Chapter 1 - Basic Neurophysiology

**The central nervous system** – the brain and the spinal cord

* Made up of neurons and glial cells
* Neurons 🡪 cells that transmit information throughout the nervous system.
* Neurons communicate with other neurons and cells at specialized structures 🡪 synapses, where chemical and electrical signals can be conveyed between neurons when action potentials occur.
* **Synapses:**
  + *Chemical* 
    - Transferring information involves changes in the electrical state of the neuron as electrical currents ﬂow down the axon
    - At the terminal 🡪 depolarization causes calcium to flow into the cells 🡪 release of neurotransmitters from one neuron to another via the synaptic cleft from vesicles in the presynaptic cell (sending)
    - Neurotransmitters binds with specific receptors embedded in the postsynaptic membrane
    - The neurotransmitter binding induces a change in the receptor, which opens specific ion channels and results in an inﬂux of ions which in turn causes excitatory or inhibitory postsynaptic potentials, depending on the properties of the postsynaptic receptor.
  + *Electrical*
    - passing current directly from one neuron to another via gap junctions
    - (directly connected to cytoplasm of another cell)

**Glial cells** = nonneural cells that serve various functions in the nervous system:

* Provide structural support, nutrition, insulation, and helps signal transmission in the nervous system (might play a bigger role in neural activity🡪 respond to and release neurotransmitters 🡪 this is still quite uncertain)
  + Types of glial cells:
    - * Astrocyte: helps form the blood–brain barrier.
    - BBB: Restricts the diﬀusion of microscopic objects (most bacteria) and large hydrophilic molecules in the blood from entering the neural tissue.
  + Oligodendrocyte: forms myelin in the central nervous system, which aids the speed of information transfer = **Nodes of Ranvier**

Neurons 🡪 like muscles need energy - oxygen - to “perform” 🡪 Therefore, blood flow in the brain couple with increase in neuronal activity (like a muscle a working neuron needs oxygen to perform) → possible to use this as a measure of local changes → haemodynamic response → BOLD → more oxygenated compared to deoxygenated hemoglobin → fMRI

Chapter 2 – Overall Structure and Function

The central issue of understanding the brain 🡪 the mind is enabled by the whole brain working in concert or by specialized parts of the brain working at least partly independently.

Diverse lines of research using different approaches have contributed to numerous behavioral associations for any brain area.

One way to look at the brain is its anatomical structure:

* From the brainstem including the Medulla, Pons(eye), Cerebellum (coordinated movement), and Midbrain (superior and inferior colliculi)
  + Carry out many sensory and motor processes 🡪 heart rate, respiration, survival
* To the thalamus and hypothalamus (Diencephalon)
  + The thalamus is the relay station for almost all sensory information.
  + The hypothalamus is important for the autonomic nervous system and endocrine system.
* To the cerebrum, which includes the cerebral cortex, the limbic system, and the basal ganglia

This is where we will put our focus: the cerebral cortex

* Gyri = protruding areas on the surface of the cortex
* Sulci + fissures = enfolded regions of the cortex
* Gray matter = neuronal cell bodies
* White matter = axons tracts + glial cells

Structural division

* Microanatomy: Cytoarchitectonic 🡪 similar cellular architecture, might indicate areas of homogeneous function, subdivide the cortex into 52 region (Brodman)
* Using diﬀerent anatomical criteria: The general patterns of layering; neo, meso, allo
* Macro anatomically: Four lobes, two hemispheres (separated by the interhemispheric fissure - connected by the large fiber bundle corpus callosum)

Another way to divide the brain, it to make a more functional division

* Based on idea that functions might be localized within discrete regions
* **Frontal lope**: planning, cognitive control, and execution of movements
* **Parietal lope:** receives sensory input about touch, pain, temperature, and limb position, and it is involved in coding space and coordinating actions
* **Temporal lope:** contains auditory, visual, and multimodal processing areas.
* **Occipital lope:** processes visual information.

Highly interconnected 🡪 distributed versus modularity hypothesis.

