

HSP id number

Completed during pre testing

First four digits of student id

Two digits of birth month

Two digits of birth day

Chapter 1:

- Psychology is the study of mind and behaviour
- Rene Descartes thought that mind and body were separate substances
 - Gilbert Ryle later called "Ghost in the machine"
 - Embraced 'philosophical dualism' (mind and body are separate)
- Thomas Hobbes believed mind is what the brain does; not separate at all
 - 'Philosophical materialism' is belief that all things are founded in material reality
 - Gives physical substance to thoughts; can study scientifically
- 'Philosophical realism' (per. John Locke) perceptions of real world are a faithful copy of what enters our eyes
- *'Philosophical idealism' (per. Immanuel Kant) perceptions of real world are brains best interpretation of what enters our eyes
- 'Philosophical empiricism' is idea that all knowledge is acquired through experience
- 'Philosophical nativism' is idea that some knowledge is innate as opposed to granted
- 'Structuralism' is style of psychology that attempted to isolate and analyze minds basic components
- 'Introspection' is analysis of subjective experience by trained observers
 - Didn't last long, only works for some experiences, colours and sounds are innately private, internal experiences unique to individuals
- 'Functionalism' is approach to psychology that emphasized adaptive significance of mental processes

September 12:

- Wilhelm Wundt
 - First course in psychology
 - First textbook, 1874
 - First laboratory, 1879, Leipzig
 - Sought to establish the 'facts of consciousness'
- William James
 - Brought scientific psychology to USA
 - Sought to reveal the function of consciousness
 - Continuous, flows, does not have actual structure
- New approaches
 - Structuralism
 - An approach to psychology that attempts to isolate the basic unit (structure) of mind
 - Can see derivation from physics

- Depended on interoceptive processing, ie.. analysig your own subjective experience
- Functionalism
 - Approach that emphasized the adaptive significance of mental processes
 - Mental states and intelligence increases survival chance
 - Influenced by darwinian evolution (heavily)
- Sigmund Freud
 - Emphasized ways unconscious thought processes and emotional responses to childhood experiences affect later behaviour
 - The mind of freud
 - Psychoanalyses
 - Therapy aiming to give people insight into the content of their unconscious
 - Psychoanalytic theory
 - A theory of psychology emphasizing the influence of unconscious feelings, thoughts and behaviours
 - Adopted by clinicians and pop-media
- Gestalt Psychology
 - Gestalt means 'whole' in german
 - An approach that emphasizes how the mind creates experiences
 - Optical illusions (more going on than what we are seeing physically)
 - Evidence includes how identical sensory stimuli can produce different subjective experiences
 - Mirrors Philosophical Idealism
 - Focused a lot on perception and reasoning (insight)
 - Kohler, Duncker, Wertheimer
- Social psychology
 - The study of cause and consequence of sociality
 - Kurt Lewin
 - People do not act based on the response, but their opinion to the response
- Developmental psychology
 - Study of how psychological phenomena change over life
 - Jean Piaget (1896 - 1980)
 - Noticed children perceive world differently
 - Set out to describe how differences developed
 - Lev Vygotsky (1896 - 1934)
 - Culture is acquired through development
 - Culture shapes the mental process
 - Scaffolding
 - On the other end: Ivan Pavlov
 - Classical conditioning
 - Neutral stimulus paired with inherently rewarding (or punishing) stimulus becomes associated with it

