

Psych 101: Week 2

Monday, January 16th

AGENDA

- ▶ Business/Housekeeping
 - ▶ Syllabus, REG/SONA participation
- ▶ Conducting Psychological Research
- ▶ The Brain and the Nervous System

The Science of Psychology

Last class

- ▶ Psychologists use scientific principles, methods, and procedures to develop a body of knowledge about human behaviour and to ‘predict’ how people behave
- ▶ Based on 2 premises: empiricism and theory development
- ▶ Theory and research work together

Research Methods and the Multiple Ways Data May be Gathered

Survey

Interview

Naturalistic Observation

Experimentation

Meta Analysis

Case Study

- ▶ We will only cover a small selection of this material in class.
- ▶ You should review and learn the contents contained in chapter 2 very well.
- ▶ The only reason we are not covering all of this material in class is due to time constraints.

Important Terms

- ▶ Variables - ‘things’ that change
 - ▶ Dependent and independent variables
- ▶ Causation: Cause and effect
- ▶ Correlation: Variables are related to one another
 - ▶ Much (most) research is correlational -- identifies the relationship between two variables
- ▶ Research Design
 - Cross sectional
 - ~~same~~ - group
 - ↳ i.e. a bunch of university students at once
 - Longitudinal → group over time.
(same)

Experimental Method

Experiment: - usual type of study

- ▶ manipulation of one variable under controlled conditions so that resulting changes in another variable can be observed
- ▶ To detect cause-and-effect relationships

Variables:

- ▶ Independent variable (IV) = variable manipulated
- ▶ Dependent variable (DV) = variable affected by manipulation (and measured)

Experimental and Control Groups: The Logic of the Scientific Method

- ▶ **Experimental group** - participants receive some special treatment in regard to the IV
(also called manipulation)
- ▶ **Control group** - similar participants; do NOT receive the special treatment
→ random assignment to each group to ignore bias

Experimental Design cont'd

Logic:

- ▶ Two groups alike in all respects (random assignment)
 - ▶ Pretest
 - ▶ Manipulate independent variable for one group only
 - ▶ Posttest
 - ▶ Resulting differences in two groups (pretest to posttest) must be due to independent variable
- Be Careful of extraneous Variables*

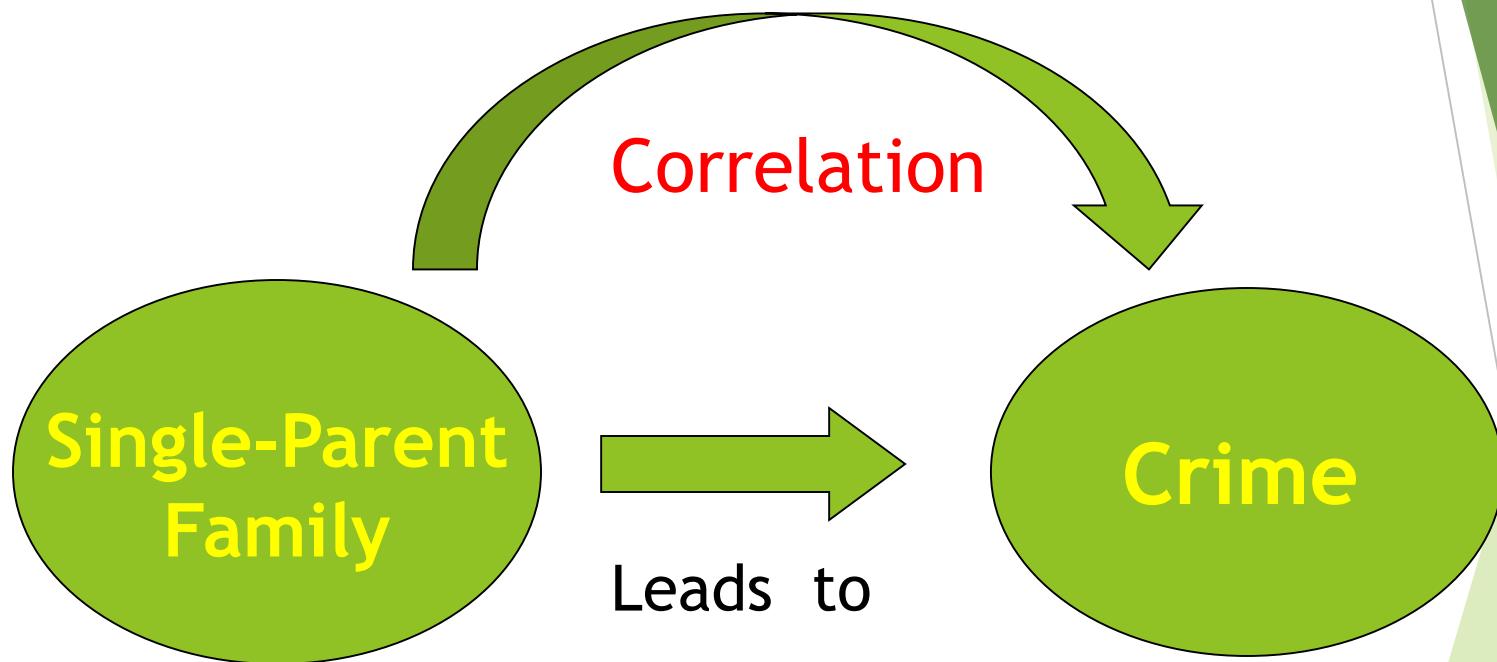
Descriptive/Correlational Methods: Looking for Links

- ▶ Methods used when researcher cannot manipulate variables under study
 - Naturalistic observation
 - Case studies
 - Surveys - Self report (user states things)
- ▶ Describe patterns of behaviour and discover links or associations between variables
- ▶ But cannot imply causation

