

# Biology Paper 2

**Central Nervous System**

- Brain
- Spinal Cord

**Reflex Arc**

Stimulus → Receptors → Sensory Neurone → CNS (Relay Neurone) → Motor Neurone → Effector

Information is sent via electrical impulses through **NEURONES**

**Endocrine System:** contains glands that secrete hormones (chemicals) to assist with maintaining a constant internal environment. They target organs to trigger a response.

**Required Practical:** Reaction times. Suler drop test OR digital sensors with button press to measure how quickly visual stimuli are reacted to.

**Synapse**

impulse arrives in neurone → sacs containing chemicals → synapse → chemicals are released into the gap between neurones → chemicals attach to the surface of the next neurone and set up a new electrical impulse

**Homeostasis**

Maintaining a constant internal environment in response to internal and external changes

- Blood sugar
- Water content
- Body temperature

**Receptors:** cells that detect internal and external changes in environment

**Coordination centres:** areas that receive and process information from receptors

**Effectors:** Muscles and glands that bring about a response to a stimuli

**REPRODUCTIVE ORGANS**

**Male**

- seminal vesicle
- sperm duct – carries sperm to the urethra
- prostate gland
- testes – make sperm
- scrotum – keeps the testes outside the body for maximum sperm production
- penis – places sperm into the vagina
- urethra

**Female**

- ovary – eggs mature here
- cervix – entrance to uterus
- uterus (womb) – the fetus develops here
- vagina – receives sperm during sexual intercourse
- fallopian tube (oviduct) – where the egg travels to the uterus and may be fertilised

**Hormones involved in menstrual cycle**

- OESTROGEN** – female hormone, produced by ovaries. Controls changes during puberty and uterus wall structure and changes during menstrual cycle.
- Luteinising Hormone (LH)** – stimulates egg release during ovulation. (Released by PITUITARY GLAND)
- Follicle Stimulating Hormone (FSH)** – causes egg to mature, stimulates oestrogen production. (Released by PITUITARY GLAND)
- Contraception** – methods used to prevent pregnancy (Barrier, hormonal, chemical)

**Contraception**

- Condom – barrier around the penis to prevent sperm being released into the vagina. Also protect against some STIs
- Spermicides – chemicals that disable or kill sperm
- Diaphragm – placed over cervix before sex to prevent sperm entry through cervix. (must be placed correctly)
- Intrauterine devices (IUD) – inserted into uterus by doctor. Can contain copper to prevent implantation. Barrier between eggs and sperm
- Surgery – Men: vasectomy where sperm ducts cut and tied. Women: oviducts cut OT tied to prevent egg reaching sperm.

**Endocrine Gland**

Endocrine Gland	Role of hormone
Ovaries (female)	Menstrual cycle. Controls/ develops secondary sexual characteristics
Testes (male)	Sperm production. Controls/ develops secondary sexual characteristics
Pituitary	Children-growth. Women – stimulates ovaries (egg release & produce oestrogen). Men – stimulates testes (testosterone and sperm production. All – metabolic rate control via thyroid gland
Thyroid	Metabolic rate control ( <i>thyroxin</i> )
Pancreas	Blood glucose control ( <i>insulin</i> )
Adrenal	Fight or flight reactions ( <i>adrenalin</i> )

**TESTOSTERONE** – male hormone, produced by testes. Stimulates sperm production and changes during puberty.

**FSH (follicle stimulating hormone)** stimulates OVARIES to release OESTROGEN

**Contraception**

**Advantages**

- scientific breakthrough
- eggs may be collected and stored until woman is ready for pregnancy.

**Disadvantages**

- expensive process and usually requires multiple attempts
- not always successful
- health risk to mothers due to hormone, emotional and physical stress
- multiple pregnancies highly likely (can result in disabilities, stillbirths, risk to mother)

**Blood glucose control (pancreas)**

Blood glucose too high	Blood glucose too low
Pancreas releases <b>INSULIN</b>	Pancreas releases <b>GLUCAGON</b>
Cells take in <b>GLUCOSE</b>	<b>GLYCOGEN</b> converts back into <b>GLUCOSE</b>
<b>GLUCOSE</b> converted to <b>GLYCOGEN</b>	<b>AMINO ACIDS/FATS</b> break down
Blood glucose lowers to normal	Blood glucose rises to normal