- Language development
 - Could not be described in terms of behaviourism
 - Noam Chomsky
 - Outlined the flaws of a purely reinforcement-based theory
 - Selection of situations in which indeed the “mind” has little to contribute
 - Lack of consideration of generalization - which Chomsky calls ‘the most interesting’ process
 - If the study of language is limited in these ways, it seems inevitable that major aspects of verbal behaviour will remain a mystery
- Edward C. Tolman
 - Burger water rat maze -> after exploring maze, rats deprived of food or given salt, will seek out specific resources depending on their need (rats learn! Knew where to go)
- Behaviourism
 - An approach to psych that restricts scientific inquiry to visible behaviour
 - No reference to mental processes
 - Proponents;
 - John B. Watson (classical conditioning) and B.F. Skinner (operant conditioning) dismissed introspection
 - Watson and Rayner conducted famous ‘little albert’ experiment
 - Rayner was interested in deconditioning and how that would work
 - Watsons behaviourism:
 - All behaviour is a relationship between stimulus and response
 - Skinner’s behaviourism:
 - We repeat behaviours based on their outcome
 - Principles of reinforcement: any behaviour rewarded will be repeated; behaviour not rewarded is not repeated
 - Operant conditioning
- Rejecting Behaviourism
 - An argument from developmental psychology (Noam Chomsky)
- Cognitive Revolution (1960s)
 - Returned focus to internal mental processes
 - Aided by the development of digital computers
 - Internal data processing was designed (gave psychology the language to talk about it)
 - Cognitive psychology (Ulric Neisser)
 - Study of human information processing
 - Neuroscience
 - Additional approach to studying human brain
 - Brain has relatively conserved hardware
 - Neuroscience is the study of that hardware (central and peripheral nervous systems)
- Pure/basic research

- Almost all discoveries are through basic research
- Research in Psychology
 - Why? - pure/applied
 - Who? - human/non-human
 - How?
- ...
- Description or experiments
 - Description: researcher does not control the variables of interest
 - Case studies
 - Examines one individual in depth
 - Provides fruitful ideas
 - Cannot be used to generalize
 - Naturalistic observations
 - Records behaviour in natural environment
 - Describes but does not explain behaviour
 - Can be revealing
 - Experiment: involves the manipulation of variables
- Scientific method
 - The goal of applied research is to generate knowledge that solves a problem
 - Basic research is more curious and less restrained to a single topic
 - Empiricism (belief that knowledge can be acquired through observation)
 - Sir Francis Bacon (1561 - 1626)
 - Are we born with knowledge? How do we attain knowledge?
 - In private life: all knowledge is learnt in the lifetime
 - Humans cannot rely solely on intuition and common sense
 - Example A
 - WREAT -> WATER
 - ETRYN -> ENTRY
 - GRABE -> BARGE
 - How long to solve?
 - We are overconfident in what we already know
 - Hindsight bias
 - The tendency to believe that after learning an outcome, it could have been predicted
 - Confirmatory hypothesis testing: tendency to seek confirming rather than disconfirming evidence
 - When do we objectively collect information vs seeking confirmatory information
 - Uncertainty (no initial expectation)
 - Have time & cognitive capacity
 - Strong motivation for accuracy
 - Confirmation bias: tendency to interpret events in a way that verifies existing beliefs
 - And to (un)intentionally ignore contradicting evidence

- Survivorship bias
 - It is harder to think about information that is NOT present
- **Scientific method is a procedure for using empirical evidence to establish facts**
 - Observation
 - Idea (Theory)
 - Implication (Hypothesis)
 - Test (Experiment/Observe)
 - Outcome
 - Revise
- Theory
 - Hypothetical explanation of a natural phenomenon
 - Good theory effectively organizes, has clear hypothesis, and stimulates research
- Hypothesis
 - A falsifiable prediction made by a theory
 - Good hypothesis
 - Follows a theory
 - State and expected outcome
 - Falsifiable (key feature is that is falsifiable with data)
- Falsifiable
 - In science, cannot 'prove'
 - Can only prove 'wrong'
 - What if a theory cannot be proved wrong?
 - It cannot be tested
 - The scientific method cannot be used
- Abstract
 - Brief 100-200 word summary of the article
 - What did you find?
 - Why is it important?
- Introduction
 - Where did you get idea?
 - What do we already know?
 - What theories are useful?
 - What hypotheses and predictions are you making
- Methods
 - Who was in sample?
 - What did you do?
- Results
 - Key statistical tests
 - Other interesting data
 - Tables/figures
 - Brief objective description/interpretation
- Observation and exploration