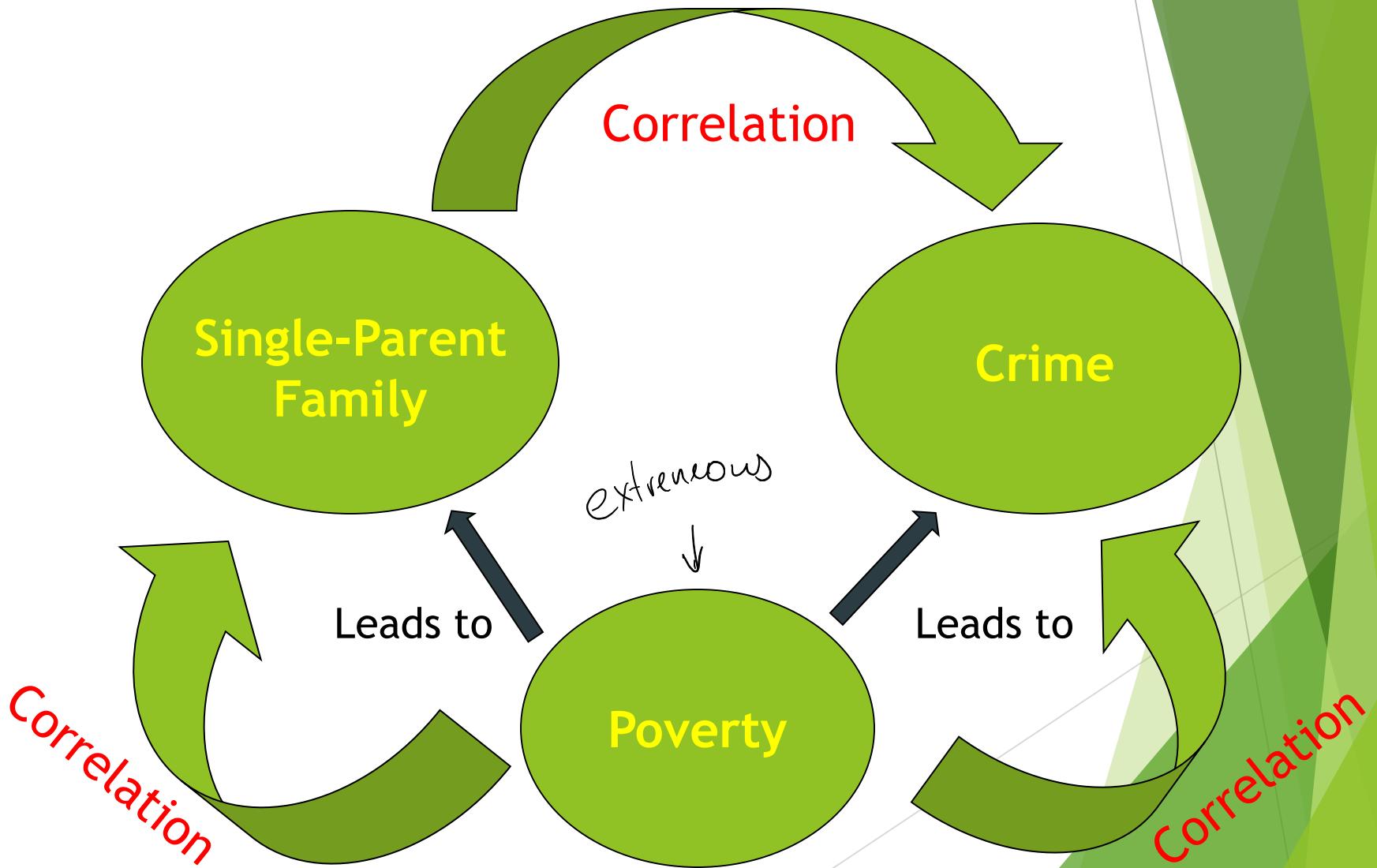
Correlational Research

- ▶ To determine the strength of the relationship between two variables
- ▶ Correlation: numerical index of degree of relationship between two variables
- ▶ Strength of relationship:
 - Expressed as a number b/w 0 and 1
 - (larger # = stronger association)
- ▶ Direction of relationship: can be positive or negative
 - ▶ indicated by (+) or (-)

Faulty Assumption vs. Correlation



More likely assumption ...



Using Statistics to Evaluate Research:

1. Descriptive Statistics

A collection of procedures to summarize, organize, and describe sets of data

Measures of central tendency:

- **Mean** is the average of a set of scores
- **Median** is the point at which 50% of the scores fall above and below
- **Mode** is the most frequent score in a set of scores

2. Inferential Statistics

- ▶ Interpreting data and drawing conclusions
- ▶ Used to determine if results obtained are statistically significant
- ▶ **Significant difference:** a difference that is unlikely to have occurred by chance alone - 0.05 level of significance

Avoiding Bias in Research

- ▶ Sample characteristics, drawing conclusions, generalizations (e.g., WEIRD) - western educated industrialized Rich, Democratic
- ▶ Self-report
- ▶ Placebo - A fake that people believe occurred
- ▶ Ethnocentrism
 - only way to observe something is through our lens
 - ie → religion running a test assuming their beliefs.
- ▶ Gender, class, socioeconomic status, age, ability, sexual orientation, ethnicity, race, culture ...
 - suspend judgement to get honest responses
 - people respond with social desirability → make things so people are honest & comfortable

Ethics in Research

Ethics: rules concerning proper and acceptable conduct that investigators use to guide their research

- ▶ Informed consent
 - tell participants what they will be doing. Don't hide anything.
- ▶ Confidentiality
- ▶ Debriefing
 - what they were looking for
 - were you deceived in any way
- ▶ Deception in research
 - sometimes you do not tell the whole story depending on the study.
- ▶ Research with animals

Psychology:

Nature (biology)
and
Nurture (environment)

The Nature-Nurture Issue

Nature

- An organism's biological inheritance

Nurture

- An organism's environmental experiences (everything from womb to tomb)

Environment or Nurture

Includes:

- ▶ Parenting, family dynamics
- ▶ Peer relations, schooling, neighbourhood quality
- ▶ Social climate (historical time period, politics, religion, etc.)
- ▶ Biological encounters (viruses, birth complications)

To what extent are we shaped by our heredity and by our life history?

Unlocking the Secrets of Genes

Genes

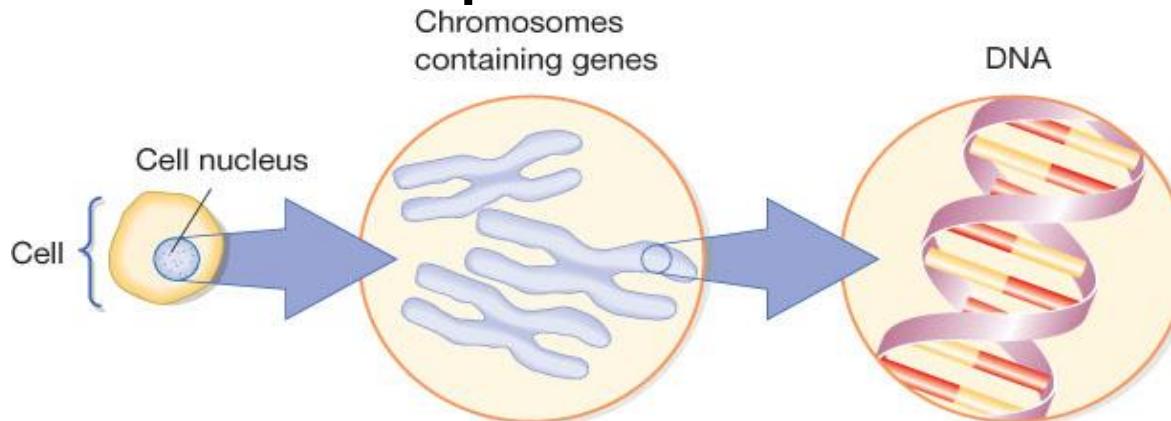
- ▶ the basic units of heredity composed of DNA and located on chromosomes

Chromosomes:

- rod-shaped structures found in nucleus of every cell (23 pairs)

DNA (deoxyribonucleic acid):

- chromosomal molecule that transfers genetic characteristics by way of coded instructions for the structure of proteins



How Genes Affect Behaviour

- Indirectly
- Moderated by environmental effects
- Behavioural genetics: focuses on influence of genes on behaviour
- Heritability: proportion of variation among individuals attributable to genes

→ the more similar the env – the more likely the changes are caused by genes.

Evolutionary Psychology

- Studies how human brain developed over time to explain/predict behavior
- 2 key factors:
 1. Natural Selection
 2. Adaptation

1. Natural Selection

- Among a range of inherited trait variations, those that lead to **increased reproduction and survival** will most likely be **passed on** to succeeding generations

2. Adaptation

- ▶ Results of natural selection - changes in traits that are passed on
- ▶ Examples of adaptations over time:
 - tendency to protect offspring
 - the development of communication
 - jealousy
 - fears/phobias
 - taste for sweets & fats

Critiques of Evolutionary Theory

- ▶ Starts with an effect and works backwards to propose an explanation
- ▶ Much of who we are is not hard-wired
 - Culture is overlooked
- ▶ What about personal responsibility, autonomy, and free will?
 - Can't go back in time to have starting group.

