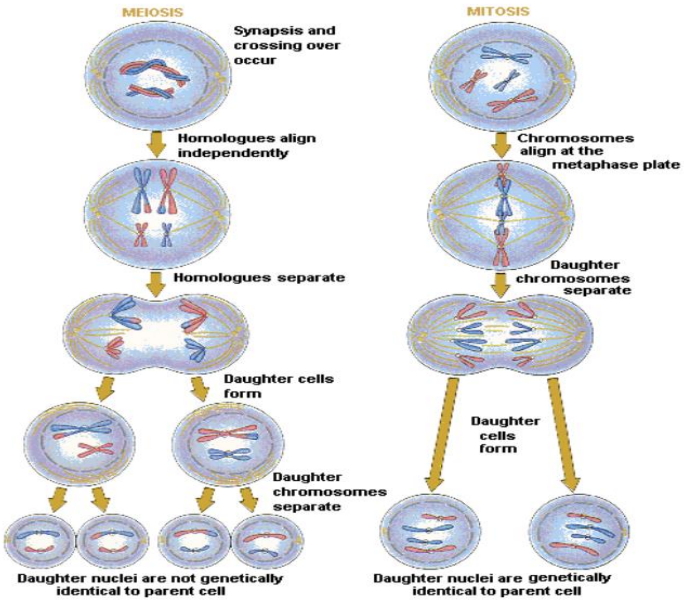
PSYC2400 LECTURE NOTES

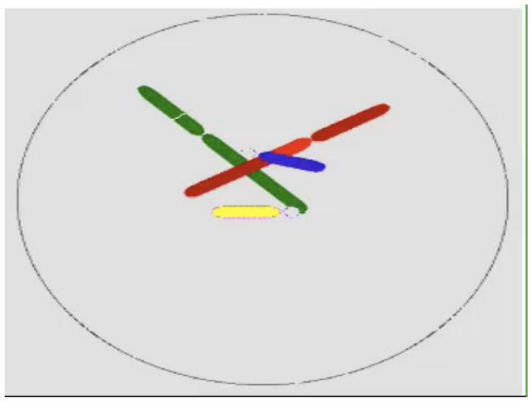
Wee 1 – Biological Psychology

- Not just how **the brain controls environment-behaviour interactions**; the way the **brain controls behaviour and access information about the world**; also includes **influence of hormones and genes on behaviour**; (fluctuations and variations on hormones) – hormones regulating eating behaviour; and is interested in how **behaviour evolves**; and so cares about psychological mechanisms in non-humans too
- **Two different parts** for **object recognition;** one to **recognise** and **one to name;**
- Left hemisphere controls speech; right hemisphere controls left-hand; consciousness (can talk about – job for left hemisphere; hemispheres seem to have independent consciousness;
- **Tinbergen's 4 questions;** a complete understanding of behaviour requires answering 4 questions;

	Current	**Past**
Proximate	**Mechanism** (causation) what is producing and controlling the behaviour right now? Environment, cognition, brain activity, hormones, gene activation	**Ontogeny** (development) What in this animal's life led to this behaviour? Maturational processes (including gene expression) and learning (and associated brain change)
Ultimate	**Adaptive Value** (Function) What is the behaviour for? In what way does it benefit the individual?	**Phylogeny** (Evolution) What is the phylogenetic history of the behaviour, and what led to this selection?

- **Genetics – What are genes?** Influence of genes on psychology (main point); Parts of chromosomes (small sections of DNA); are parts that code for traits; traits are observable differences between individuals; genes also influence behavioural traits;