- Case studies
 - Examines one individual
 - Produces fruitful ideas
 - Cannot be used to generalize
- Naturalistic observations
 - Records behaviour in natural environment
 - Describes but does not explain behaviour
- Surveys and interviews
 - Examines many cases in depth
 - Random sampling of pop for best results
- Capture information using variables
- A variable is anything that varies
- A good variable
 - 1. Need to know question; how are you defining it?
 - Operational definition; a description of property in measurable terms
 - 2. Do the variables measures what you want them to measure
 - Construct validity; extent to which the thing being measured characterizes the property
 - 3. Can be outcomes be replicated?
 - Reliability; ability to detect an absence of difference, or a difference in property
- Reliability vs validity
 - Validity: Accuracy of measurement produced
 - Reliability: Stability of measurement produced
- Good variables cannot be assumed
 - Many problems can arise when we collect data
 - Sampling error
 - Observer bias; people aware of being studied, behave differently while observed (especially when related to behaviour considered acceptable)
 - Representative samples are better than biased samples
 - Less variable observations are more reliable than those that are more variable
 - More cases are better than fewer
- Showing data
 - One of the standard ways to look at data is a frequency distribution
 - Normal distribution (normal curve)
 - The normal curve
 - Mathematically defined distribution with greatest frequency in the middle, and decreases symmetrically in both directions
 - (How most variables studied in psychology are distributed)
 - Middle of dist. Is the 'central tendency'
 - Gap between sides of middle of dist. Is 'variance'

- Standard deviation is how far away from the average (how wide the distribution is)
- Correlation
 - Scientific definition; relationship that results when variations in the value of one variable are synchronized with variations in the value of another
 - Correlation coefficient (r) is measure of strength and direction of correlation ($[-1, 1]$)
 - Positive correlation indicates synchronous increase/decrease
 - Direct relationship
 - Negative correlation indicates opposite increase/decrease
 - Inverse relationship
- Correlation and causation
 - Establishing causality
 - Covariation, or relationship, between variables
 - Temporal precedence
 - Causes must precede effects
 - Eliminate alternative explanations, or third variables (confounders)
- Experiment
 - Manipulating the factors of interest to determine their effects
 - Holding constant/controlling factors
 - Variables
 - Independent variable; variable that is manipulated in an experiment
 - Dependent variable; variable that is measured in an experiment
 - Confounding variable; factor other than independent variable that may produce effects
 - Random assignment (aka randomization)
 - Groups are randomly assigned to conditions of the independent variable -> minimized selection bias
 - Blinding
 - Participants don't know what is being tested
 - Treatments' actual effects can be separated from potential placebo effect
 - Double-blinding
 - Neither those in the study group nor those collecting the data know which group is receiving treatment
- Dependent variable; is there a difference
 - When is an observed difference significant
 - When sample averages are reliable and difference between them is relatively large, the difference has statistical significance
 - Observed difference is probably not due to chance variation between the samples

- In psychological research, proof beyond a reasonable doubt means that the odds of its occurrence by chance are less than 5 percent ($p < 0.05$)
- Lab vs life; ecological validity problem
 - Can laboratory experiments illuminate everyday life?
 - Controlled, artificial environments are created in laboratory experiments to test general theoretical principles
 - These general principles help explain everyday behaviours
 - When do they apply?

Comparing Research Methods

Research Method	Basic Purpose	How Conducted	What Is Manipulated	Limitations
Descriptive	observe and record behavior	Case studies, naturalistic observations, surveys	Nothing	No control of variables; single cases may be misleading
Correlational	detect naturally occurring relationships	Collect data on two or more variables; no manipulation	Nothing	Cannot specify cause and effect
Experimental	establish causality	Manipulate one or more factors holding everything else constant; use random assignment	The independent variable(s)	Sometimes not feasible; results may not generalize to other contexts; not ethical to manipulate certain variables