Are We More Than Just Biology?

- ▶ Twin Studies used to try to tease apart environment and heredity

Twins ...

- **Fraternal twins:** product of two sperms fertilizing two eggs; not identical genetically
- **Identical twins:** product of one fertilized egg splitting into two identical cells; identical genetically (for the most part)

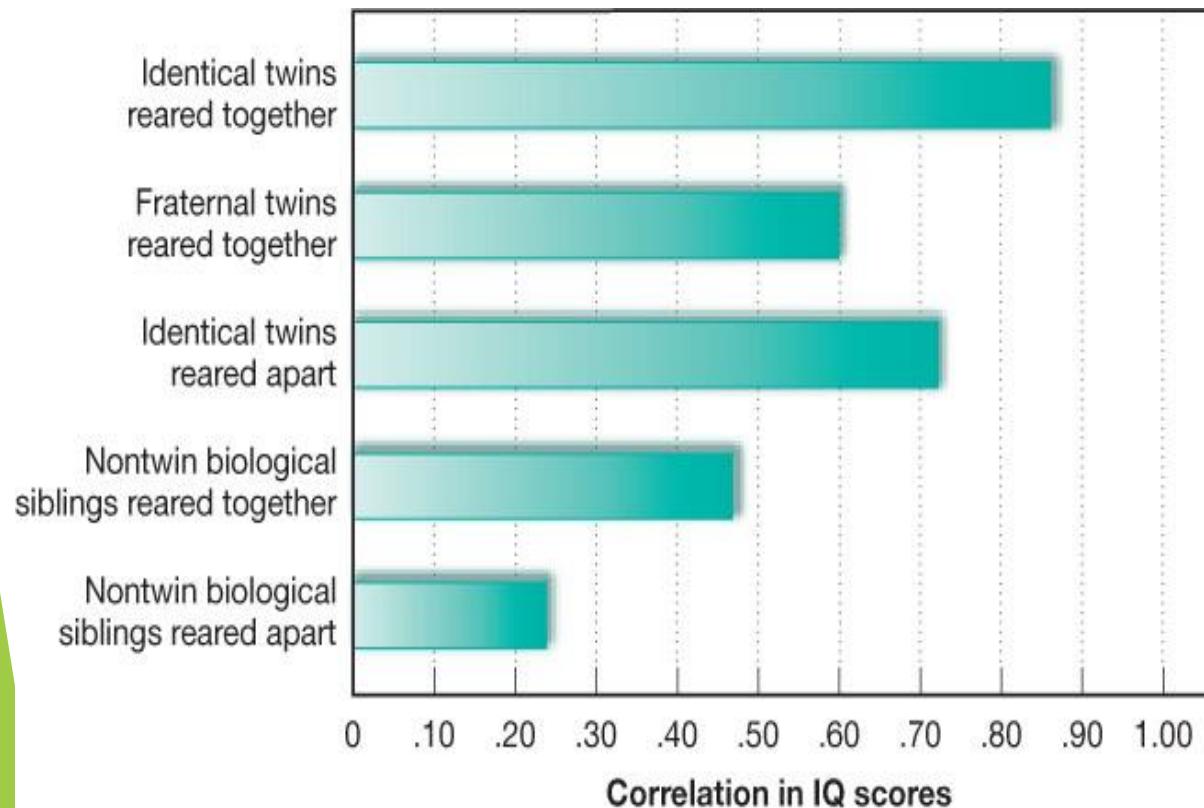
Twin Studies...

- ▶ Identical twins share genetics and history
- ▶ Are identical twins behaviourally more similar to one another than fraternal twins?
- ▶ If so, is this solely due to genetics?
- ▶ E.G.: “The two Jims”

*- raised apart for 38 years
- when they were re-united they had a lot of similarities.
- when they were tested it was like the same person*

Twins, Adoption, & Intelligence

- IQ scores of identical twins more highly correlated than those of fraternal twins



Those of adopted children also highly correlated with biological parents

A Critical Look at Twin Studies

- ▶ Identical twins share same environment for 9 months
- ▶ Impact of shared appearance/features
- ▶ Adoption issues

Heredity & Environment Interaction

- ▶ Effects of genes and environment intertwine
- ▶ Interacting with others and others' responses to us
 - ▶ Identical twins reared in different families recall parents' warmth as similar
 - ▶ Fraternal twins recall early family life more differently - even if reared in same families

Environmental Influences (Nurture)

Prenatal Development

- ▶ individual versus shared placenta

Experience and Brain Development

- ▶ enriched environments stimulate brain development
- ▶ touch stimulates weight gain and brain development
- ▶ stimulation during early years crucial to maturing brain

Environmental Influences cont'd

Peer Influence

- Judith Harris argues that peer influences may exceed parental influences (e.g., food tastes, accents)

Culture

- behaviours, ideas, attitudes, and traditions shared by large group of peoples and transmitted from one generation to next
- cultural norms - rules for accepted & expected behaviour
- social/behaviour scripts (e.g., personal space, expressiveness, pace of life)

Biology, Brain, and Behaviour

Biology, Brain, and Behaviour

- ▶ How does the body “talk”?
- ▶ Cells and nerves “talk” to one another via chemical messages
- ▶ Result in sensory experiences and behaviours

