

Structures and Functions in Living Organisms

Cell Biology

Organisation

Infection and Response

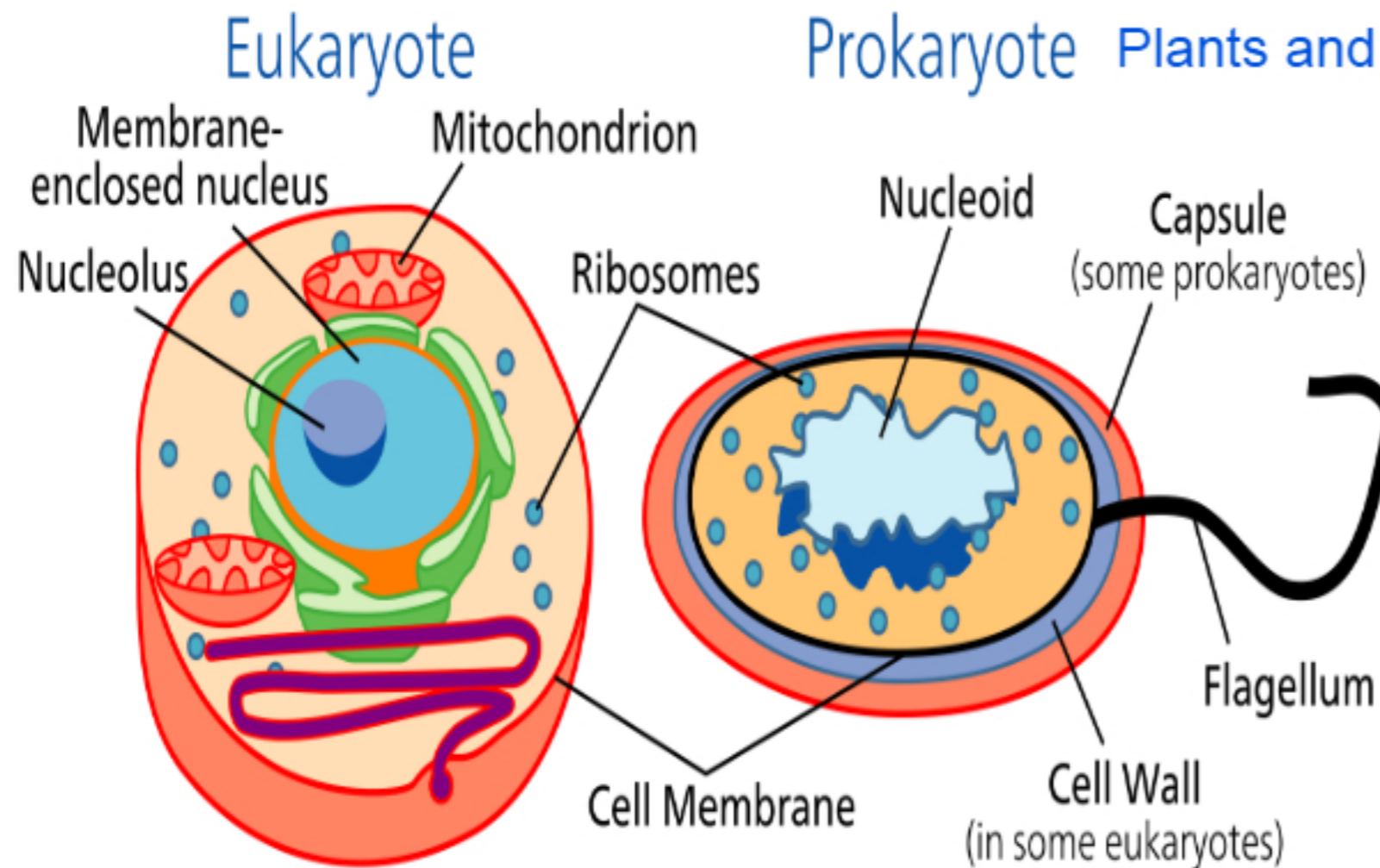
Bioenergetics

Eukaryotic and Prokaryotic Cell
Animal Cell and Plant Cell
Specialised Plant Cells
Specialised Animal Cells
Microscopy
Culturing Microorganisms
Cell Division: Mitosis
Stem Cells
Diffusion
Osmosis
Active Transport