- Ethics
 - Be aware of what you know and do not know
 - “The more you know, the more you don’t know” - Aristotle
 - Investigate the primary literature
 - When you are researcher you must
 - Acquire informed consent
 - Follow ethical practices set out by regulating body
 - Anonymity
 - Distress justification
 - Debrief participants
 - ANIMAL WELLBEING MATTERS
 - Ensure proper training for care and handling
 - Minimize unnecessary discomfort, distress, illness, pain
 - Only use models when necessary to the research
 - Can the research be done another way? If it can, it should
 - Ensure appropriate anesthetic and post operative care

- Neurons in the Brain
 - Have a lot of neurons
 - Best estimate is 86 billion in the human brain
 - Total humans on earth; 8 billion
 - Total # of devices on the internet; ~15.4 billion
 - Total pages on internet; ~50 billion
 - Neuron types
 - Shapes
 - Neurons are not consistent shapes
 - Purkinje cell
 - Hippocampal pyramidal
 - Bipolar neuron
 - Function
 - Described by the things they connect or function they have
 - Sensory neurons: bring information from the external world into the brain/spinal cord
 - Motor neurons: carry signals from the spinal cord to muscles
 - Interneurons: for connections between neurons (sensory, motor, self, etc)
 - Most common
 - Cell membrane
 - Semipermeable phospholipid layer
 - Cause difference in electrical charge between inside and outside of cell
 - Neurons communicate electrochemically
 - Resting membrane potential
 - Inside of the neuron is negative with respect to the outside
 - Difference = -70mV
 - Ionic basis of the resting potential
 - Ions, charged particles, are unevenly distributed
 - 4 ions contributing
 - Sodium (Na⁺)
 - Chloride (Cl⁻)
 - Potassium (K⁺)
 - Negatively charged proteins
 - Synthesized within the neuron
 - Found primarily within the neuron
 - Salty banana (sodium outside, potassium inside)
 - Four factors influence resting potential and the unequal ion distributions
 - Two factors are homogenizing (distribute ions equally)
 - Two factors counteract the homogenization

- Factors contributing to even distribution
 - Random motion
 - Particles move down their concentration gradient
 - Drop of dye in water slowly combines due to molecular motion
 - Electrostatic pressure
 - Like forces repel, opposites attract
- Factors contributing to uneven distribution
 - Selective permeability
 - Ions move in and out through ion-specific channels
 - Sodium potassium pump
 - 3Na^+ out, 2K^+ in
 - Active process - much of the energy consumed by the brain (asleep or awake) goes toward maintenance of ionic differences between membranes
- Postsynaptic Potentials (PSPs)
 - Neurotransmitters bind postsynaptic receptors
 - Can cause:
 - Depolarization; making the membrane potential LESS negative (more positive)
 - Going from -70mV to -67mV
 - Excitatory - more likely a neuron will fire
 - Hyperpolarization; making the membrane potential more negative
 - Going from -70mV to -73mV
 - Inhibitory - less likely a neuron will fire
 - Postsynaptic depolarization; Excitatory PSP (EPSP)
 - Postsynaptic hyperpolarization; Inhibitory PSP (IPSP)
 - EPSP and IPSP's are graded (size varies)
 - Sum together and determine if the neuron will fire an action potential
 - Graded; greater the stimulus, the greater the response
 - Travel passively from their site of origination
 - Decremental; they get smaller as they travel
 - One EPSP typically will not suffice to cause a neuron to fire, summation is needed
 - PSP Summation
 - To fire an action potential need to reach threshold of activation
 - -65mV
 - Usually requires more than one EPSP
 - Action Potential

