, tongue, jaw and throat of motor cortex
- Involved in production of **clear fluent & articulate** speech

- **Broca's aphasia (expressive aphasia)** – damage to area – a language disorder characterised by an impaired ability to produce speech
- Can understand others, can read, but likely to have difficulty with speaking (motor) and poor grammar and pronunciation. Know what they want to say but can't get the words out.
- So: - Poor grammar, **slow** and **laboured** speech
  - Mainly verbs and nouns, no conjunctions
  - (May have difficulty interpreting the meaning of words if the usual order of words is changed)
- E.g. *“here....head....operation...here...speech...  
none.... talking....what....illness....”*

# PARIETAL LOBES

- Located at the top and centre of the brain between the frontal and occipital lobes of **EACH** cerebral hemisphere
- Involved in functions such as:
  - Sense of touch
  - Detection of movement
  - Location of objects in the surrounding environment

# Primary somatosensory cortex

Contains the primary somatosensory cortex

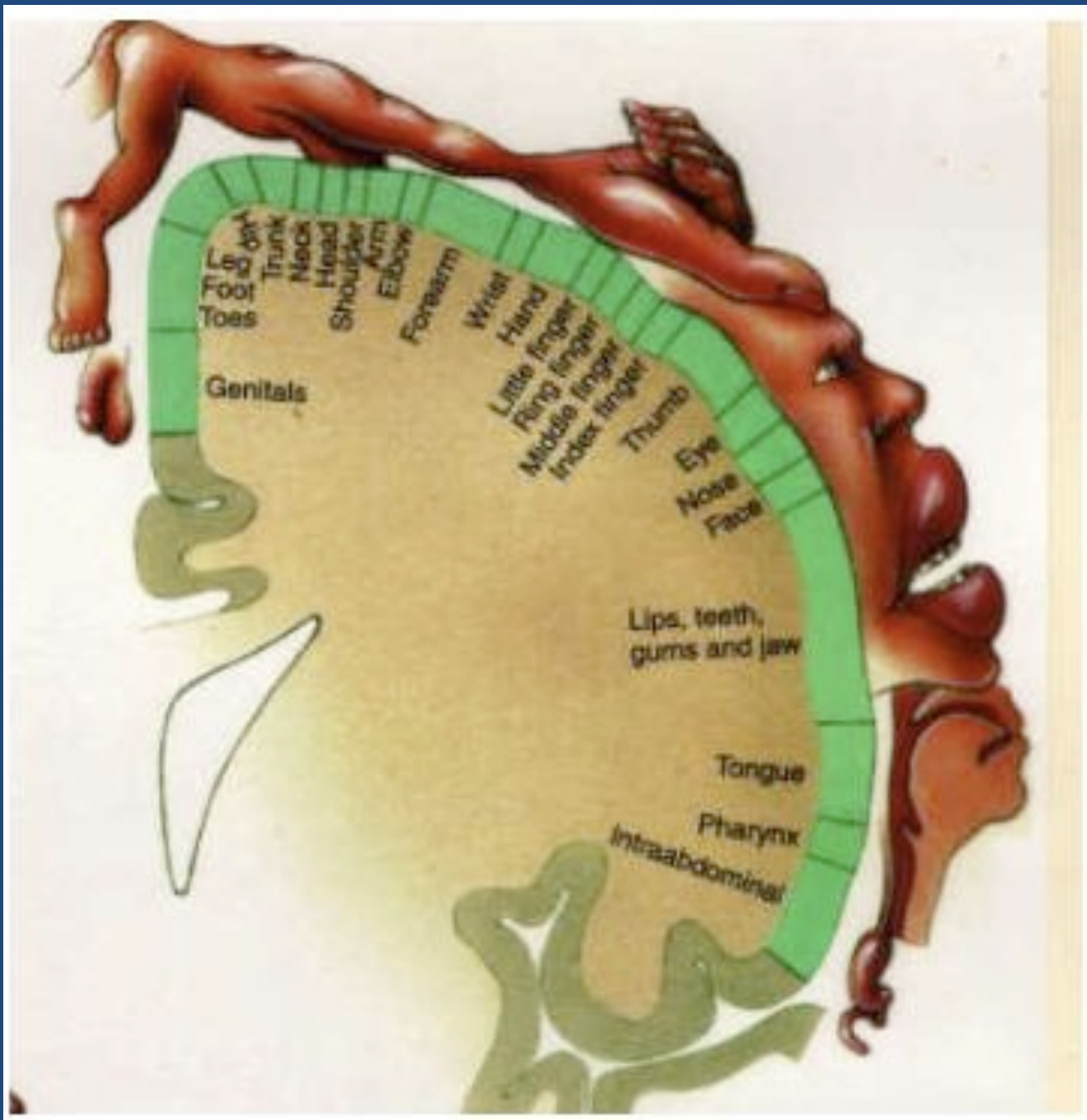
Runs laterally (across) the top of the brain at the front of the lobe

primary somatosensory cortex is characterised by:

**1. Contra-lateral organisation** – left somatosensory cortex receives sensory information from the right side of the body and vice versa

**2. Topographically** (how they are mapped out) - The size of the somatosensory cortex devoted to body parts reflects the sensitivity of the part.

**3. Inverse representation** of body – feet at top and face at bottom



# Homunculus of the sensory cortex



# Comparison of sensory & motor homunculus

## Inside the cortex

We know that different areas of the cortex control different parts of the body. Scientists can say *how much* of the cortex relates to each part of the body, as this exhibit shows.