**Thyroxine levels controlled by negative feedback**

- insulin replacement (protein, so must be injected) enables glucose to be converted and stored in cells as glycogen.
- Diet to balance blood glucose
- exercise while monitored with diet

**GLUCAGON** – hormone stimulating liver to break down **GLYCOGEN** into **GLUCOSE**

**Genetics**

- GENOME** – the entire genetic material of an organism
- GENE** – small section of DNA that codes for each characteristic
- CHROMOSOMES** – tightly wound DNA. Humans have 46 chromosomes in body cells and 23 in gametes.
- DNA** – polymer arrange in a double helix shape. Found as chromosomes in cell nuclei

**Diabetes**

- Type 1** – Blood glucose levels are not controlled due to pancreas not producing enough/any insulin.
- Type 2** – body stops responding to own insulin production (linked with with age, weight or lifestyle)

**Treatment**

- Pancreas transplant. Rare, high risk and difficult operation. Still require constant meds (immunosuppressants rather than insulin) and not enough organs
- transplant of pancreatic cells (low success but research with stems cells and mice trialling)
- drugs for increased pancreas activity so more insulin production

**MEIOSIS**

DNA has 4 protein bases: A-T, C-G. The order of these bases determines what features are expressed by each gene

Cell division results in gamete production – genetically different haploid cells

DNA is random mixture of parent gametes

Diploid cells – 46 chromosomes

Homologous Chromosomes

Haploid cells – 23 chromosomes

**MITOSIS**

Cell division making identical copies of original

Makes Identical Two

**ASEXUAL REPRODUCTION** – only involves parent. Offspring are genetically identical to original. Cell division through mitosis

**SEXUAL REPRODUCTION** – involves 2 parents, these gametes fuse. Offspring genetically vary due to combined DNA. Gametes are formed through meiosis

**Evolution**

We can understand human evolution and history, along with patterns of DNA, and identify inheritance and family trees

- balanced diet
- regular exercise
- weight loss

**In vitro fertilisation (IVF)** used if parents have egg or sperm production problems.

- Mother given artificial FHD and LH to stimulate egg maturing and releasing -egg and sperm collected and fertilised in lab, kept in optimum conditions -once substantial embryo formed, implanted into uterus.

**Infertility** – some women have low FHS production and require additional methods for supporting fertilisation and pregnancy. Adoption and surrogacy are 2 methods

**Contraception**

Abstinence – not having sex until wanting to get pregnant

Hormone based – Pill, implant, injection or patch. Contain oestrogen, progesterone or both. Inhibits normal body LH or FSH hormone production to prevent egg release.

**Genetics**

Genetic links to diabetes and heart disease have been researched to find faulty genes and early diagnosis to improve life

**Endocrine System**

Information is sent via electrical impulses through **NEURONES**

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Maintaining a constant internal environment in response to internal and external changes

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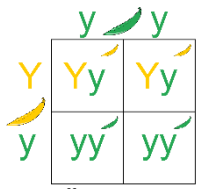
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Key word	Definition
Allele	Different forms of the same gene
Heterozygous	2 different alleles for a characteristic (eg Bb)
Homozygous	2 identical alleles for a characteristic (eg BB, bb)
Genotype	Type of gene (eg hair colour, eye colour) represented with letters (BB, Bb, bb)
Phenotype	Physical characteristics displayed from the genotype (eg brown hair, blue eyes)
Dominant	Only 1 allele needed for this characteristic to show through
Recessive	Characteristic can only be expressed when both alleles are present

Punnett squares – used to calculate the potential offspring characteristics, dependent on parents genotype



Offspring:  
Yy – Yellow plant 50%  
yy – green plant 50%

**MATH CONTENT** – working out the % or ratio of the offspring Geno & Phenotypes.  
 $\frac{1}{4} = 25\%$ .  $\frac{2}{4} = 50\%$ .  
 $\frac{1}{4} = 75\%$   
 Potential ratios can be: 1:3, 2:2, 1:2:1 (with each genotype being identified)

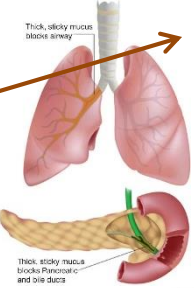


## Genetic disorders

**Polydactyl**

- Dominant allele
- Extra finger or toe
- If sufferer is homozygous offspring will 100% inherit condition
- If sufferer is heterozygous offspring will 50% inherit condition
- Treatment: surgery to remove digit (complete cure)