- If threshold is reached the neuron fires and action potential occurs
 - If threshold not reached, no AP
 - Through APs - message can be transmitted from one neuron to another
 - When threshold is reached, voltage-activated ion channels are opened
- Ionic basis of action potentials
 - When threshold of activation is reached, voltage-activated Na⁺ channels open and sodium rushes in
 - Remember, all forces were acting to move Na⁺ into the cell
 - Now permeability isn't an issue
 - Membrane potential moves from -70 to +50mV
 - Four steps
 - Depolarization: Na⁺ moves membrane potential from -70mV to +50mV
 - End of depolarization: After about 1 millisecond, Na⁺ channels close
 - Repolarization: Concentration gradient and change in charge leads to efflux of K⁺
 - Hyperpolarization: Channels close slowly; K⁺ efflux leads to membrane potential < -70mV
 - Refractory periods
 - Prevent the backwards movement of APs and limit the rate of firing (to 1000 times/sec!)
 - Two types
 - Absolute; impossible to initiate another action potential
 - Relative; harder to initiate another action potential
- Conduction in myelinated axons; saltatory conduction
 - Passive conduction along each myelin segment to next node of Ranvier
 - New action potential generated at each node
 - Like the beacons in LOTR
- Neurotransmitter release
 - Exocytosis; mediated by Ca⁺⁺
 - AP Arrives at axon terminal
 - NTs are released from vesicles into synapse
 - NTs act on next neuron
- Recycling of NTs; reuptake, enzymatic degradation
 - As long as NT is in the synapse, it is "active"; activity must somehow be turned off
 - Reuptake; 'scoop up' and recycle NT
 - Enzymatic degradation; a NT is broken down by enzymes
- Neurotransmitters
 - Serotonin; mood, temperature, aggression, sleep cycles
 - Dopamine; motor function, reward
 - Acetylcholine; muscle contraction (PNS), cortical arousal, learning (CNS)

- Anandamide; pain reduction, increase in appetite
- Norepinephrine; arousal, mood, hunger, and sleep
- GABA; main inhibitory neurotransmitter
- Glutamate; main excitatory neurotransmitter, sensory info, learning
- Amino-Acid neurotransmitters
 - Usually found at fast-acting directed synapses in the CNS
 - –Glutamate
 - Most prevalent excitatory neurotransmitter in the CNS
 - GABA (gamma-aminobutyric acid)
 - Most prevalent inhibitory NT in the CNS
 - –Synthesized from glutamate
 - –Alcohol; Epilepsy
 - –Aspartate and glycine
- Acetylcholine
 - Only NT released at neuromuscular junction
 - Learning and memory
 - Alzheimers?
 - One of only a few NTs broken down by an enzyme (acetylcholinesterase)
- Large molecule NTs
 - Endorphins
 - Endogenous “opioids”
 - Produce analgesia
 - Receptors were identified before the natural ligand was
- Effects on synaptic transmission
 - Many drugs act to alter neurotransmitter activity
 - AGONISTS; increase or facilitate NT activity
 - Amphetamines; norepinephrine
 - –Stimulates release of Norepinephrine
 - –Also blocks reuptake
 - –Increases wakefulness, elevated HR
 - –Cocaine; dopamine agonist
 - –Blocks reuptake; preventing the activity of the neurotransmitter from being “turned off”
 - Intense euphoria, stimulant
 - –High doses produce symptoms similar to schizophrenia
 - Prozac; SSRI
 - –Blocks reuptake of serotonin
 - –Used as antidepressant to elevate mood
 - –New treatments are SNRIs
 - ANTAGONISTS; decrease or inhibit NT activity
 - Propranolol; ‘Beta Blocker’
 - –Binds and blocks receptors sites for norepinephrine
 - –Anxiolytic; disrupts HR control
 - –Botox; Ach antagonist