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EUKARYOTIC and PROKARYOTIC CELLS

Bacteria

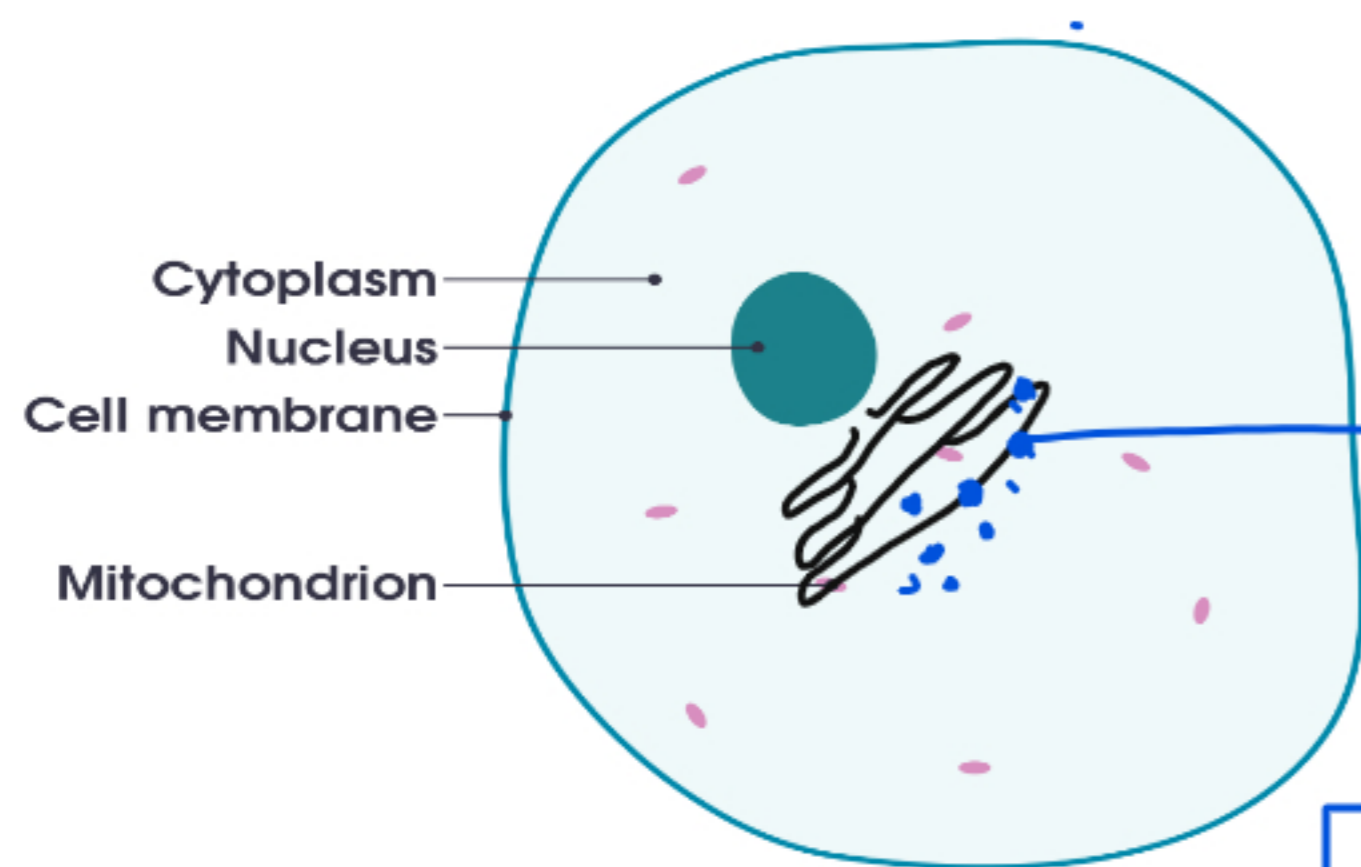


Source: Wikipedia

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| EUKARYOTIC | PROKARYOTIC |
|-------------------------------------------|---------------------------------------|
| Nucleus is present. | Nucleus is absent. |
| All membrane bound organelles are present | Membrane bound organelles are absent. |
| DNA is enclosed in the nucleus | DNA lies naked in the cytoplasm. |
| They are multicellular | They are mostly unicellular |
| DNA is linear | DNA is circular |
| Ribosomes are big | Ribosomes are small |
| They are big cells | They are small cells. |
| Example: Plants and Animals | Example: Bacterial Cell |

ANIMAL CELLS



Ribosomes

NUCLEUS

It is the brain of the cell
It controls the activities of the cells
It contains DNA which holds our genetic information.