* Small world architecture

Chapter 3 – Methods of Neuroscience

When we conduct experiment with this field there are two important kind of methods:

* The scientific method:
  + Begins with an **observation** of a phenomenon 🡪 The scientist devises **a hypothesis** to explain an observation 🡪 Designing **experiments** to test the hypothesis and its predictions 🡪 employ the various methods, that we will get to in a moment

·

Our knowledge about the brain = much depend on the methods we have available.

For instance: In the beginning the way to study the mind was through behavior deficits and postmortem examinations. Or the idea that the skull could indicate function **phenology.**

Valuable knowledge: Broca 🡪 Tan 🡪 language as left-lateralized, the idea that different functions have different locations.

Split-brain 🡪 the idea that different halves had specific tasks too.

Today the **structure of the brain** can be pictured very accurately with CT 🡪 MRI. Connectivity quite vivid with DTI

**Function of brain:**

**Single-cell recording:** Allows recordings from individual neurons i.e. measures membrane potential (intra- or extracellularly) 🡪 Often used on animals due to invasiveness

**Multiunit recording**: The activity of hundreds of cells can be recorded at the same time.

**Electroencephalography (EEG):** Measures the electrical activity of the brain (sum of EPSP)

* + An event-related potential (ERP): A change in electrical activity that is time-locked to specific events based on averaging of experimental stimuli. (Good temporal resolution)
  + Electrocortogram (ECoG): Similar to an EEG, except that the electrodes are placed directly on the surface of the brain (spatial)

**Magnetoencephalography (MEG):** measures the magnetic signals generated by the brain.

* + The electrical activity of neurons also produces small magnetic fields, which can be measured by sensitive magnetic detectors placed along the scalp.
  + Similar temporal resolution, superior spatial resolution (magnetic signals are minimally distorted by organic tissue), expensive

**Function + structure = neuroimaging:**

* PET
  + inject radioactive tracer → emit positron → meet electron → gamma radiation released → scanner pick up signal
    - Assumption: increased blood flow around active tissue
    - Weakness: radioactive tracers, poor temporal resolution (wait for blood to “arrive/circulate”), VERY expensive
* fMRI
  + BOLD response  🡪 ratio between deoxygenated and oxygenated blood Activation of a brain area → the vessels to widen → more oxygenated blood→ less magnetic field disturbances → the spin of the water molecule synchronizes for a longer period of time → the signal wished measured stays for a longer period of time

Chapter 4 – Lateralization

In lateralization of functions: Most dramatic “evidence/example” the eﬀect of left-hemisphere damage on language functions

Broca 🡪 Tan 🡪 language as left-lateralized, the idea that different functions have different locations and different sides in the brain

The idea of mind right 🡪 mind left more than just language: split brain patients

* Roger Sperry and Gazzaniga
  + Connected by a large fiber bundle: the corpus callosum: important for hemispheric integration of information.
  + Carrying *homotopic and heterotopic* connections between specific regions
  + Knew that motor and visual systems were contralateral
  + Some tasks are impossible for these patients (but that the knowledge is still there – communication between L/R is gone)
  + Pop-press 🡪 boiled-down notion that the left hemisphere 🡪 analytical and logical : the right hemisphere 🡪 creative and intuitive 🡪 The hemispheres performs processes that the other does not = exaggeration 🡪 most cognitive processes = redundant 🡪 Each hemisphere is capable of carrying out most processes

Unilateral damages and split-brain patients have revealed 🡪 The two hemispheres do not represent information in an identical manner

Language: There’s a lot to say about the lateralization of language 🡪 lexicons 🡪 emotional prosody 🡪 Our experiment has no word processing.