- **Mitosis;** is about getting bigger (growing of liver by division of cells; muscle growth; - duplicated into two daughter cells which are equal
- **Miosis;** the genetic material contains half the gene the parents had; produce sex cells; random division of chromosomes; crossing over of chromosome parts (sometimes); share new genes and causes variation; - create variable offspring;
- **Alleles;** you have 2 copies of each gene for each trait; genes that code for the same trait are called alleles and compete to express; of trait is controlled by a single gene then the alleles have a predictable effect on the trait; but most traits area actually **polygenic** (many genes are involved in producing it); some alleles are dominant over others and one such allele is sufficient to produce the trait; need two recessive genes to expressive recessive gene;
- **Mendellian Behaviours;** genes that are neutral in their effects will have a fairly even spread across the population; so each allele combination will be roughly equally common; AA Aa aA and aa; tongue rolling and arm-crossing are good examples; given that inability to tongue-roll is recessive, what proportion of the population should be unable to do it;
- **Genotype → Phenotype;** the collection of genes you are born with is your **genotype**; the effect that they have (the things they make- you) is your **phenotype**; **same genotype does not always produce same phenotype** (**due to environments**); genes can only express themselves via long, complicated, developmental processes; they are like recipes than blueprints; (product cake; **cannot pull out individual processes**); every genes just makes a protein; **folded up collections of amino acids;**
- **Measuring genetic effects;** psychologists very rarely actually study particular genes having particular effects; **they are instead interested in the role played by genes in determining behavioural characteristics;** to do this they usually compare correlations in traits between genetically identical individuals (monozygotic twins) and those who only share half their genes but almost everything else (same sex dizygotic twins)
- The heritability of the trait is calculated from the difference between the correlations 2 x ($R_{MZ} – R_{DZ}$). It is a statistical estimate for that particular population of the variation in the trait attributable to genetic differences;

The classic twin design aims to quantify the roles of genetic and environmental causes of variation in traits and in disease susceptibility.

- Estimate correlations rMZ and rDZ
- Compare MZ correlation with DZ correlation
- Divide total residual variance into components due to:
  A = (additive) effects of genes
  C = environmental (i.e., non-genetic) factors that are shared by twins in the same pair
  E = environmental effects specific to a person
  $\sigma 2 = A + C + E$

In 1918,in his mid-20s, a twin called R. A. Fisher famously showed how the correlation between relatives (r) relates to A, C and E:

rMZ = A + C
rDZ = 0.5 A + C

Heritability = % of variation explained by genes
H = A / (A + C + E)
H = 2(rMZ – rDZ), provided H < rMZ
This equation assumes that MZ and DZ pairs share – to exactly the same extent – the non-genetic (environmental) factors specific to the characteristic of interest (C).
If rMZ > rDZ , then genetics might play a role.

- If environments are similar than most variance will be caused by genes; (how much variability is caused by either gene or environment);

Wee 2– Evolution and techniques used to investigate biological psychology

- Understanding genes leads to understanding of evolution; (fitness; adaptability

Evolution occurs whenever these 4 factors are present;

1. **Heredity** (or **replication**) – genes are what is copied to successive generations In species with sexual reproduction, a parental gene has a 50% chance of being passed on to any given offspring; behaviour output can be written in our genes;
2. **Variability**

- Because of genetic differences, members of a population differ, **(evolution only selects for variation expressed by genes**); individua's can differ because of environmental differences too but cannot affect evolution. Genes can influence both morphology and behaviour, so individuals differ in both of these ways.

3. **Selection pressures** – success of a variance; happens slowly mostly;

- Individuals who are better able to survive and/or reproduce (for whatever reason) will leave more offspring;

4. **Mutation/genetic change (replication error)** –

- Because **of copying errors, or mutations produced by natural radiation, gene change** (this is what causes the **variability factor**) – some of these mutations (by chance) will lead to individuals who are better able to survive and/or produce. (mutations lack the many years of selection pressure); **it is the mutated genes that are passed on**;
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Examples of mutations

- **Morphological;** fur colour as predator protection or predator disguise; fox fur changing in relation to season
- **Physiological –** Hunger mechanism, shivering; individuals who eat when their body needs nutrition better adapted; those able to withstand changes in the environment
- **Extended phenotypes –** (something the species creates as an extension of their genes; Beaver dams, birds' nests;
- **Behavioural –** A hunting strategy, or parental care

Selfish Genes and Kin Selection

- The real unit of natural selection is genes; this gives us a much deeper understanding of genetically 'controlled' behaviour, in particular it helps us understand genetically 'controlled' helping behaviour; **genes are competing;** creating individuals in an environment to compete for reproduction.
- **Why should parents care for their young;** because if genes arise (through mutation) which lead to parental care, then the parents possessing them will raise more young, many of whom will carry then parental care gene. Those with parental care reproduce slowly;
- **Theoretically, any gene that leads to the assistance of individuals carrying the same gene will be selected for - will select for itself**

Kin Selection

- Siblings have a 50% chance of sharing a gene, so gene which somehow leads to helping your siblings will be selected for too;
- All relatives share genes depending on their relatedness (r); Hamilton's rule says that helping gene will be selected for if rB > C./ **provided of course, you can tell who's your relative**