- -Blocks release Ach at nicotinic receptors at NMJs
 - -Paralyzes facial muscles; giving firm and stiff appearance
 - Drugs may alter NT activity at any point in its life cycle
- How do we study brain; recording human brain activity
 - Approaches
 - Imaging methods; recording activity of a living brain
 - EEG
 - Electroencephalography
 - Measure of average electrical activity in brain
 - Some EEG wave forms associated with certain states of consciousness
 - Cerebral pathology? (such as epilepsy, brain tumor)
 - -Event-related potentials; measuring electrical patterns in response to external stimuli
 - Disadvantages?
 - Cost
 - Projectile effect
 - fMRI
 - Magnetic Resonance Imaging
 - Measures waves emitted by hydrogen atoms when they are placed in magnetic field
 - -Neural structures have different densities of H atoms (e.g. water, iron, fat etc) → white and gray matter, cerebral spinal fluid (CSF)
 - Functional Magnetic Resonance Imaging
 - Images in oxygen (blood) flow to active brain areas
 - -Blood Oxygenated Level Dependent Signal (BOLD)
 - -Advantages:
 - -Provides structural and functional info
 - -Spatial resolution better
 - -Changes can be measured in real time
 - Disadvantages?
 - Lesion method
 - Human patients with unknown lesions
 - Phineas Gage
 - Blasting rocks with explosives, metal rod went through his head
 - Survived a brain injury which
 - -Kept him alive
 - Without any cognitive deficits
 - But changed his personality (and destroyed his life)
 - mPFC must have been involved
 - Paul Broca and Carl Wernicke's patient

- Suffered stroke, lost ability to speak words, could understand what was being said to him
 - Found another patient vice versa
- Died rather soon
- Language section of left side of brain was damaged
- Human patients with known lesions
 - Henry Molaison (H.M.)
 - Bumped into pole on a bike as a kid
 - Started having seizures, increasing in severity
 - Had surgery at age 16
 - Removed hippocampus bilaterally (conducted by Scoville)
 - Lost ability to create new memories, unable to remember new information
 - Concluded hippocampus stores episodic memory
- Animals studies

October 3:

- How is it organized?
 - What is the NS evolved/designed to do?
 - Bring in information (senses and internal organs)
 - Manipulates information (assess, process, interpret, relay)
 - Produce output (behaviour)
- Divisions of the nervous system
 - Peripheral
 - Central
- General layout of the nervous system
 1. Central Nervous System (CNS)
 - Brain (in the skull)
 - Spinal Cord (in the spine)
 2. Peripheral Nervous System (PNS)
 - Located outside of the skull and spine
 - Connects the CNS to the body's organs and muscles
- Peripheral nervous system
 - Autonomic
 - Conveys involuntary and automatic commands that control internal organs and glands
 - Somatic
 - Information into and out of central nervous system; sensation from sensors go into central nervous system; controls voluntary movements of skeletal muscles
- General layout of nervous system
 - Peripheral nervous system
 - Somatic NS

- Info from sense organs to CNS
 - Nerves that contacts voluntary muscles control
 - Interacts with external environment
 - Afferent nerves (sensory to CNS)
 - Efferent nerves (motor from CNS)
- Autonomic NS
 - Nerves that carry commands blood vessels, body organs, and glands
 - Regulates body's internal environment
 - Afferent nerves (sensory to CNS)
 - Efferent nerves - 2 kinds
 - Sympathetic and parasympathetic nerves generally have opposite effects
 - Sympathetic - 'fight or flight'
 - Nerves that prepare the body for action
 - Parasympathetic - 'rest & relaxation'
 - Nerves that help the body return to rest
 - How quickly do we recover after stressor?
- Spinal Reflexes
 - Simple pathways in the nervous system that rapidly generate muscle contractions
 - Stretch reflex:
 - Monosynaptic reflex arc
 - i.e., sensory neuron -> motor neuron
 - Maintain limb stability
 - Withdrawal reflex
 - Interneuron reflex arc
 - i.e., sensory neuron -> interneuron -> motor neuron
 - Retracts hand from harmful situation
- Spinal Anatomy
 - Spinal cord is divided into 4 major sections
 - Cervical
 - 'neck'
 - Includes control of head/neck, diaphragm, wrists, etc
 - Thoracic
 - 'upper back'
 - Includes control of chest, core muscles, etc
 - Lumbar
 - 'lower back'
 - Control of legs, feet
 - Sacral
 - 'pelvis / tailbone'
 - Bowel, bladder, sexual organs
- Directions in the NS ** MUST BE MEMORIZED