**Visuospatial specialization**🡪 more relevant 🡪 The two hemispheres have diﬀerent visuospatial capabilities.

* The right hemisphere: specialized for detecting upright faces and discriminating among similar faces.
* The left hemisphere: not good at distinguishing among similar faces, but it is able to distinguish among dissimilar ones when it the feature diﬀerences with words (blond versus brunette, big nose versus button nose).
* As for the recognition of familiar faces🡪 right hemisphere outperforms the left hemisphere in this task (Turk, 2002) 🡪 also what we find.
* A double dissociation was found (Figure 4.19). The left hemisphere was biased towards recognizing one’s own face, while the right hemisphere had a recognition bias for familiar other 🡪 further studies

*Different visual tasks:* the hemispheres interact diﬀerently in how they control reﬂex and voluntary attention processes. Right hemisphere 🡪 reﬂexive automatic attention orienting 🡪 automatic shifting of attention to gaze direction. Voluntary attention orienting (given a clue) 🡪 left has more to say.

The left hemisphere: more adept at representing local information 🡪 the right hemisphere is better with global information (efficiency) *Right: bigger picture. Left: detail oriented.*

Why lateralization: The need for unified action, rapid communication, and reduced costs associated with interhemispheric processing 🡪 small-world” architecture 🡪 high degree of local efficiency and fast communication with the global network

**Memory:** left hemisphere damage can result in selective impairment in verbal memory, whereas right hemisphere damage may result in nonverbal memory impairment

Chapter 5 – Perception and sensation

Begins with some sort of anatomical structure for collecting, filtering, and amplifying information from the environment.

Perception 🡪 stimuli (external) 🡪 elicits neural activation 🡪the mental representation 🡪 whether it accurately reﬂects the stimulus? 🡪 percept

Sense can be intact 🡪 percept deficit – bottom up vs. top down(context) 🡪 prosopagnosia.

**Anatomically**: sensory systems 🡪 very distributed 🡪 reflected in modality specific deficits 🡪 Very alike: take input: sounds, light turn into neural signals 🡪 Receptor cells.

**Vision:** Light through the lens 🡪 back surface of eye (retina) 🡪 photoreceptors: rods and cones (distinct properties) 🡪 bipolar cells 🡪 ganglion cells – optic nerve 🡪 optic chiasm (cross over) 🡪 lateral geniculate nucleus through thalamus 🡪 primary visual cortex.

Receptive field (primary cortex) 🡪 orderly mapping according to spatial representation 🡪 retinotopic maps 🡪 common for all sensory modalities. Dividing the visual cortex 🡪 discontinuities in retinotopic 🡪 5.25.

Why so many and how?: Hierarchical processing 🡪 each area elaborates on the representation derived by processing in earlier areas (not necessarily number-wise) 🡪 primary: edges. Secondary: corners 🡪 higher-level: integrate this information into shapes 🡪 match to representation in memory.

Or: analytical process: respond to object attributes: color, movement. Each area provides its own limited analysis: specialized and distributed processing 🡪 this theory is supported by area MT/V5 🡪 neurons respond to movement and direction 🡪 does not care about features.

One question: does that information have to be relayed to higher visual areas in order for us to recognize the presence of a stimulus? 🡪 unconscious information integrated in pri+sec 🡪 higher areas = conscious perception. Example in chapter on V5 🡪 stimulation of neurons /areas. Chapter 6 🡪 stimulation of STS in monkeys 🡪 more prone to perceive a face.

Prosopagnosia – great example of this. No deficit in vision. Or other higher order processes 🡪 objects, complex objects 🡪 sense intact 🡪 percept deficit. Is FFA necessary to recognize a face? To perceive a face?

Patient P.T. 🡪 cannot recognize familiar people or landscapes. Not blind! Not agnostic.

* + - Monet versus Picasso – realistic + continuous whole versus separate units + sharp contrast.
    - Deficit in color and form perception = both landscapes and people.

Highly specialized functions – perception of motion still on top. FFA 🡪 ability to perceive faces, degree of skill?

* Quite interesting: prosopagnosia – did respond in FFA. It’s the connections to other extended areas.

Sensory modalities: survival 🡪 Face specificity has evolved through some kind of experience 🡪 innate or not🡪 the two theories – category or expertise: Donald Hebb 🡪 cortical plasticity 🡪 studies = functional plasticity

Brain = dynamic place 🡪 pp. 183 amputees 🡪 face next to arm.