Natural Selection vs Sexual Selection

- Natural selection refers to anything that directly increases an individual's chances of surviving or reproducing/ being a faster gazelle, say or a more fertile one or a better mum
- Sexual selection favours genes that make an individual better able to get access to mates, or that make them more attractive to mates; big antlers or beautiful plumage; can produce characteristics that liked by selector even if it reduces fitness;

Homology and Analogy

- Organism can have their similar characteristics and/or behaviours for either of two reasons; **homology**; they are closely related (their evolutionary paths only diverged recently) - **Hands and grasp reflexes**; (common ancestor and divergent evolution)
- **Analogy**; they have faced similar selection pressures – e.g., shark, dolphin, turtle, and penguin flippers; e.g., alarm calls in birds and monkeys;
- Gross anatomy can be derived from physical dissections; and in living people from scans (MRI best); understanding the fine details of neural structures and connections has depended on microscopes and cellular staining techniques;
- **Brain Damage;** in non-humans. Deliberate brain damage by **ablation** (physical removal) or **lesion** (electrical damage) is sometimes used to understand the role of brain areas; in humans we wait for natural brain damage from accidents or stroke (usually) – neuropsychology;

Bio-psych Research Method	**Measuring other physiological activity; Measuring brain chemistry**
• Examining the structure of the brain • Global and local	Manipulating brain chemistry
• Measuring brain activity • Global and local	Manipulating brain chemistry
• Brain stimulation techniques • Global and local	• Examining the effects of genes ; Examining the effects of hormones
Brain damage • deliberate and accidental	Cross-species comparisons to understand evolution

Studying brain chemistry •

- Local neurotransmitter levels can be measured with very fine glass probes to extract fluid between neurons
- Gross levels can be measured in other bodily fluids
- Tiny amounts of neurotransmitters can also be delivered down fine tubes
- and people (and other animals) can be given Psycho-active drugs (which flood the brain with neuro-active chemicals) to examine their effects

Hormones

- Can be measured in saliva or blood • and can be manipulate

Genes

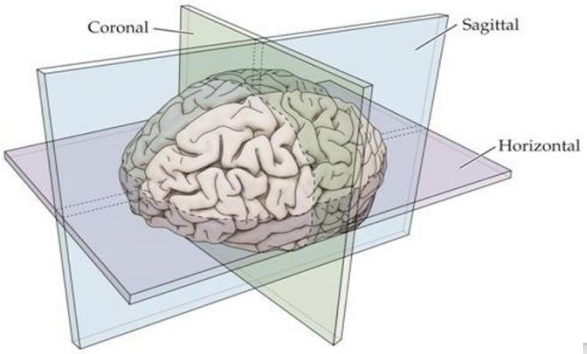
- Are very rarely directly studied by Psychologists
- But overall influences of genes (but who knows how many or which ones?) are examined using twin studies and heritability estimates

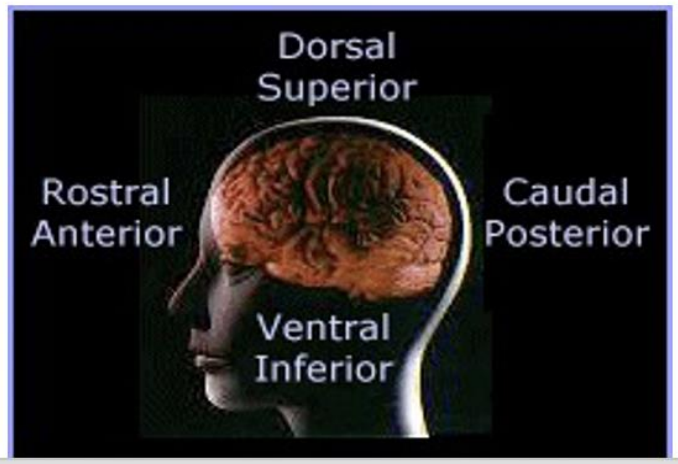
Evolution

- Studying the evolution of brain and behavioural mechanisms can involve many of the techniques already covered.
- But also relies on cross-species comparisons and knowledge about an animal's ecology and phylogeny

