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Technique Types	
CT scan	With the use of X-ray (invasive) through various angle of circumferential plane and the changes being collected by the detector, it reconstruct the inside depletions to determine the density of each area inside the skull.
PET scan	With use of gamma rays (more invasive) through glucose and oxygen emitting positron (positive electron) giving of gamma rays, and by detecting the origin of the gamma rays to determine regions of brain that is active, yet generate poor spatial resolution due to time taken for positron annihilation.
MRI scan	Using radio waves (most harmless with high resolution) by measuring water or proton (paramagnetic) density (and location) through using strong magnetic field for molecules to align in magnetic fields with radio pulse to flip the alignment so that they realse energy, which will be detected by the scanner to produce structural (spatial) images.
fMRI scan	Functional brain imaging method (non-invasive with high resolution) by looking through paramagnetic properties (blood oxygenation) of haemoglobin to determine brain activity (more active, higher level of oxygenated blood supply in that brain region).
MR tractography	With the use of MR signals (non-invasive with high resolution) by detetcting the location of movement (diffusion) of molecules, which allow to map the major pathway of brain (structural map, map of connectivity).
Modern technique	Now techniques that can be applied to collect data on structure and function at all relevant level of spatial and temporal resolution. • Functional changes over time → temporal resolution. • Field of view (fine structural details) → spatial resolution. *important to consider invasiveness.

Spatial Resolution (best → worst)	Temporal Resolution (best → worst)
1. MRI / fMRI / MR tractography 2. MEG 3. PET 4. CT 5. EEG	1. EEG / MEG 2. fMRI 3. PET 4. CT / MRI / MR tractography

Week 3-3: Tactile Sensation and Perception

- ➢ The skin as a sensory surface.
    - The somatosensory system mediates sensations from the whole body surface, including skin and deeper tissues.
    - Structure of skin – most of the body is covered by hairy skin. The palmar surface of the hands and the soles of the feet are covered by glabrous skin, with skin ridges a prominent feature.
    - System overview – there are four types of mechanoreceptors in glabrous skin (responding to different aspect of force stimuli):
        - Meissner corpuscles and Merkel complexes are close to the surface.
        - Ruffini organs and Pacinian corpuscles are deeper in the skin.
        - These receptors are innervated by large myelinated axons with cell bodies in the dorsal root ganglia.
        - Transmission of this information to the brain generates our conscious experience of touch.

- ➢ Transduction in a Mechanosensory Afferent
    - Force alter the shape of skin to cause mechanosensitive ion channels to open, allowing ions (Na+) to flow in, which depolarized leading to firing action potential.

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- ★ <u>What defines the threshold for a mechanosensory receptor?</u> (highly examinable)
    - The threshold is the point at which there is enough sodium enter through the mechanosensitive channels to cause the activation of the voltage-gated sodium channels. ⇒ all about sodium.

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- ➢ Receptor Field
    - Sensory receptors and neural activation
        - Receptor field – area that is able to detect force that activate a particular neuron (corpuscle).

Slowly adapting mechanoreceptors	Rapidly adapting mechanoreceptors
Merkel complexes are found at the tips of the epidermal ridges where they respond to indentation. **Ruffini** endings are found in the upper dermis, have a sustained response to skin movement.	**Meissner** receptors are found near the skin surface and have a transient response to skin movement. **Pacinian** receptors are located deep in the dermis and hypodermis and have a transient response to vibration.

Colliculospinal tract	Reticulospinal tract	Vestibulosinal tract
(from superior colliculus in midbrain) → mediate reflexive orientation of the head and neck in response to visual stimuli to adjust posture and movements unconsciously.	(from reticular formation in pons and medulla) → selecting and suppressing movement (motor activity) by turning groups of motor neurons on or off to maintain gait.	(from vestibular nuclei in pons or medulla) → maintains balance and posture in response to head movement and gravitational signals non-consciously to stabilize the body.

*All three tracts are for the maintenance of postural stability.

Lateral Corticospinal Tract	Corticobulbar Tract	Medial Descending Motor Pathways
– Fine, voluntary body movement. – Motor cortex to spinal cord (connects to motor neurons). – Crossing over: At the medulla (pyramidal decussation), which control opposite side of body.	– Voluntary face and head movement. – Motor cortex (face area) to brainstem (connects to cranial nerve motor nuclei). – Crossing over: mostly bilateral (both sides of the brain send signals), but lower face and tongue are mainly controlled by the opposite side.	– Automatic (non-conscious) posture and reflexes. – Brainstem (not the cortex). – Usually doesn't cross (or only partially crosses), which works on both sides or the same side of the body.

- Motor integration, voluntary movement and its foundation.
    - Before the muscle on the hands activate, the muscle on the legs activate to anticipate the effect of pulling on the bar, for the posture to be maintain preemptively (brain contributes unconsciously).

    - The primary motor cortex and motor association areas.
        - Cortical association → abstract pattern of movement.
        - Primary motor cortex → discrete activation of spinal motor areas.
        - Motor association cortex → plans, sequences, and goal-related.