RIBOSOMES

It is the site for protein synthesis.
They are involved in making of proteins and enzymes required by the cell

CYTOPLASM

Jelly like fluid which fills the cell.
It is the site where all the chemical reactions of the cells take place as it contains all the major enzymes

CELL MEMBRANE

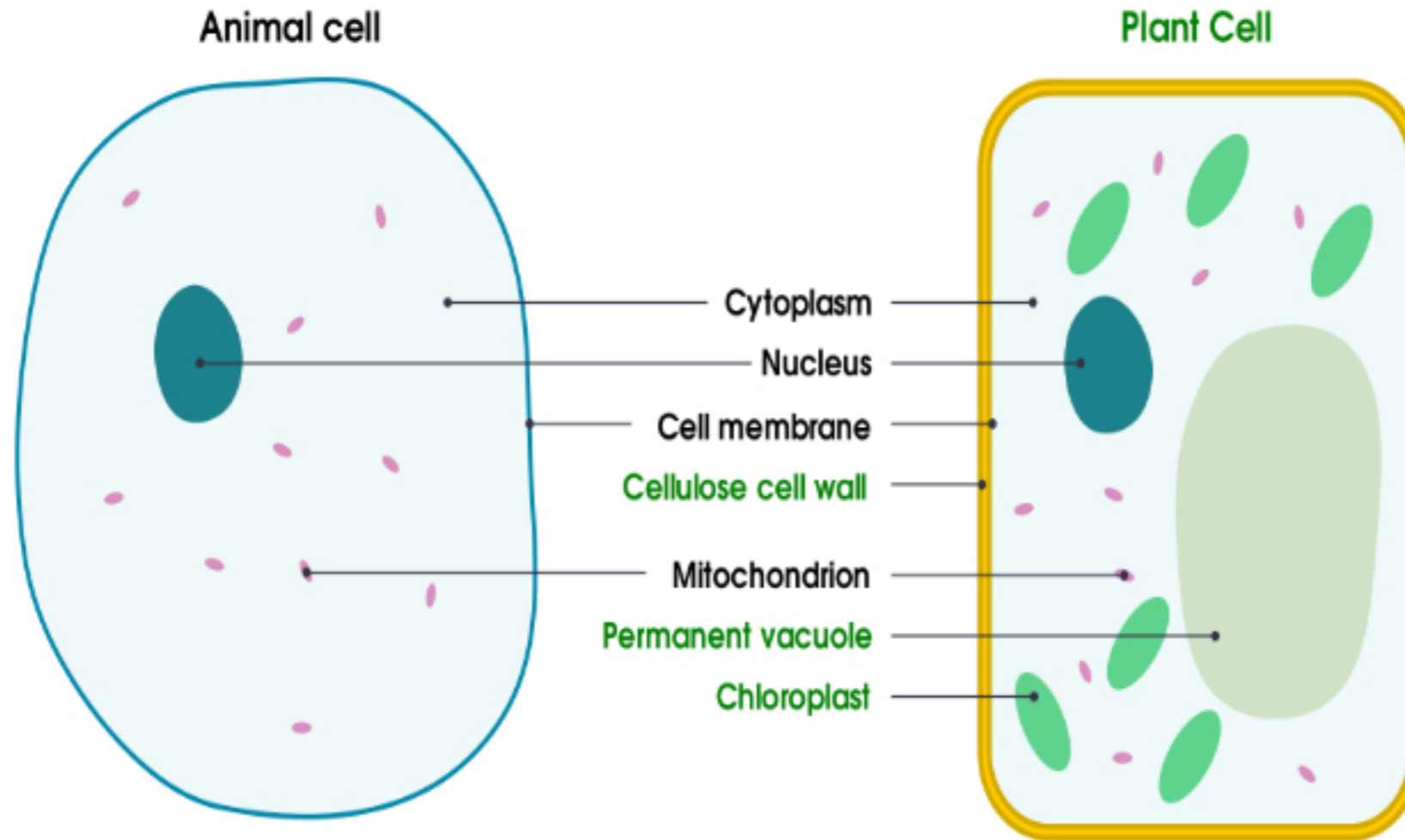
It the membrane that surrounds the cells
It controls what goes in and out of the cell.