**Cystic Fibrosis**



- Recessive allele
- Affects digestive, respiratory and reproductive systems
- affects membranes affecting movement of substances.
- Treatment: antibiotics, physiotherapy, enzyme replacement, lung transplant, gene replacement (no cure yet)
- As recessive, parents can 'carry' gene

C = dominant allele (normal metabolism)  
c = recessive allele (cystic fibrosis)

Both parents are carriers, so (Cc)

	C	c
C	CC	Cc
c	Cc	cc

Genotype of offspring:  
25% normal (CC)  
50% carriers (Cc)  
25% affected by cystic fibrosis (cc)

Phenotype of offspring:

3/4, or 75% chance normal  
1/4, or 25% chance cystic fibrosis

**Amniocentesis** – takes fluid from fetus containing fetal cells for screening (15-16 weeks)

**Chorionic villus sampling** – early stage check, taking small tissue sample from placenta for screening (10-12 weeks)

Parents with inherited conditions use IVF, these embryos can be screened before implantation. Positive affected embryos wont be implanted.

**Upon results, parents can decide their plan, to keep or abort their offspring. This raises ethical concerns**

Requires a decision on possible abortion

Although accurate, can still provide a false positive or negative result

Expensive procedure – Offered to high risk and older parents first

Can cause miscarriage during screening due to invasive procedure

May be evolved into genetic engineering/designer babies

Fossil records are incomplete because: not been found, organisms were soft-bodied so no fossils formed, incorrect fossilisation conditions, damage and destruction

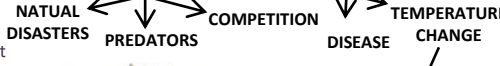
**ENDANGERED** – when an organism is at risk of extinction due to low numbers

# Biology Paper 2

**EVOLUTION** – the change of a living thing over a period of time – evidenced by **FOSSILS**

Fossil: organism remains from millions of years ago, preserved in ice, peat or through mineralisation

**EXTINCTION** – when every member of a species has died, meaning a permanent loss



**Killing the dinosaurs**  
Asteroid hit the earth causing tsunamis, earthquakes etc causing natural dimming due to dust. This prevented photosynthesis and global temperatures dropped. Dinosaurs (reptiles) cannot control body temperature, and CO2 levels were high

Extreme heat or cold has affected the earth over its millions of years. Unless animals adapt to the extreme climate they cannot survive



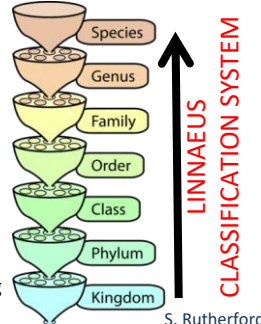
- Causes:**
- Taking antibiotics incorrectly
  - Bacteria mutation
  - Cross use between humans and animals
  - Taking the wrong antibiotics
  - Not washing appropriately

Only take antibiotics when completely necessary

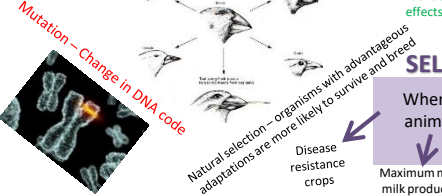
Use correct antibiotic for each bacteria

High standards of hospital hygiene

Classification – organisation of living things according to similarities



**NATURE VS NURTURE**



**Evolution (survival of the fittest/natural selection)** **6 MARKER:**

- Animals isolated (geographical – natural disasters/ oceans/ forests/ mountains)
- Mutation and adaptations for that environment
- Survival due to adaptations
- Reproduce
- Pass on characteristics to offspring
- Two populations can no longer interbreed to produce fertile offspring (new species formed)

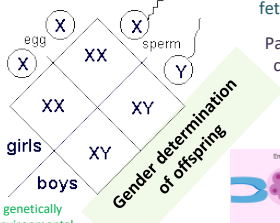
**GM (genetically modified) crops**

- + increase in yield
- + resistant to insect attack (produce own insecticides)
- + herbicide resistant
- + better suited to extreme condition
- + used to feed poorer countries
- + improved nutrient quality
- + disease resistant