Neural Communication

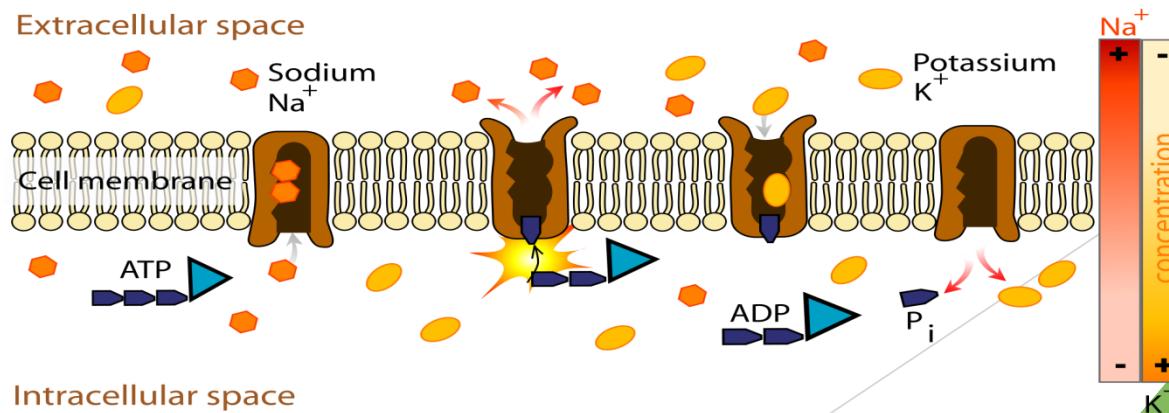
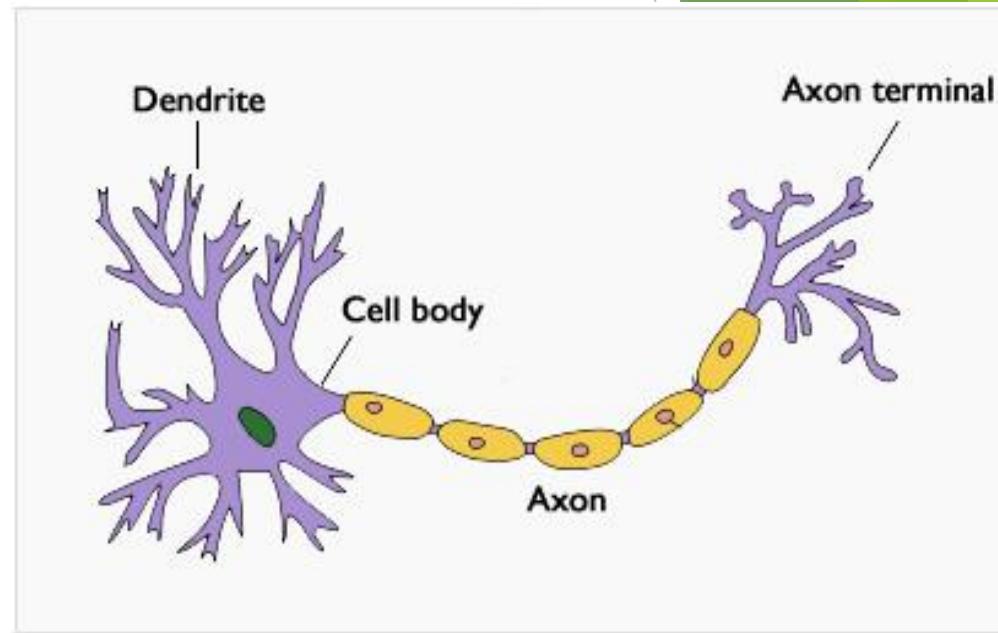
- ▶ The nervous system consists of:
 - ▶ ***Central Nervous System (CNS):***
brain and spinal cord
 - ▶ ***Peripheral Nervous System (PNS):***
nerves connecting the CNS to the rest of the body

Neural Communication

- ▶ Messages sent from one part of body to another through neurons (nerve cells)
- ▶ Afferent Neurons (messages to brain)
- ▶ Efferent Neurons (messages from brain)

The Neural Impulse: The Action Potential

► Hodgkin & Huxley (1952) studied giant squids to understand mechanics of neural transmission



Neural Communication

- ▶ Neurons receive signals through dendrites and cell body
- ▶ Transmit electrical impulse (action potential) down axon to next neuron
- ▶ Neurons do not touch each other directly; messages sent across synaptic gap through release of chemical messengers: neurotransmitters

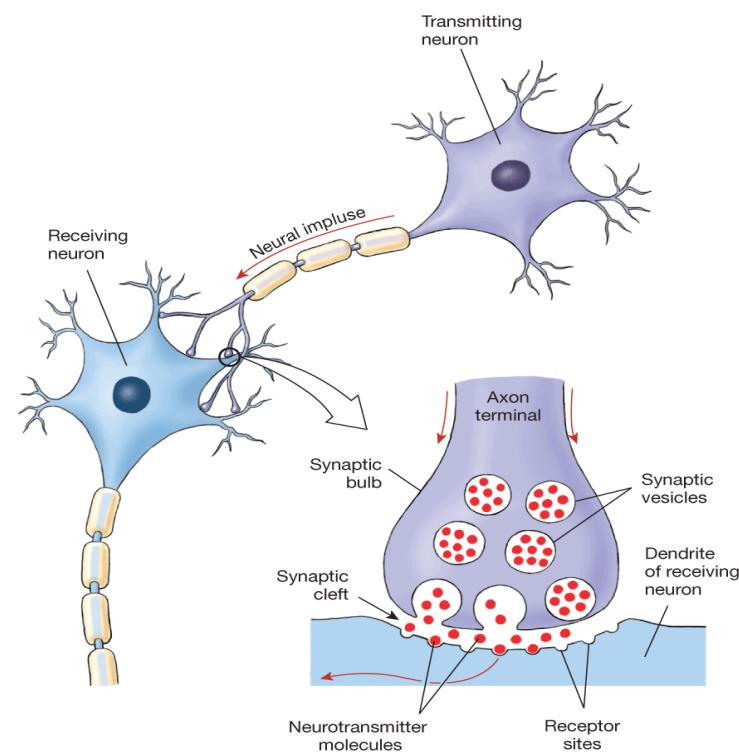


Figure 4.6 Neurotransmitter Crossing a Synapse

Neurotransmitter molecules are released into the synaptic cleft between two neurons from vesicles (chambers) in the transmitting neuron's axon terminal. The molecules then bind to receptor sites on the receiving neuron. As a result, the electrical state of the receiving neuron changes and the neuron becomes either more likely to fire an impulse or less so, depending on the type of neurotransmitter.

Neurotransmitters

- Chemical messengers carry information across the synaptic gap
- Communicate with other neurons by binding to receptors
- Reuptake

3D Animation of Neurotransmitter
Synapse

Neurotransmitters & Behaviour

Dopamine (DA)

- movement
- learning, attention
- emotion
- ↑ : schizophrenia
- ↓ : tremors & decreased mobility of Parkinson's

Acetylcholine (ACh)

- muscle action
- learning, memory
- ↓ : Alzheimer's

Neurotransmitters & Behaviour

Serotonin

- mood, hunger
- sleep, arousal
- ↓ : depression

Norepinephrine

- alertness & arousal
- ↓ : can depress mood

Neurotransmitters and Behaviour

GABA (gamma-aminobutyric acid)

- major inhibitory neurotransmitter
- ↓ : seizures, tremors, insomnia

Glutamate

- alertness & arousal
- ↓ : can depress mood

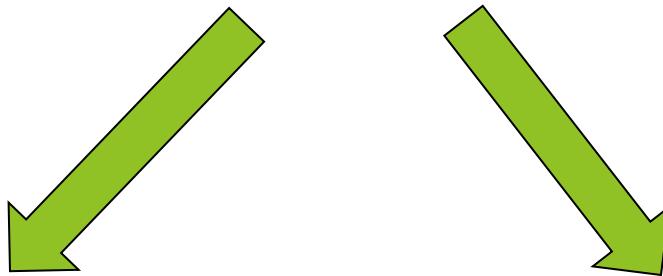
Endorphins

- natural opiates
- shield body from pain
- elevate feelings of pleasure

Organization of The Nervous System

- ▶ **Central Nervous System:**
 - ▶ brain and spinal cord
 - ▶ > 99% of all nerve cells in our body located in the CNS
- ▶ **Peripheral Nervous System:**
 - ▶ network of nerves that connects the brain and spinal cord to other pars of the body
 - ▶ 2 major divisions (Somatic & Autonomic)

Peripheral Nervous System

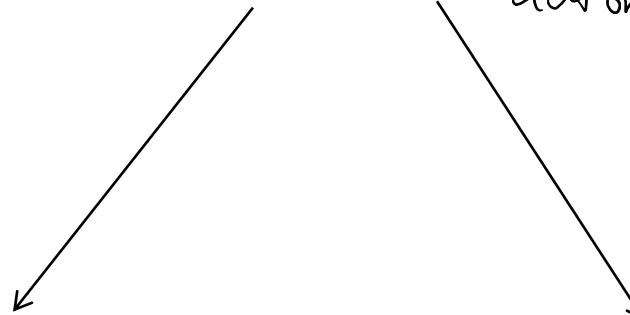


Somatic NS

- Things you mean to do
- under the person's control

Autonomic NS

- automatic



Sympathetic NS

(arouses)

fight or flight

Parasympathetic NS

(calms)