- Dorsal - base side
- Posterior - back of head
- Anterior - front of head
- Ventral - front of body
- Other Neuroanatomical Directions
 - Medial – towards the middle
 - Lateral – towards the side
 - Proximal – close to the body
 - Distal – further away from body
 - Contralateral – opposite side
 - Ipsilateral – same side
- Sections of the Brain
 - Horizontal – a slice parallel to the ground
 - Frontal (coronal) – slicing from ear to ear, parallel to the shoulders
 - Sagittal – a midsagittal section separates the left and right halves
- Protecting the CNS
 1. Protection from Physical Dangers
 - Skull
 - Meninges
 - Cerebrospinal fluid (CSF)
 2. Protection from Chemical Dangers
 - Blood-brain-barrier (BBB)
 - Psychoactive drugs?
- Three major divisions of the human brain
 - Hindbrain
 - Midbrain
 - Forebrain
- Hindbrain Divisions
 - Cerebellum – “little brain”
 - Motor execution
 - Muscle coordination (walking, speech) – in highly trained motor skills
 - Learning, memory
 - Alcohol disrupts movement-control functions
 - Damage?
 - Pons – “bridge”
 - Ventral surface
 - Main connection b/w cortex and cerebellum
 - Role in sleep, dreaming, eye mvmts, vestibular sense
- Midbrain Division
 - Tectum (dorsal surface)
 - “Roof”
 - Superior colliculus - vision
 - Inferior colliculus - audition
 - Visual reflexes and reactions to moving stimuli

- Orienting!
- Tegmentum (ventral)
 - “Hood”
 - 3 ‘colorful’ structures involved in movement and arousal
 - Periaqueductal gray - analgesia
 1. Substantia nigra - sensorimotor
 2. Red nucleus - sensorimotor
- Forebrain Divisions
 - Cerebral cortex
 - Surrounds the cerebral hemispheres, convolutions serve to increase surface area
 - Made up of:
 - Sulci (small grooves)
 - Fissures (large grooves)
 - Gyri (bulges or bumps)
 - Longitudinal fissure – a groove that separates right and left hemispheres
 - Corpus callosum thick band of nerve fibers that supports communication between hemispheres
 - Central fissure and Lateral/Sylvian fissure divide hemispheres into lobes
 1. Frontal - motor, complex cognitive functions
 2. Parietal - somatosensation, locating objects and self in space
 3. Temporal - audition, visual recognition, memory
 4. Occipital - vision
 - Specialized areas
 - Broca area - speech production
 - Frontal lobe
 - Wernicke area - speech perception
 - Temporal lobe
 - Motor Cortex (precentral gyrus)
 - Contralateral control
 - Located at rear of frontal lobe
 - Somatosensory Cortex (postcentral gyrus)
 - Contralateral sensation
 - Located in parietal lobe
 - Subcortical structures
 - Thalamus
 - ‘switchboard’
 - senses (except olfaction) stop here before going to appropriate area of cortex
 - Ex. Nucleii:
 - LGN - vision
 - MGN - audition
 - VPN – touch, taste
 - Limbic system

- Regulation of motivated behaviors (4 F's: fleeing, feeding, fighting and sexual behaviour)
- Processing emotions
- Hypothalamus
 - Located just below thalamus
 - Homeostatic control motivated behaviors
- Hippocampus
 - Big role in learning and memory
 - Spatial navigation (our internal Google Maps)
 - One of the few places in the brain that grows neurons in adults
 - Atrophy of H is associated with Alzheimer's disease
- Amygdala
 - Organizes emotional responses
 - Especially those linked to aggression & fear
- Basal ganglia
 - Putamen
 - Caudate
 - Globus Pallidus
 - Voluntary muscle control
 - Parkinson's disease
 - DA neurons supplying BG degenerate & die
 - Inability to initiate voluntary movement
 - Tremors, jerky movements
- Pituitary gland