- offspring crop infertile  
- Produced tasted/tested on humans  
- Used in poorer countries – have to buy seeds  
- Expensive, new technology

**Benefits**

- Used in gene therapy for genetic disorders
- Higher yield = higher food value
- Improved plant/animal growth rate
- Foods can grow in extreme conditions or control pests



**Genetic Engineering**

Where humans breed plants or animals together, for desirable characteristics

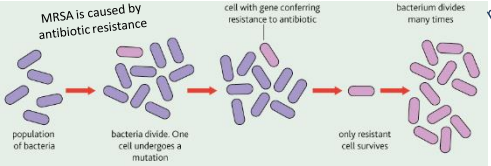
The gene for a desired characteristic from one organism is removed **USING ENZYMES** and is transferred into the genetic material of a **VECTOR** also using **ENZYMES**. The **VECTOR** then inserts the engineered **GENE** into required cells. Cells then multiply using **MITOSIS**, causing the organism to develop with desired characteristics.

### Concerns

- Effects on human health??
- Long-term effects unknown
- GM crops could enter wildlife (crop offspring could be infertile)
- Could progress to 'human engineering'

Fossils and their records allow us to track how species have evolved (if at all) over time. They can also help explain how environments, landscapes and ecology has changed during these time periods

**Antibiotic resistance** – Caused due to bacteria's rapid reproduction, they can evolve quickly



Case study: MRSA, bacteria mutation in hospitals and care homes, resistant to antibiotics and spreads easily

Infected people to stay isolated

Washing hands when visiting ill people

**SELECTIVE BREEDING**

Identical twins are genetically identical, however environmental effects will impact on appearance.

Flowers with colour, scent or variety

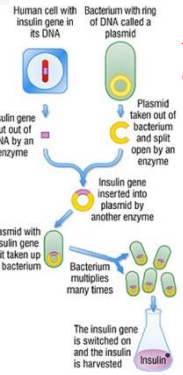
inbreeding increases breed risks of diseases and health defects

Maximum meat/milk production

Pets and cattle with good temperament

Genetic engineering of **INSULIN**

Modifying genetic material of an organism for desirable characteristics



**Method 2**

- Plant/animal dies
- body covered in ice/peat.
- No oxygen, bacteria or temperature present to allow Bacteria to decay matter
- Organism preserved

Classification – organisation of living things according to similarities



# Homo sapiens

genus name species name

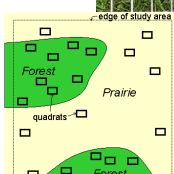
**ECOSYSTEM** – interaction of living (BIOTIC) and non-living (ABIOTIC) factors in an environment

**COMMUNITY** – populations of different species of animals, plants, Protista, fungi, bacteria and archaea that are independent organisms in that habitat

BIOTIC FACTORS	ABIOTIC FACTORS
Light intensity	Food
Temperature	Pathogens or parasites
Moisture	Predators
Soil pH and minerals	Interspecific competition (competition of different species)
Wind intensity & direction	
Oxygen availability	
Carbon dioxide availability	

## Distribution and abundance

Quadrats are used to measure the number of specific organisms growing in an area



**RANDOM SAMPLE:** QUADRAT IS PLACED IN RANDOM LOCATIONS WITHIN A GIVEN AREA. E.G. plant growth, number of organisms

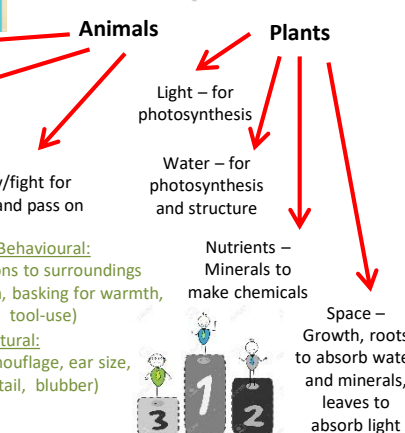


**TRANSECT:** A MEASURED LINE OR AREA ALONG WHICH ECOLOGICAL MEASUREMENTS ARE MADE E.G. light intensity, plant growth, number of organisms

**MEAN**- sum of values ÷ number of values  
**MEDIAN**- middle value within the range  
**MODE**- most frequently occurring value



## Competition



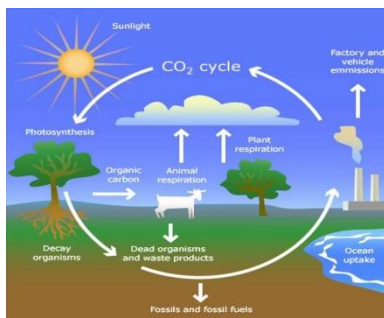
**Adaptation** – Features living organisms have that make it possible for them to survive in particular habits.