PERIPHERAL NERVOUS SYSTEM:

1. Somatic Nervous System

- ▶ **Sensory Nerves:**

- ▶ convey info from the skin and muscles to CNS about conditions such as pain and temperature

- ▶ **Motor Nerves:**

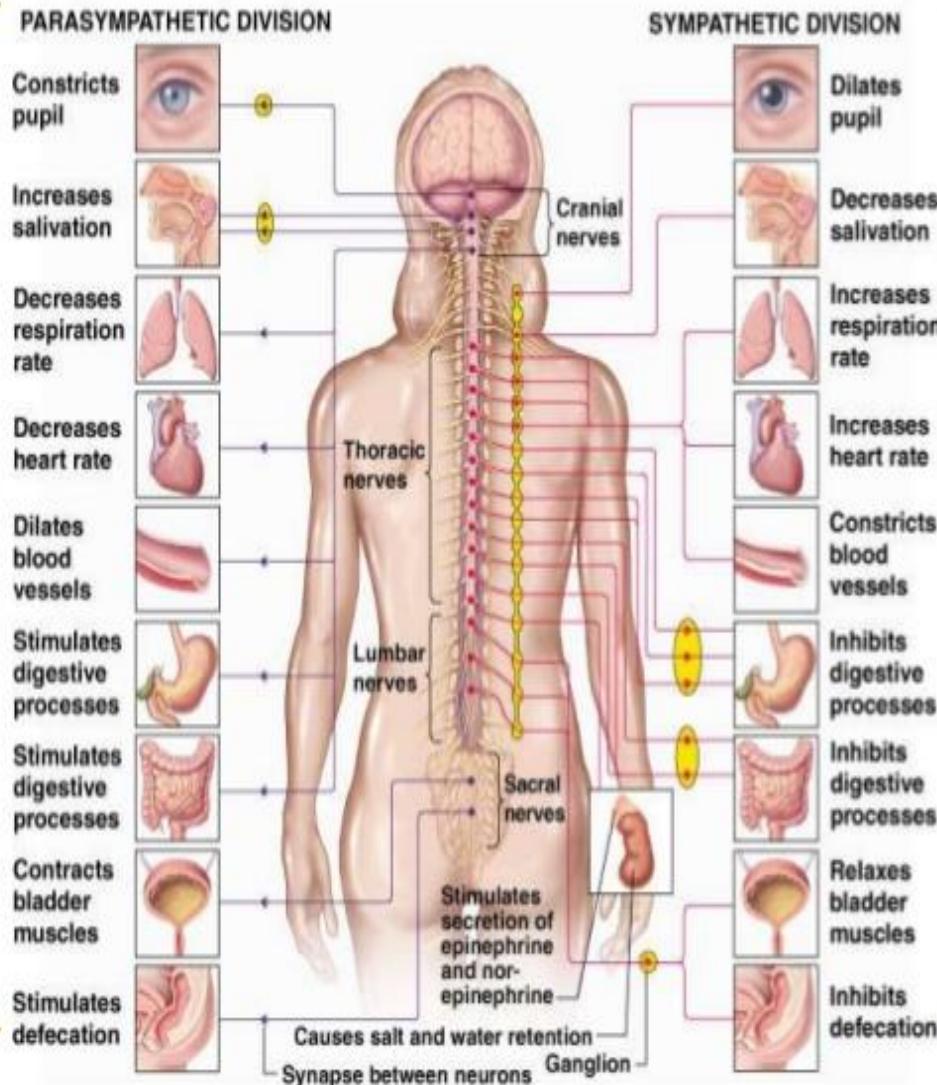
- ▶ function is to tell muscles what to do

PERIPHERAL NERVOUS SYSTEM:

2. Autonomic Nervous System

- ▶ Takes messages to and from the body's internal organs
- ▶ Monitors breathing, heart rate, digestion
- ▶ Divided into 2 parts:
 - ▶ **Sympathetic** nervous system (**arouses**)
 - ▶ **Parasympathetic** nervous system (**calms**)

Autonomic Nervous System (ANS)



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ANS composed of nerves that connect to heart, blood vessels, smooth muscles, & glands

Sympathetic division: mobilizes bodily resources in times of need

Parasympathetic division: conserves bodily resources

Some key functions controlled by each division of ANS summarized in this diagram

THE BRAIN: The Body's Control Centre

The Brain/Biology: An Historical Look

- ▶ Plato: located the mind in the spherical head
- ▶ Aristotle: believed the mind was in the heart
- ▶ Franz Gall (early 1800's): *Phrenology* - theory that bumps on skull revealed mental abilities and character traits

Phrenology as a theory was discarded,
but what did it “give” to our
understanding of the brain?