MITOCHONDRIA

It is the powerhouse of the cell
It produced energy for the cell as it is the site for aerobic respiration

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PLANT CELL



PERMANENT VACUOLE

It is filled with cell sap.

It gives rigidity to the cells and makes the cell turgid

CELL WALL

Made up of cellulose.

It is the layer outside of the cell membrane

It supports the plant and maintain its shape.

CHLOROPLAST

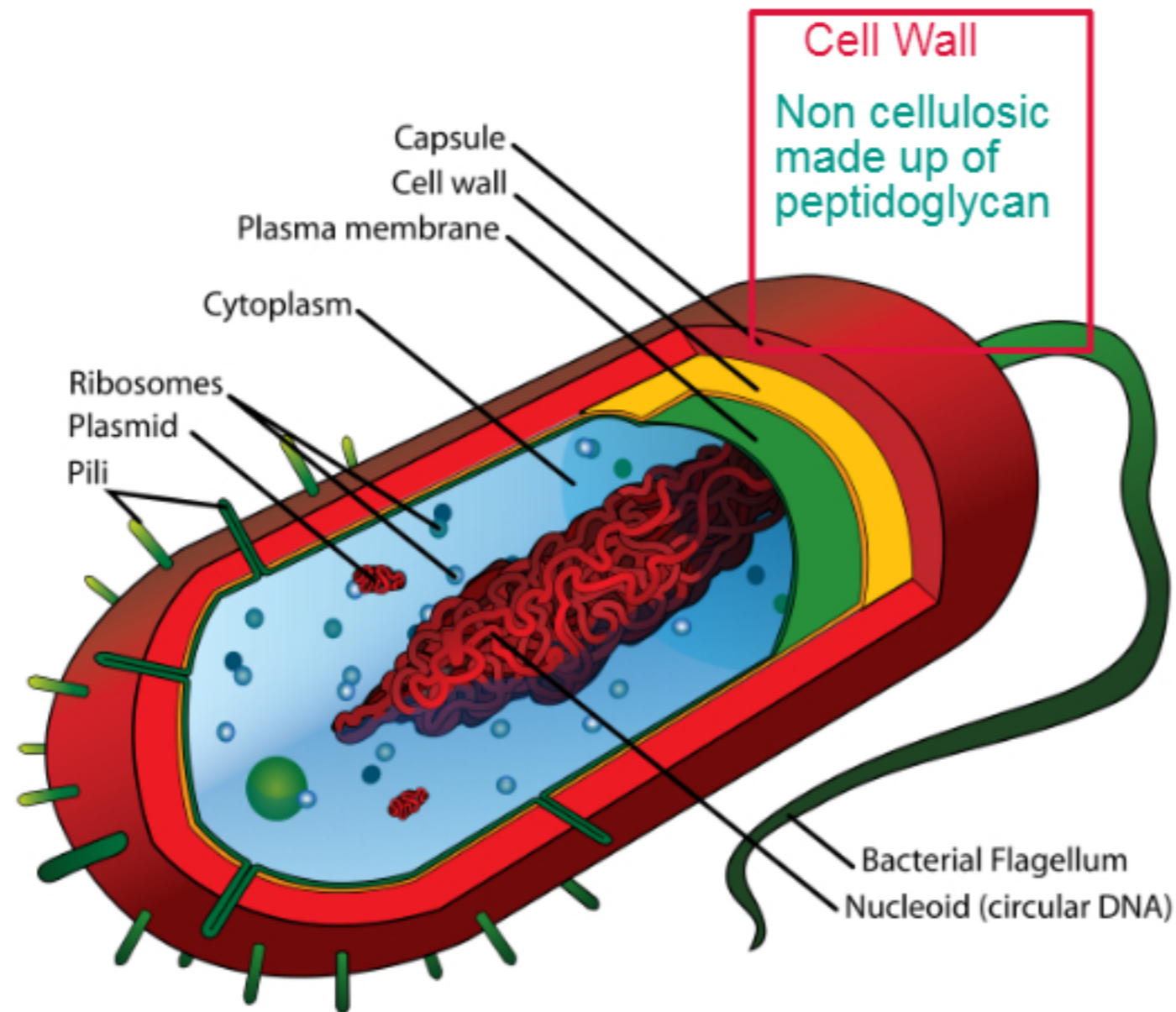
It is the site for photosynthesis

It contains a green pigment, chlorophyll which absorbs light and prepared food.

PLANT VERSUS ANIMAL CELLS

| ORGANELLE | PLANT CELL | ANIMAL CELL |
|-------------------|------------|--------------|
| Nucleus | ✓ | ✓ |
| Cell Membrane | ✓ | ✓ |