**Extremophile** – an organism that survives and reproduce in the most difficult conditions (salt, pressure, temperature)

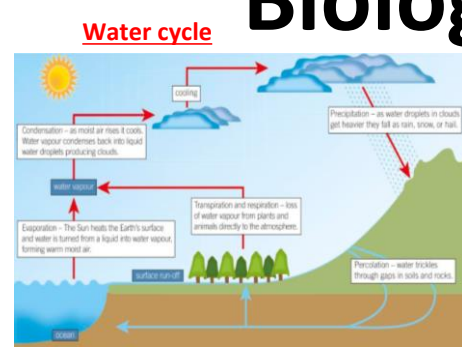


- Behavioural:** Reactions to surroundings (migration, basking for warmth, tool-use)
- Structural:** Body design (camouflage, ear size, body shape, tail, blubber)
- Functional:** Processes within the body (metabolism, reproduction, photosynthesis, respiration)

**BIOACCUMULATION** – the build up of toxins in organisms higher up the food chain due to consumption.



## Carbon cycle

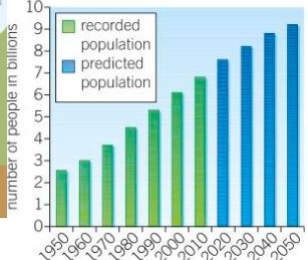


## Water cycle

# Biology Paper 2



**BIODIVERSITY** – a measure of the variety of all the different species of organisms on Earth, or within a particular ecosystem



## Population growth

- Quarrying for resources – reducing available land
- More land needed for houses – reducing habitats and biodiversity reduction
- Increased waste production – packaging, sewage, gases, industrial waste.

## Deforestation

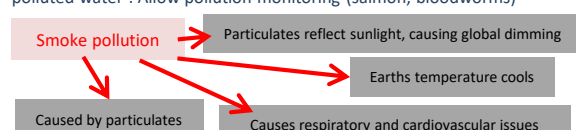


- REASONS**
- Cattle
  - Food growth
  - Crops for biofuels
- EFFECTS**
- Increased CO<sub>2</sub> release
  - Reduces CO<sub>2</sub> absorption
  - Loss of CO<sub>2</sub> 'sinks'
  - Loss of biodiversity
  - Habitat destruction
  - Animal endangered and extinct

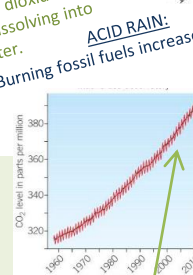
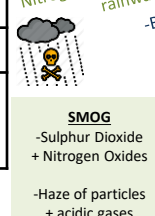
Humans reduce species biodiversity by taking land for farming, houses, waste and pollution.

Polluting Land	Polluting water
Household waste	Untreated sewage
Farming	Micro-organism respiration
Industrial toxic waste	Fertilisers
Fertilisers	- Pesticides and herbicides (causing bioaccumulation)

**Bioindicators** – species that can only survive in very clean or very polluted water. Allow pollution monitoring (salmon, bloodworms)



**ACID RAIN:** Caused by sulphur dioxide and Nitrogen oxides dissolving into rainwater.



**ACID RAIN:** Burning fossil fuels increases acid rain

**ACID RAIN:** Kills plants and animals, reducing biodiversity



**Greenhouse effect** – trapping of sun radiation by greenhouse gases causing heating of earth and atmosphere

Methane and CO<sub>2</sub> levels increase, contributing to global warming

**GLOBAL WARMING** – more greenhouse gases + effect causing increase in temperature. Having negative effects on the globe.

**Breeding programmes** – restore endangered animals.



## Maintaining biodiversity

- Deforestation and CO<sub>2</sub> reduction – improvements to transport and electricity production to reduce emissions
- Field margins and hedgerows – farmers provide land at field edges for biodiversity to improve
- Habitat protection and regeneration – coral reefs, mangroves and heathlands protected to allow re-establishing.