Wee 3– The Brain and Nervous System

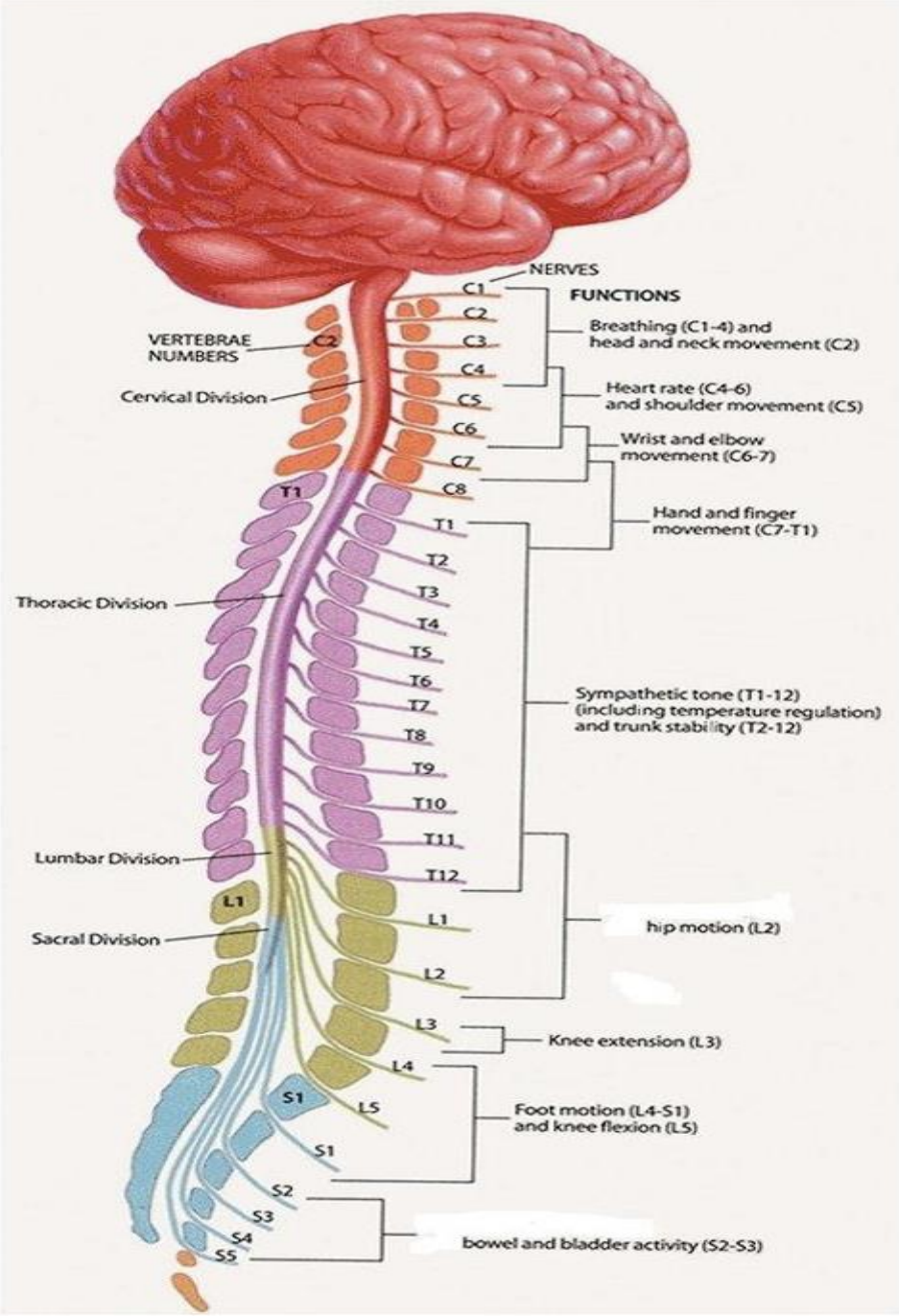
- Important to know which parts of the brain are being referenced; there are three planes in which