### 'Cortex man' (representational models)

This is what a man would look like, if each part of his body grew in relation to the area of the cortex that controls it.

sensory

motor



Sensory model



Motor model



## *Parietal lobes cont...*

- **Association areas:**

- Sense our body in space (using information from visual and auditory cortex)
- Determining where objects are in the environment (using visual and spatial reasoning)

- **Damage to the parietal lobe association areas:**

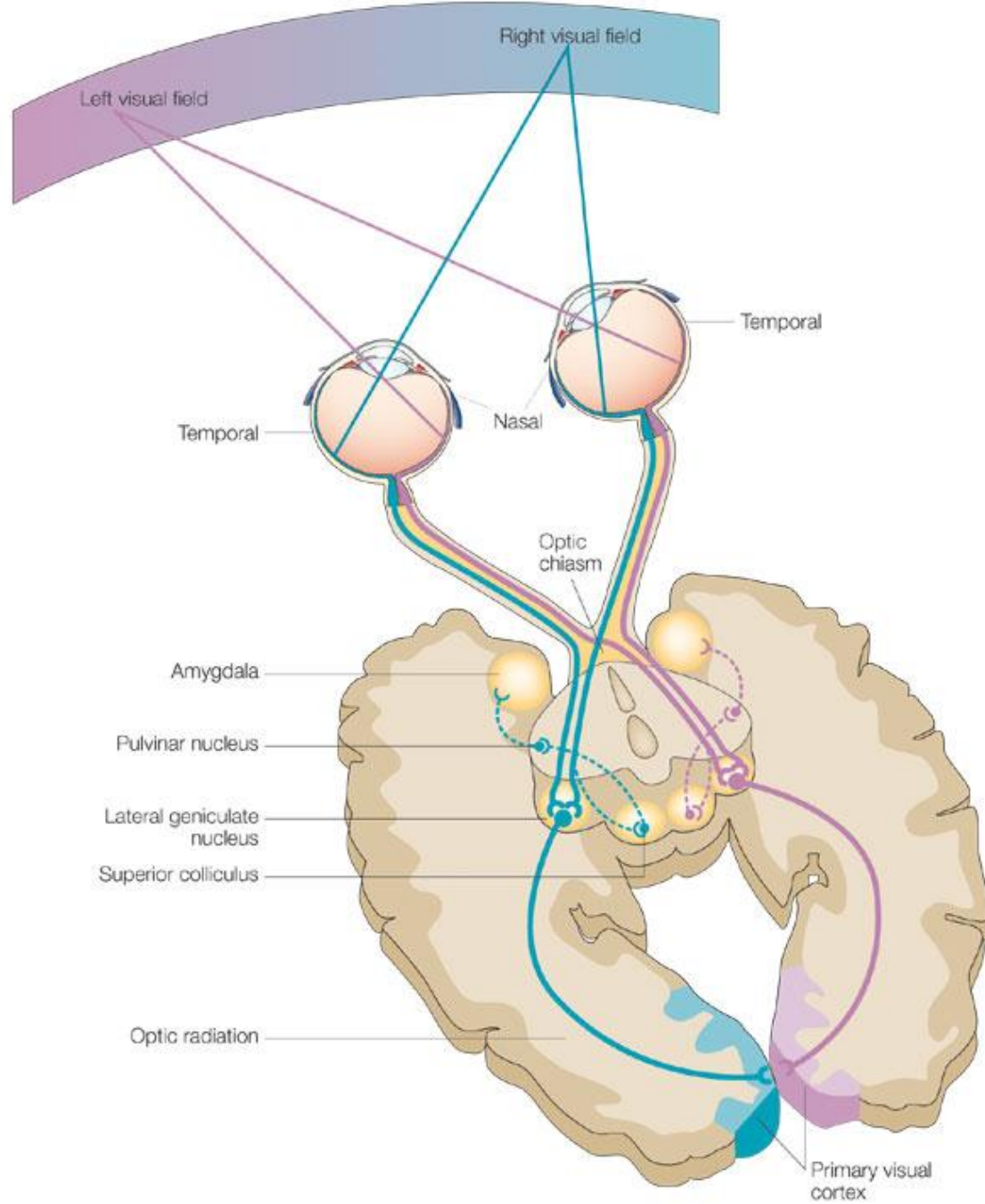
- May result in 'Neglect Syndrome' i.e. ignoring the left side of the 'world'
- May result in spatial disorientation e.g. unable to find the way home



# OCCIPITAL LOBES

- Located at the back of the brain
- Contains the **primary visual cortex**
  - Receives visual information from photoreceptors (rods and cones ) in the back of the eye
- **Association Area:**
  - Allows us to form visual perceptions, think visually and remember visual things

What might occur if there is damage to the occipital lobe?



# TEMPORAL LOBES

- Located in the lower, central area of the brain
- Used in auditory perception, memory, visual perception & recognising faces
- Contains the **primary auditory cortex**
  - Receives and processes auditory information
- Has different locations for different aspects of sound (pitch, frequency etc)
- **Association Areas:**
  - Involved in memory & linking emotions
  - Involved in facial recognition

# Wernicke's Area

- Located in **left temporal** lobe
  - Near primary auditory cortex
- Involved in **comprehension** of speech, **interpreting sounds**, and **locating appropriate words** to express meaning

- **Wernike's aphasia (receptive aphasia)** – no trouble with a word's pronunciation or grammar but the words chosen may be inappropriate and the meaning may be expressed in a round about way . Also, difficulty with understanding the meaning of the spoken word.
- So:
  - Causes fluent, meaningless strings of words
  - Sounds like normal speech, but makes no sense
- E.g. *“I was over the other one, and then after they had been in the department, I was in this one”*

- Besides Wernicke's aphasia, what other problems might arise as a result of damage to the temporal lobe?

## Functions of the Cerebral Cortex