The Brain's Main Divisions

- ▶ Hindbrain
- ▶ Midbrain
- ▶ Forebrain

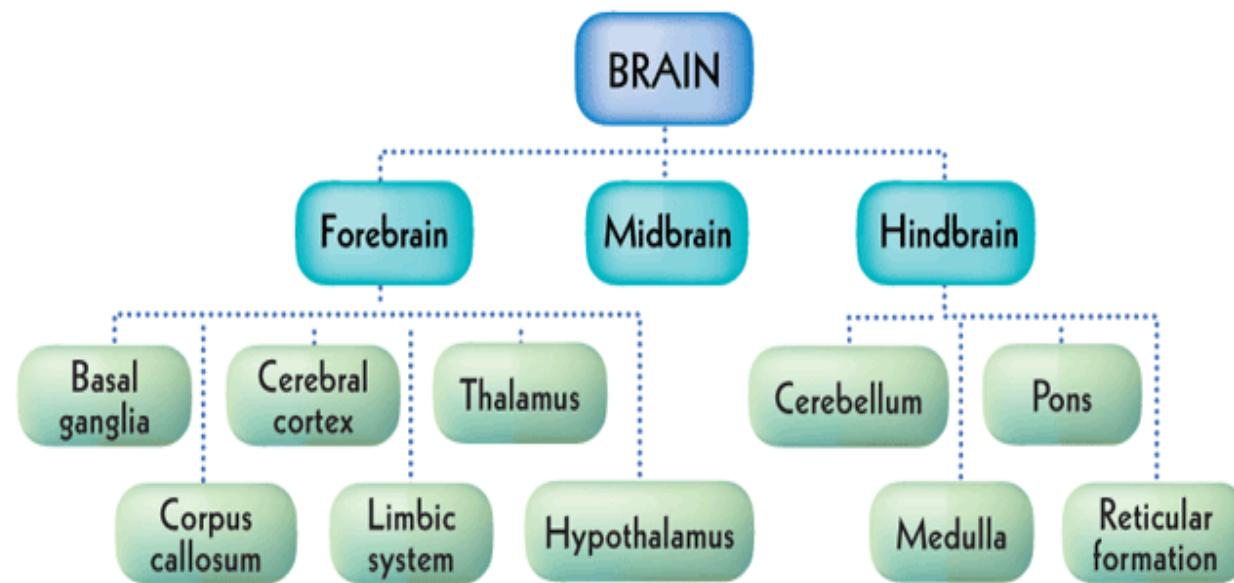


FIGURE 3.8

The Human Brain

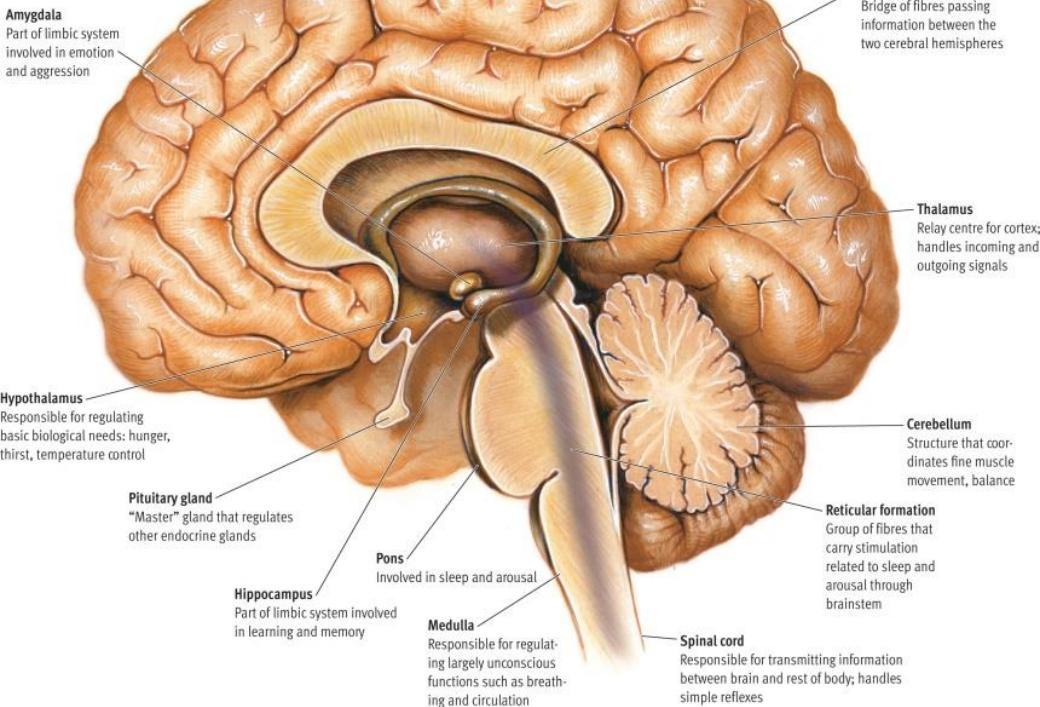
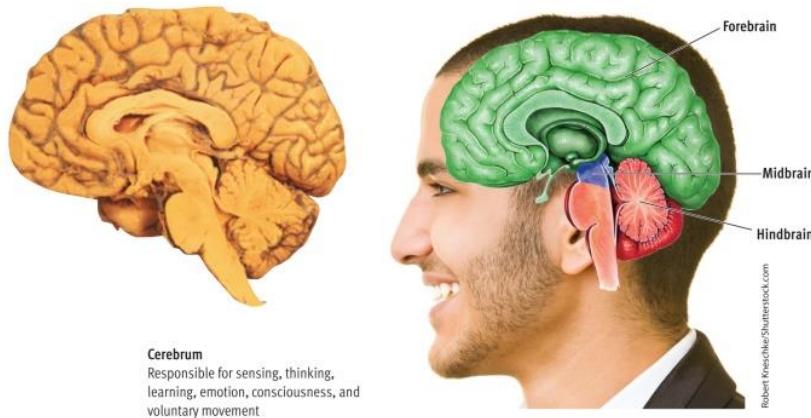
The human brain is divided into three major sections: the forebrain, the midbrain, and the hindbrain. Each of these is revealed in progressively more detail here.

Figure 3.17 Structures and areas in the human brain

FIGURE 3.17

Structures and areas in the human brain.

(Top left) This photo of a human brain shows many of the structures discussed in this chapter. (Top right) The brain is divided into three major areas: the hindbrain, midbrain, and forebrain. These subdivisions actually make more sense for the brains of other animals than of humans. In humans, the forebrain has become so large that it makes the other two divisions look trivial. However, the hindbrain and midbrain aren't trivial; they control such vital functions as breathing, waking, and maintaining balance. (Bottom) This cross-section of the brain highlights key structures and some of their principal functions. As you read about the functions of a brain structure, such as the corpus callosum, you may find it helpful to refer back to this figure.

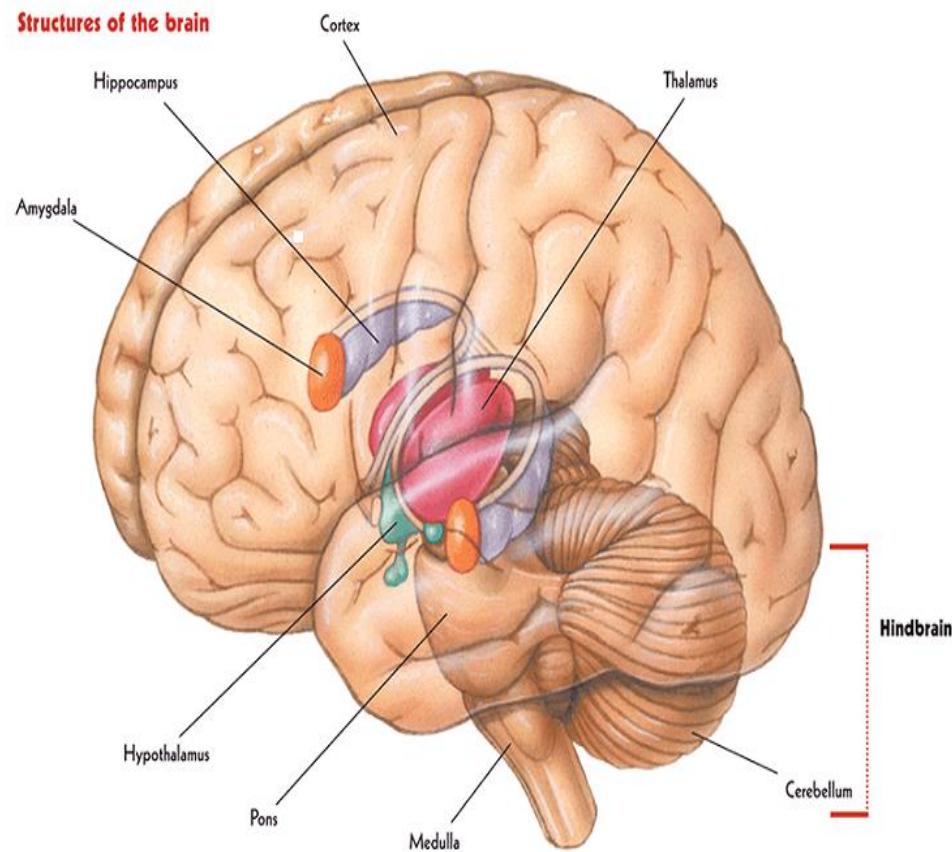


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The Hindbrain

- ▶ **Medulla** controls basic bodily functions
- ▶ **Reticular Formation** controls person's state of arousal
- ▶ **Pons** links medulla & cerebellum
- ▶ **Cerebellum** influences balance, coordination and movement