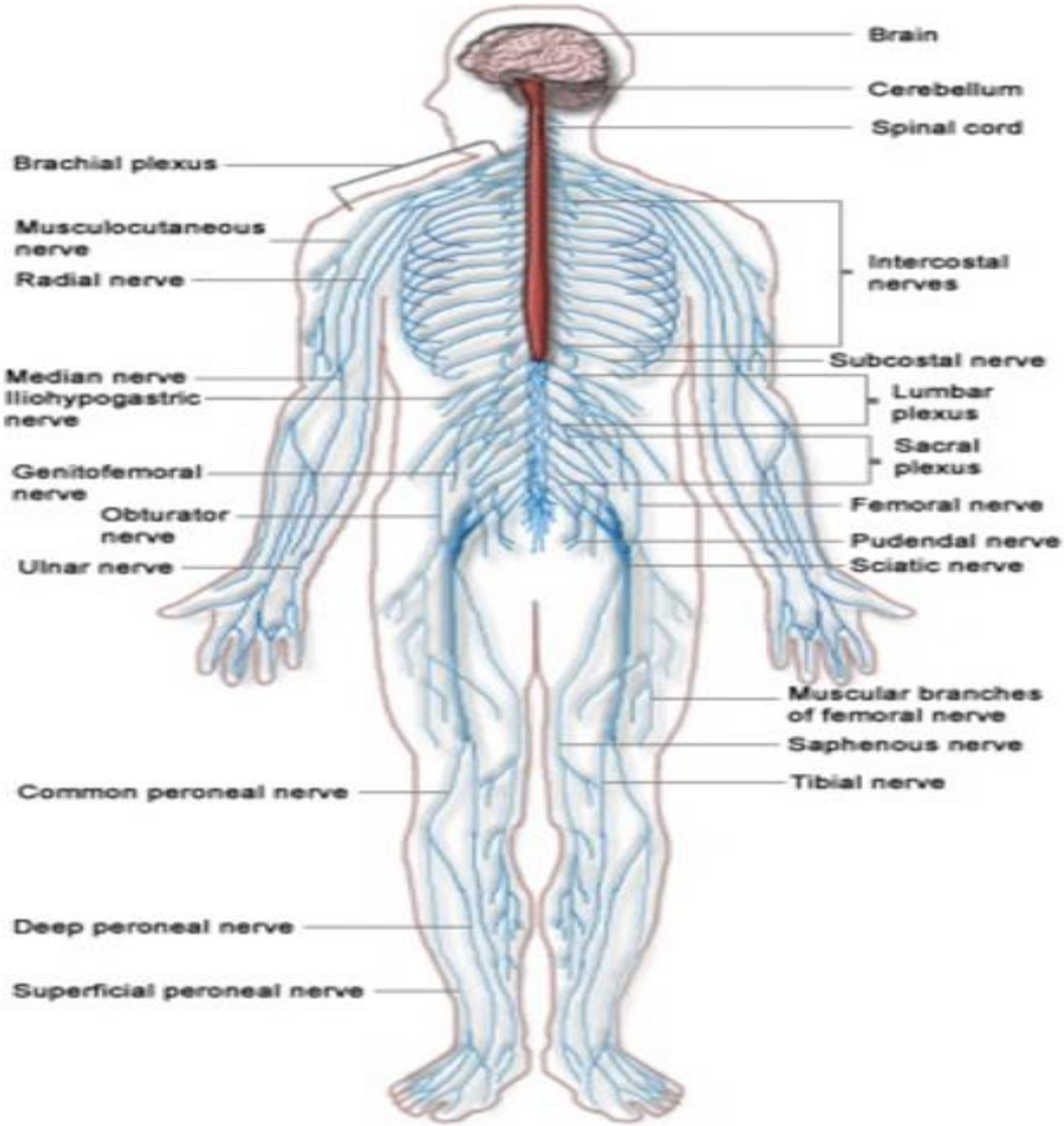
- Each reveals imagery of the brain that are important to understand function; relative locations or gross view of a section of the brain;

• Central (CNS)



- The centre of the body and consist primarily of the brain and spinal cord, integrates the received information and coordination's and influences the activity of all parts of the bodies of bilaterally symmetric animals;
- Can distinguish into categories; some have less obvious boundaries;

Somatic



- The ability to make movements; feeling senses; from body to CNS/ (more about the internal function of the body