| Mitochondria | ✓ | ✓ |
| Ribosomes | ✓ | ✓ |
| Cytoplasm | ✓ | ✓ |
| Cell Wall | ✓ | ✓ |
| Permanent Vacuole | ✓ | ✓ |
| Chloroplast | ✓ | ✓ |

BACTERIAL CELL



Source: Wikipedia

Cell Wall
Non cellulose
made up of
peptidoglycan

Circular DNA
No nucleus
Single DNA loop
found naked in the
cytoplasm,

Plasmid
Extra chromosomal
materials
They are in the form of
small rings
They give special properties
to bacteria like antibiotic
resistance

Pili
Hair like structures
found on the surface
that helps
bacteria to
reproduce

Capsule
Slime layer
that protects the bacteria

Flagellum
Tail like structure
helps the bacteria
to move.

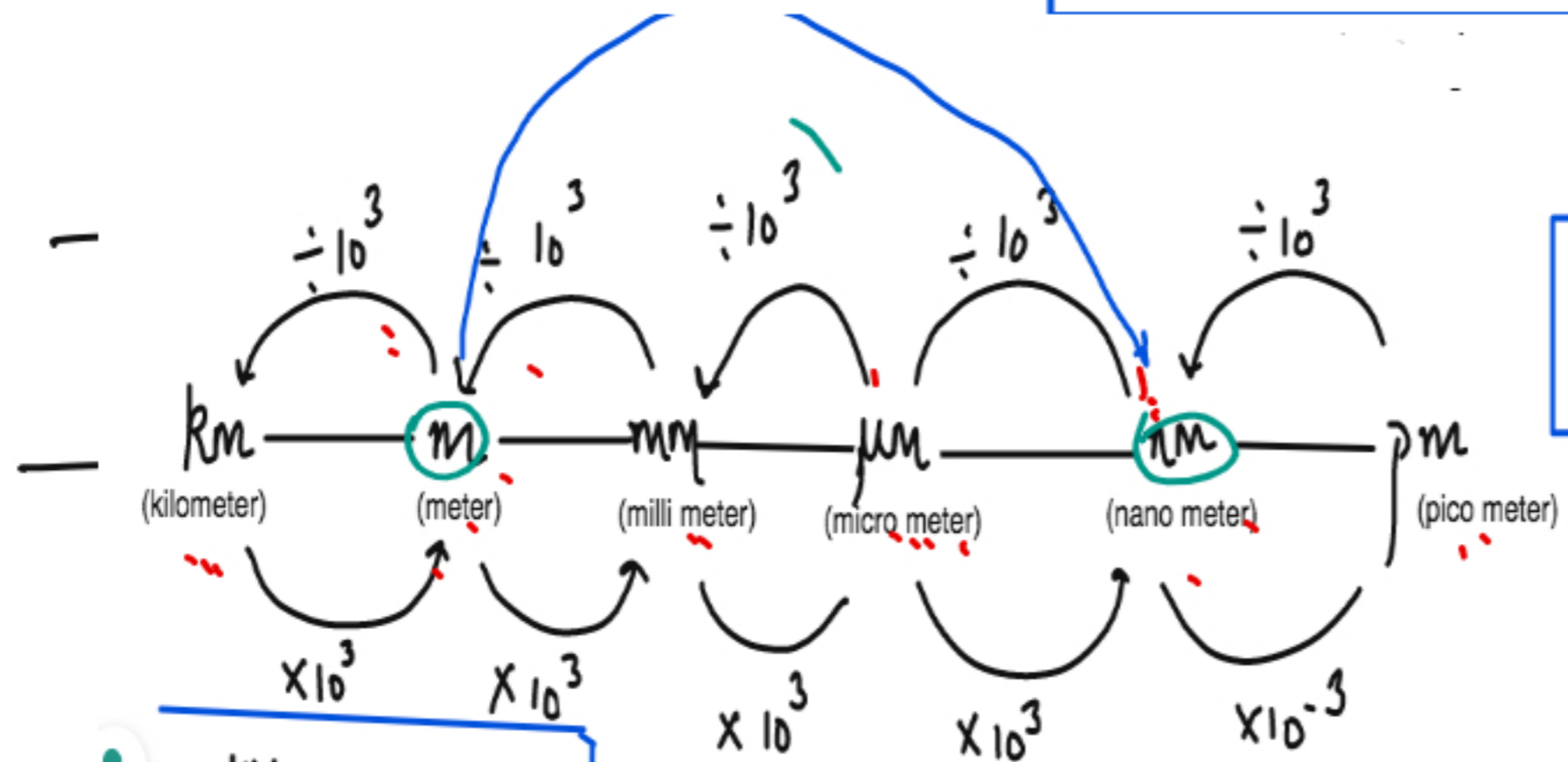
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BACTERIAL VERSUS PLANT VERSUS ANIMAL CELLS