Expertise: Thomas Elbert 🡪 violin players – right hemisphere was stronger than controls + correlation between age at which they began.

Juggler experiment 🡪 increased left parietal-sulcus = spatial judgement 🡪 size returned 🡪 use it or lose it.

FFA size – known to vary a lot 🡪 relevant for skill?

**Audition:**

Sound waves 🡪 enter auditory canal 🡪 amplified 🡪 eardrum = vibration 🡪 air-filled middle ear – rattle tiny bones 🡪 oval window vibrates 🡪 cochlea = fluid filled. Basilar membrane 🡪 inner surface: “hair cells” – sensory receptors. (Composed of up to 200 tiny filaments: stereocilia)

Vibration at the oval window 🡪 tiny waves in fluid 🡪 move basilar membrane 🡪 move hair cells.

Location on the membrane determines FREQUENCY TUNING 🡪 thinkness of the basilar membrane varies along its length (OW = thick = high frequency)

Tonotopy = information about sound source at early processing

Deflected hair cells = mechanically gated ion channels open 🡪 positively charged K+ and Na+ flow into the cell = depolarization 🡪 release of transmitter = neural signal.

Chapter 6 – Object recognition

Low level features 🡪 high level processing 🡪 memory invoking.

Anatomically: V1 🡪 ventral or dorsal (temporal or parietal cortex) 🡪 what and where 🡪 similar input =different aspects of cognition: Studies = ventral occipitotemporal cortex = import for object recognition

**Object constancy** 🡪 recognition of specific objects in countless situations: the fact that we did not correct for angles stimuli-wise: might not have affected anything: tong study.

Hierarchical structure: posterior 🡪 simple features 🡪 more anterior 🡪 complex feature 🡪 specific features = each stage adds complexity 🡪 cells in the inferotemporal lobe = selective respond to complex stimuli.

How do we recognize specific objects?

* Level of neurons: grandmother cell
  + Gnostic units = neurons that recognize a complex object (known/encountered)
  + Problem: dead cell, novel stimuli, change over time
* Or a collection of neurons? Ensemble theory 🡪 network (lion/tiger)

Category-specific deficits; animate versus inanimate = different representations: kinesthetic. “Stored” differently.

C.K 🡪 double dissociation 🡪 faces and objects are process differently in higher order.

Faces: Does face perception involve physically distinct mechanisms? Functionally independent?

* One region in the superior temporal sulcus, one in the inferotemporal gyrus
* Hypothesis: FFA prosses invariant facial properties. STS processes dynamic features (emotions: lip reading and eye gaze)
* Highly automatic regions 🡪 unconscious perceptions
* When stimulated (in monkeys) more prone to see faces (combined flowers and faces)

Only faces?

* Fine perceptual discriminations with highly familiar stimuli: underemphasized confound: level of expertise.
* Cars versus birds + trained to make fine discriminations (Greebles)
  + Broader activity in VOC
  + Engagement of fusiform gyrus increases with expertise // recognition

W.J: sheep farmer 🡪 recognizing human faces uses a particular mental pattern//set of cues

Objects 🡪 between category. Faces = within category 🡪 LETTERS. Visual word form area. Left hemisphere: Experiment: letter strings/familiar words = increase. Confirms our findings. Pp 255.

Pp 256: Faces+objects. Objects+Words. Words+faces. Faces alone. Words alone. Objects? Not alone: Holistic (right), decomposing into parts (left)

Modules: general thing?

* Parahippocampal place area, also evolutionary useful
* EBA – body parts

Necessary?

* TMS (rLO, OFA and rEBA) = triple dissociation.

Chapter 7- Action and Motor

Scientists studying vision are fond of claiming that over 50 % of the brain is devoted to this one sensory system, A motor control chauvinist could reasonably argue that over 50 % of the brain is devoted to the control of action.