The Midbrain

- receives signals from other parts of the brain
- relays information to more complex part of the brain
 - voluntary movement
 - spatial information

The Forebrain

- newest part of the brain

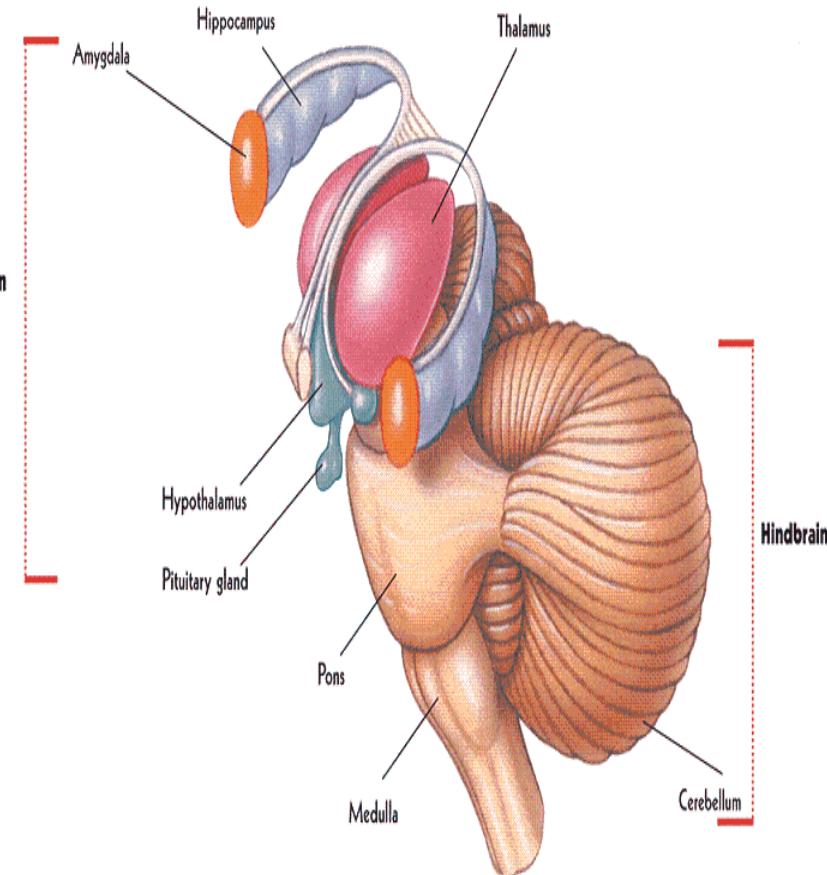
Thalamus: sends information to other parts of brain

Hypothalamus: affects many complex behaviours
(3 pleasurable beh's)
Hunger, thirst
Sex drive, stress
reward

Limbic System: interconnected group of structures; influences emotions and memory

- Amygdala: emotional control
- Hippocampus: new learning

Basal Ganglia: movement & posture



The Forebrain

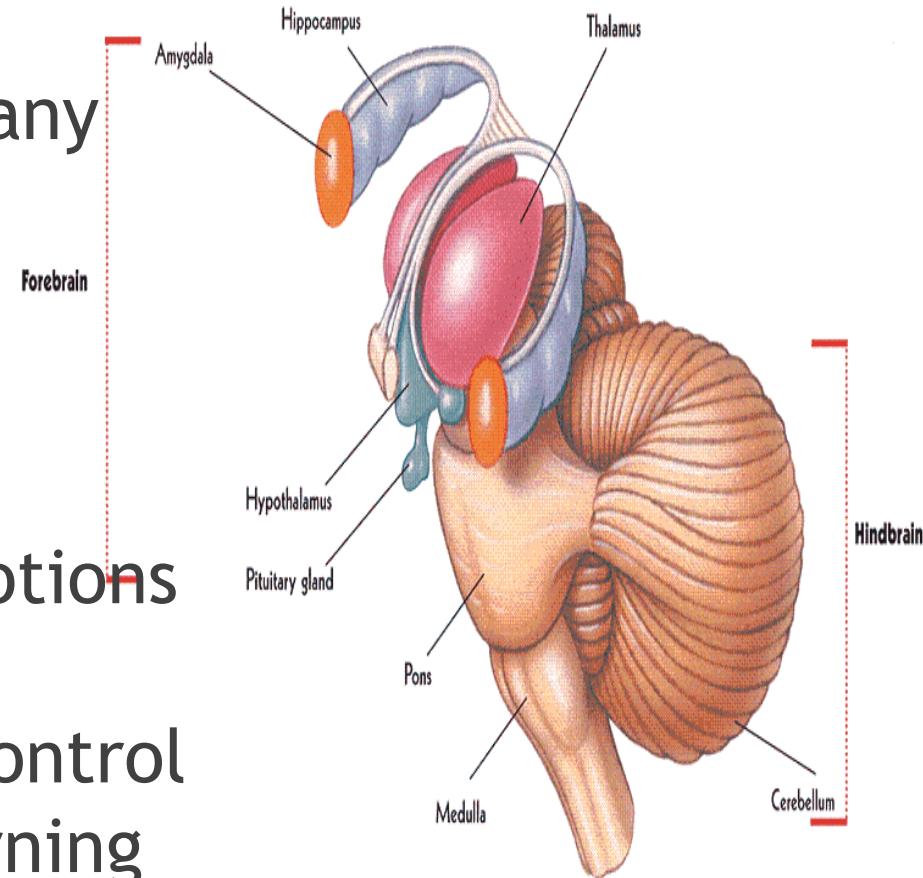
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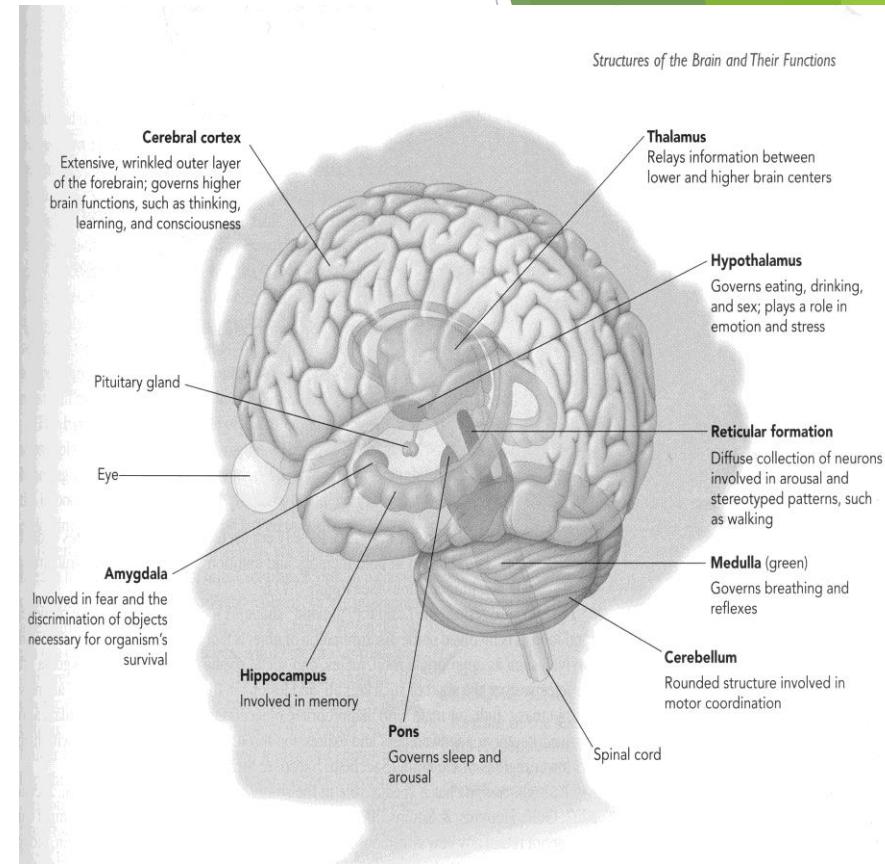
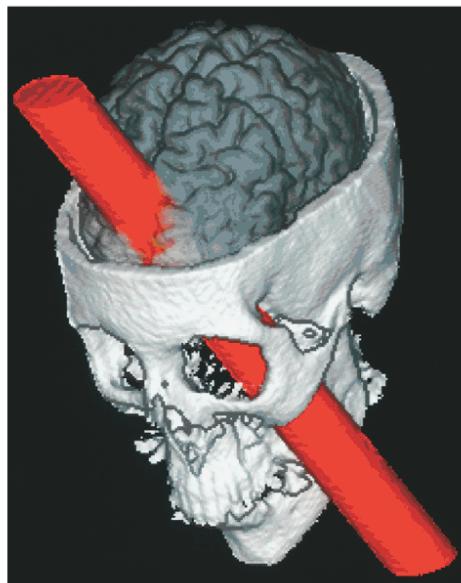
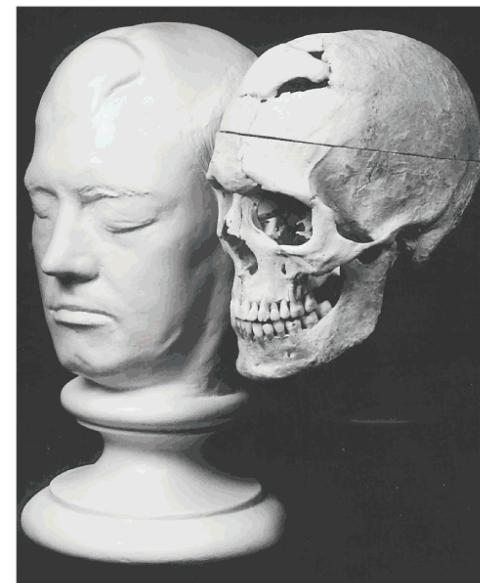
- **Amygdala**: emotional control
- **Hippocampus**: new learning