| BASIS | BACTERIA | PLANT | ANIMAL |
|------------------|---------------------------|-----------------------------------|-----------------------------------|
| Cell Type | Prokaryotic | Eukaryotic | Eukaryotic |
| Nucleus | Absent | Present | Present |
| Cell Wall | Present but non cellulose | Present and cellulose | Absent |
| Cell Membrane | Present | Present | Present |
| Ribosomes | Present but smaller | Bigger Ribosome | Bigger Ribosome |
| DNA | Circular DNA | Linear DNA | Linear DNA |
| Genetic Material | Naked in the Cytoplasm | In the nucleus inside chromosomes | In the nucleus inside chromosomes |
| CHLOROPLAST | Absent | Present | Absent |
| VACUOLE | Small vacuoles | Big Vacuoles | Absent |

ORDER OF MAGNITUDE

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$1 \text{ nm} = 1 \times 10^{-9} \text{ m}$

Handwritten notes in red: 10 nm , 100 m , and a circled 10 .

- + KIL — Killing
- M MET — Metal
- L MIL — Milo
- M MIC — Mickey
- N NAN — Nano
- P PIC — Pictures

Convert 10 nm to :-

a) meter $\rightarrow \text{nm} \xrightarrow{\div 10^9} \text{m} = \frac{10 \text{ m}}{10^9} = 10^{-8} \text{ m}$

b) micrometer $\rightarrow \mu\text{m} \xrightarrow{\div 10^6} \text{m} = \frac{10 \text{ m}}{10^6} = 10^{-5} \text{ m}$

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Divide the relative size of the two cell to determine the order of magnitude

Make sure the units for the size is the same

SPECIALISED ANIMAL CELLS

Special cells which have some extra features that allows them to perform specific functions