Our experiment can be related to motor action and controls in two ways:

Our experiment does not investigate anything close to motor control at all 🡪 included at button press for every stimuli 🡪 very simple movement coordination wise 🡪 still an execution of movement,

Basically 🡪 the motor system is organized in a hierarchical feedback loop with multiple levels of control. - Involves **the spinal cord, the sub cortex, and the cerebral cortex**.

The spinal mechanisms 🡪 contact between the nervous system and muscles (in itself capable of producing simple reﬂexive movements.

At the top of the hierarchy are premotor and association areas of the cortex 🡪 the planning of action based on current goals and perceptual input.

Between the premotor and association areas and the spinal cord 🡪 sit the primary motor cortex and brainstem structures, which with the assistance of the cerebellum (coordination, monitoring) and the basal ganglia (likelihood), translate this action goal into a movement.

An action requires a sequential set of simple movement 🡪 Hierarchical representational structures organize movement elements into integrated chunks.

Hierarchy: At the top 🡪 the *conceptual level* = representation of the goal of the action 🡪 this goal must be translated into an eﬀector system 🡪 then translate these movement plans into patterns of muscular activation.

Each cerebral hemisphere is devoted primarily to controlling movement on the opposite side of the body 🡪 We could actually see that our participant was using her left-hand.

Moreover 🡪 somatotopic 🡪 just as the fusiform gyrus is divided into “parts” representing different stimuli 🡪 represents the body.

**The recognition part:**

Recognition 🡪 mirror neurons

* + Our comprehension actions involve referring to our own ability to perform them

Expertise: the extent and intensity of the activation pattern reﬂect the individual’s own particular motor repertoire. Skilled dancers show stronger activation in the mirror network when watching videos of familiar dance routines as compared to unfamiliar dances

* Basket example (Basket players, sports journalists and control) pp. 365
* Critique of mirror neuron

Chapter 9 - Memory

The brain can change through experience: learn 🡪 At the neural level = changes occur in the synaptic connections between neurons 🡪 It also implies that learning can occur in multiple regions of the brain (not specific)

“Several types of memory” 🡪 mediated by diﬀerent neural mechanisms 🡪 H.M. lead to way to this notion: the medial temporal lobe 🡪 involved in certain memory functions: not general intelligence, cognitive control, language, perception, or motor functions.

**(WM) Long-term memory:** Famous cartoons + humans stored in long term memory (declarative) → semantic memory (objective knowledge)

* The medial temporal lobe memory system: Hippocampus, the perirhinal, entorhinal, and parahippocampal regions.

The parahippocampal and perirhinal areas: - Receive information from the visual, auditory, and somatosensory association cortex 🡪 Project to the hippocampus (Figure 9.21) and from there to other cortical regions

p. 404 – experiment with words 🡪 fMRI: the hippocampus is activated when information is correctly recollected 🡪 During retrieval, the hippocampus was selectively active *only* for items that were *correctly recollected* (Figure 9.26) 🡪 hippocampus is involved in retrieval for episodic memories but not memories based on familiarity.

The interesting question for our study: What are the roles of diﬀerent subdivisions of the medial temporal lobe in long-term memory?

* Been proposed 🡪 encoding processes 🡪 item = *familiar* // correctly identified (recollection), 🡪 depend on diﬀerent regions of the medial temporal lobes.
* Diﬀerent types of information from all over the cortex 🡪 converge on the medial temporal lobe regions surrounding the hippocampus 🡪 not all types pass through the same structures.
* Information about the **features of items (“what” an item is):** neocortex -🡪 passes through the anterior parts of the parahippocampal region known as ***perirhinal cortex*** *(PRC)*.
* Information from neocortical areas about **“where”** something is located passes through the more **posterior parts of the parahippocampal cortex.**
* Model: ***binding of items and contexts (BIC) model****:* the perirhinal cortex represents information about specific items (e.g., who and what) 🡪 the parahippocampal cortex represents information about the context in which these items were encountered (e.g., where and when) 🡪 processing in the hippocampus binds the representations of items with their context
* To recognize that something is familiar, perirhinal cortex is sufficient; but to remember the full episode and everything related to it, the hippocampus is necessary
* The perirhinal cortex showed activity patterns that correlated with the strength of familiarity with scenes other than recollected ones (Figure 9.28) 🡪 what we want to investigate for the FFA as well!