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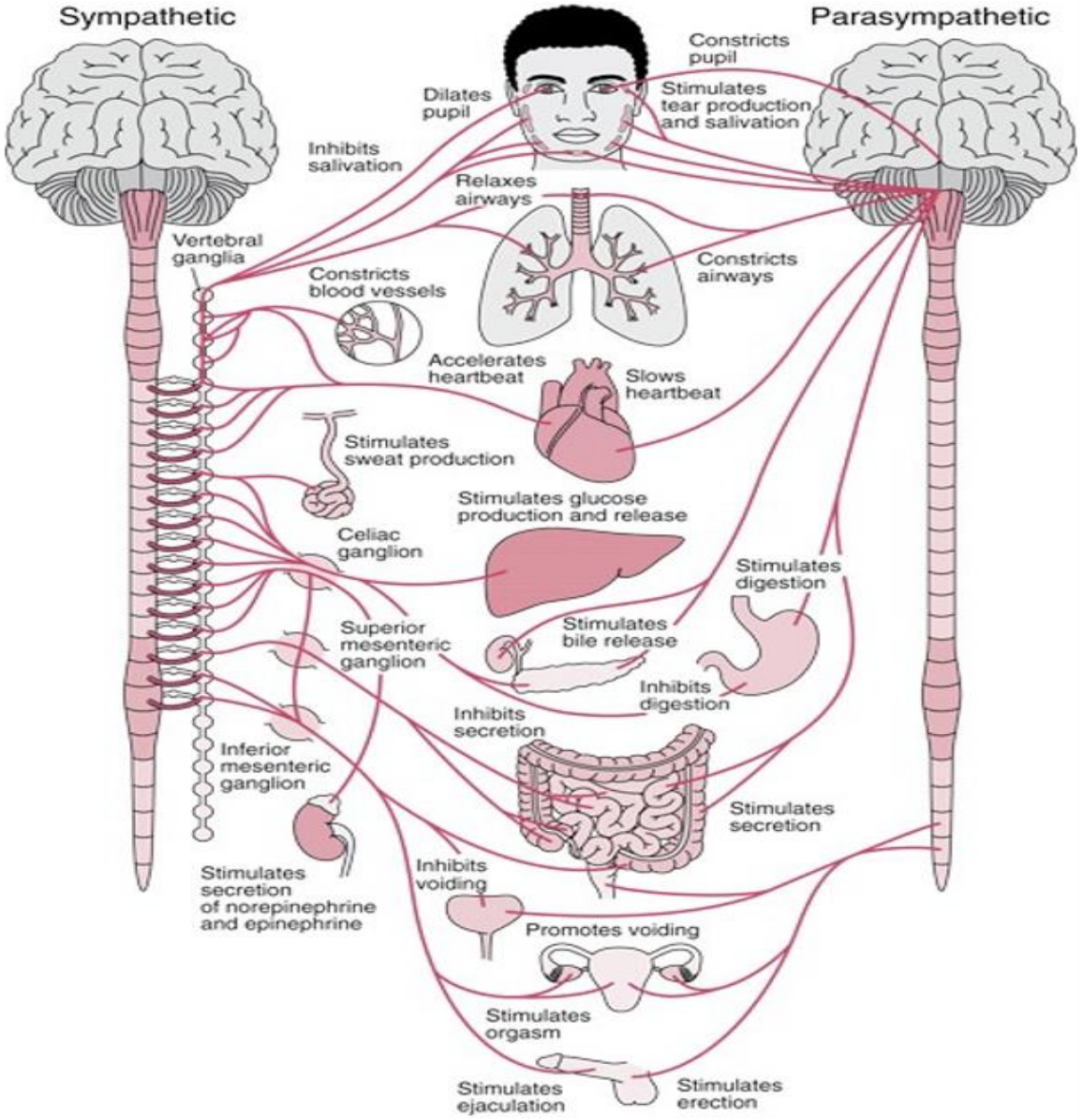
Autonomic


Sympathetic
Parasympathetic
Constricts pupil
Dilates pupil
Stimulates tear production and salivation
Inhibits salivation
Relaxes airways
Vertebral ganglia
Constricts airways
Constricts blood vessels
Accelerates heartbeat
Slows heartbeat
Stimulates sweat production
Stimulates glucose production and release
Celiac ganglion
Stimulates digestion
Superior mesenteric ganglion
Stimulates bile release
Inhibits digestion
Inhibits secretion
Inferior mesenteric ganglion
Stimulates secretion
Stimulates secretion of norepinephrine and epinephrine
Inhibits voiding
Promotes voiding
Stimulates orgasm
Stimulates ejaculation
Stimulates erection

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