Basal Ganglia: movement & posture



The Forebrain: Cerebral Cortex

- ▶ Divided into a series of lobes
- ▶ Highest mental functions take place here
- ▶ Convolutions (folds) in tissue create more surface area

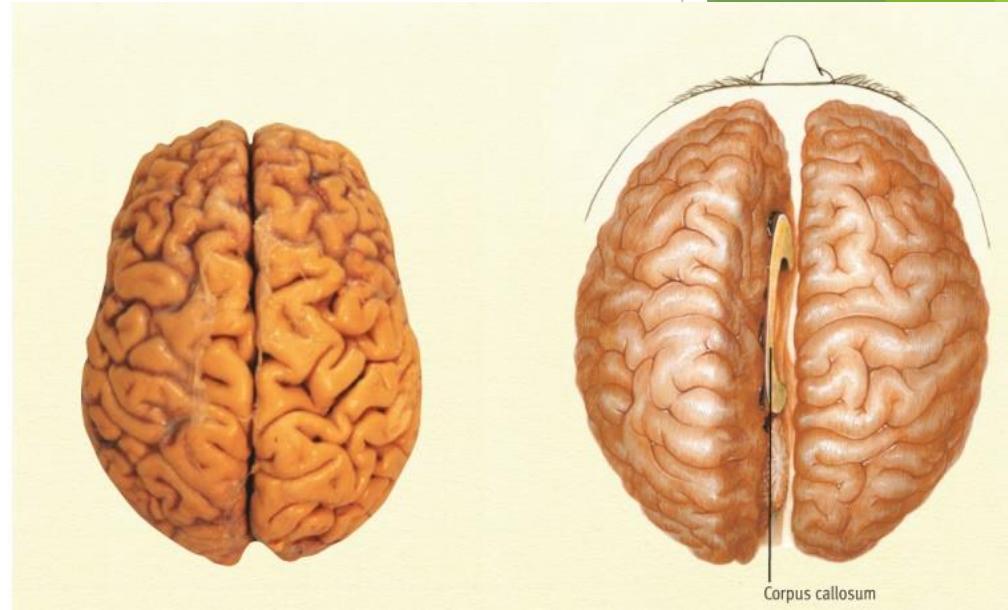


- associable without it
- part of personality
is changed upon damage.

The Cerebrum: The Centre of Complex Thought

Cerebral hemispheres:

- two specialized halves connected by the corpus callosum



Left hemisphere -
verbal processing:
language, speech,
reading, writing

Right hemisphere -
nonverbal processing:
spatial, musical, visual
recognition

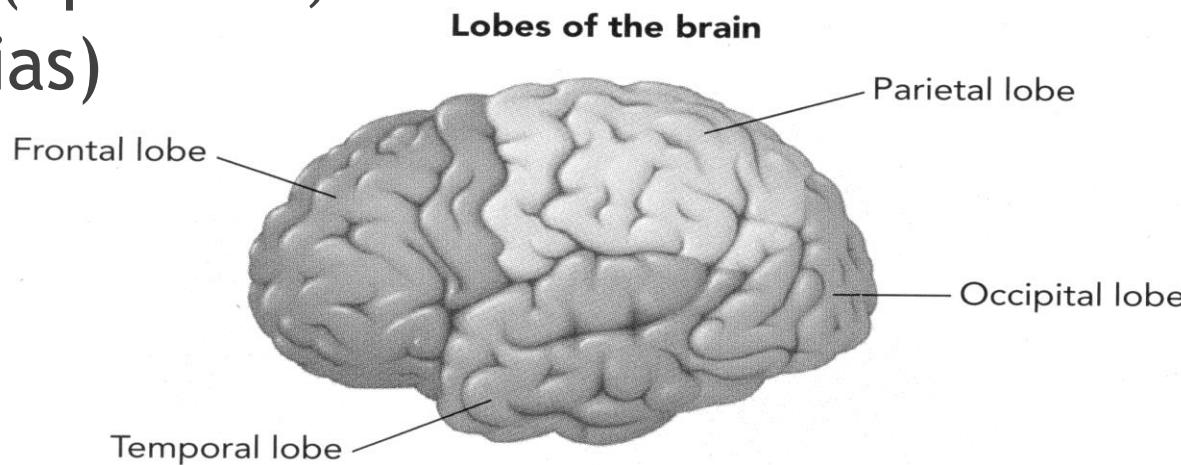
Forebrain: The Lobes of the Cerebral Cortex

Frontal lobe: directing thought processes, body movements

Parietal lobe: integrates visual input (aphasias, agnosias)

Occipital Lobe: processes visual input

Temporal Lobe: language comprehension and memory function



Conclusion

- ▶ This is how our bodies talk!
- ▶ The brain is a very complex organ
- ▶ When it ‘malfunctions’ or signals get crossed, it impacts everything from our behaviours, to thoughts, and feelings/emotions.
- ▶ Take care of your brain as part of overall body health ☺