Chapter 10 – Emotions

FFA 🡪 evolutionary to increase our survival chances 🡪 emotions are neurological processes evolved to guide behavior 🡪 to increase survival and reproduction.

The study of the neural basis of emotion are very complex.

Many parts of the nervous system are involved 🡪 disagreement in the research field 🡪 diﬀerent theories of emotion generation.

Early attempts to identify neural circuits of emotion 🡪 a unitary concept that could be localized to one specific circuit that dealt with emotions: the limbic system.

* Network 🡪 *originally hypothalamus, anterior thalamus, cingulate gyrus, and hippocampus* 🡪 later expanded to orbitofrontal cortex and amygdala
* Today 🡪 it isn’t captured by one definition or contained within a single neural circuit. Depending on the emotional task or situation = expect diﬀerent neural systems to be involved 🡪 again the complexity.

Most psychologists agree that emotion consists of three components: 1. A physiological reaction to a stimulus, 2. A behavioral response, and 3. A feeling

An emotion🡪 own interaction with the world: use other peoples’ emotional states to guide us: here facial expression has proved specifically important in the prediction and for changes.

One hypothesis: Based on the assumption that facial expressions are observable, automatic  
manifestations that correspond to a person’s inner feelings.

* Paul Ekman 🡪 finite set of basic emotional states revealed by expressions 🡪 no cultural difference = defined a set of 6 basic emotions 🡪are all innate, universal, and short-lasting human emotions.

Hence: important for our social abilities

**Our study**: basic facial perception and recognition: Studies have shown that there is  
a dissociation between identifying an individual’s face and identifying the emotional expression on that face.

In the report🡪 lesion to the occipitotemporal region = prosopagnosia 🡪 deficit in facial perception but not an overall visual perception deficit.

* Damage to amygdala: Can perceive faces; but not recognize the expression of fear on a face. (general huge role in fear)
* More research 🡪 specific facial expressions depend on different neural mechanisms and regions of the brain are at work (not just for processing specific facial expressions per se, but more generally for processing different emotions)

James Blair 🡪 orbitofrontal cortex increasingly active when viewing angry facial expressions, not sad.

**Amygdala and FFA:** aspect of the amygdala’s response to fearful facial expressions is that the participant does not have to be aware of seeing the fearful face for the amygdala to respond 🡪 (I believe I found the same for FFA) = highly automatic.

**Eye gaze:** The amygdala appears to be an integral part of a system that automatically directs visual attention to the eyes when encountering any facial expressions 🡪 Impaired eye gaze is also a main characteristic of several psychiatric illnesses and social disorders in which the amygdala may be dysfunctional (e.g., autism spectrum disorder) 🡪 google glasses

Chapter 11 – Language

Specific region for face perception/recognition 🡪 other regions in the brain seems to have different tasks 🡪 language 🡪 deficits indicates different regions for knowledge and language.

H.W 🡪 left hemisphere stroke 🡪 retrieval of object knowledge is not the same as retrieval of the linguistic label. Moreover 🡪 speech production and comprehension have different networks.

Split brain patients (and lesions) = Most studied and profound lateralization 🡪 Left hemisphere 🡪 does the lion’s share. Right 🡪 prosody and rhythm, metaphorical meaning.

*Broca’s aphasia (non-fluent)* 🡪 “Tan” 🡪 left inferior frontal gyrus 🡪 telegraphic, effortful.

*Wernicke’s aphasia* 🡪 comprehension deficit 🡪 posterior superior temporal gyrus 🡪 fluent, grammatical : nonsense. Semantic paraphasia (Horse instead of cow)

**How does the brain produce and store?** 🡪 mental lexicon: semantic information, syntactic information, details of word form 🡪 Organization principles: morphemes, frequency, lexical neighborhood (phoneme), semantic.

Conceptual knowledge 🡪 semantic networks.

Quite interestingly 🡪 Category-specific deficits (as with vision) 🡪 Impairment involving living things: medial temporal cortex (anteriorly) = close to areas crucial for visual perception 🡪 the “what” information, object recognition stream in vision. = conceptual representation of living things versus human-made tools rely on separable neural circuits (distinct representations)

Warrington 🡪 processing of non-living and living things 🡪 patients with anterior temporal lobe lesions 🡪 different levels: domain specific (detailed semantic information) or domain general 🡪 anterior temporal lobe = greater activation for specific-level naming.

Like our study with faces, language is a huge “nature//nurture” debate.

Infants 🡪 perceptual ability to distinguish between *any* possible phoneme during their first years 🡪 pp 481 🡪 tuned perceptual sensitivity to the language experienced 🡪 expertise 🡪 L // R : English // Japanese 🡪 FFA = expertise 🡪 studies of in-group and out-group.

Identification of orthographic units: The visual word form area occipitotemporal regions (left) 🡪 more excited by letter string than faces and other stimuli 🡪 figure 11.15.

Objects 🡪 between category. Faces = within category 🡪 LETTERS. Visual word form area. Left hemisphere: Experiment: letter strings/familiar words = increase. Confirms our findings. Pp 255.

Chapter 12 – Cognitive Control

Cognitive control – executive function 🡪 use our perception, knowledge, goals to bias the selection of action and thought from a multitude of possibilities 🡪 Cognitive flexibility rather that automaticity = goal-oriented behavior

Prefrontal cortex 🡪 lateral and frontal pole: goal-oriented behavior (working memory system interconnected with parietal lobe and basal ganglia 🡪 attention and action selection). Medial frontal cortex 🡪 guiding and monitoring behavior

Almost all cortical and subcortical areas influence the prefrontal cortex either through direct projections or indirect via a few synapses.

Lesions: very stimulus driven behavior 🡪 complicates social interaction and focal points, attention span.

Working memory 🡪 temporary maintenance of task relevant information 🡪 blackboard of the mind 🡪 prefrontal importance for working memory 🡪 delayed-response tasks 🡪 lesions to PFC impairs.

Lesion: Temporal structure is lost 🡪 has our task been to remember patients with damage to PFC would be impaired.

Cells in the prefrontal cortex during working memory 🡪 exhibit task-specific selectivity and task-dependent behavior. High plasticity function wise 🡪 probably reflects that prefrontal activation acts as an interface//crossing point with task-relevant long-term representations in other neural regions.

Delayed-response: faces versus scrambled faces 🡪 “remember the face” 🡪 varying number of faces = demands on working memory 🡪 probe 🡪 decision: match? == BOLD response in LPFC rise with onset and maintained through delay + sensitive to demand. Using faces: FFA: strong response.

* Lateral prefrontal cortex is critical for working memory: sustaining a representation of the task goal (to remember faces) and working in concert with inferotemporal cortex to sustain information across the delay period that is relevant for achieving that goal.

N-back task: continuous stream of stimuli 🡪 repeated stimulus = respond. Maintenance and manipulation of WM.

Frontal pole: essential for integrating specific contents of mental activity into general framework.

Our experiment: very simple task. Probably no anterior regions of PFC would be recruited. Only premotor cortex 🡪 response selection > rule specification.

Goal-based cognitive control: Participant to keep attention 🡪 achieved by the inhibition of task-irrelevant information.

Pp 543: fMRI: interactions between PFC and posterior cortex 🡪 inferior temporal lobe: preferentially activated by face and place 🡪 modulated by task goal? 🡪 2 faces, 2 scenes 🡪 instructed to pay attention to one category 🡪 results: task goal (instruction) can modulate perceptual processing = amplify or inhibit.

Our results might simply reflect: Modulation in posterior cortex as a function of task goal 🡪 engaged when famous: yes.