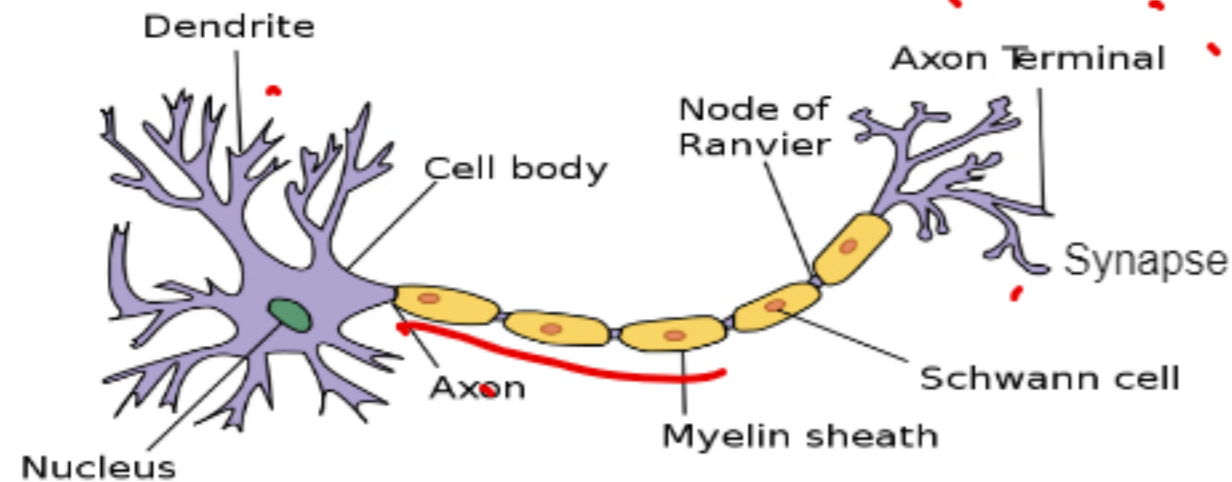
NERVE CELL

Function is to send electrical impulses round the body

They are hair like structures that receives the impulses.

Long stalk the transmits the nerve impulses

They transmit impulses from one neurone to another.

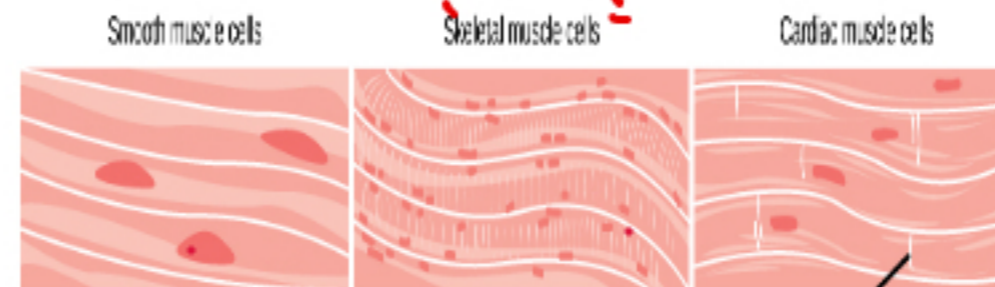


Source: wikipedia

MUSCLE CELL

Functions is to contract to bring about the movement of different parts of the body.

- They are made up of special fibres which helps them to contract and relax.
- Contain special proteins that allows them to contract and relax
- They have loads of mitochondria which provides them energy to contract
- They can store special storage carbohydrate called glycogen which acts as fuel for the muscles



Source: wikipedia

SPERM CELL

Functions is to swim to the egg and fertilize it



studentreader.com

Flagella

Helps it to swim to large distances

Provides Energy to swim

Contains genetic information

contains hydrolytic enzyme to break the egg wall and penetrate inside the egg fuse with the egg nucleus.

Source: Flickr.com

SPECIALISED PLANT CELLS !!!!

| ROOT HAIR CELLS | XYLEM CELLS | PHLOEM CELLS | PHOTOSYNTHETIC CELLS |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>IT act as exchange surface and the function is to absorb water and minerals from the soil.</p> | <p>It transport water and minerals from the roots to all parts of the plant.</p> <p>It is in the forms of vessels and the cells are dead.</p> | <p>It transports food from the leaves to all parts of the plant.</p> <p>It is in the form of tubes supported by companion cells.</p> <p>Support the phloem cells as it has mitochondria and provides energy for active movement of food.</p> | <p>The main job is to prepare food by photosynthesis.</p> <p>Helps in movement of water by osmosis</p> <p>Helps to trap the light for photosynthesis</p> |

It helps the easy movement of food.

Helps to trap the light for photosynthesis

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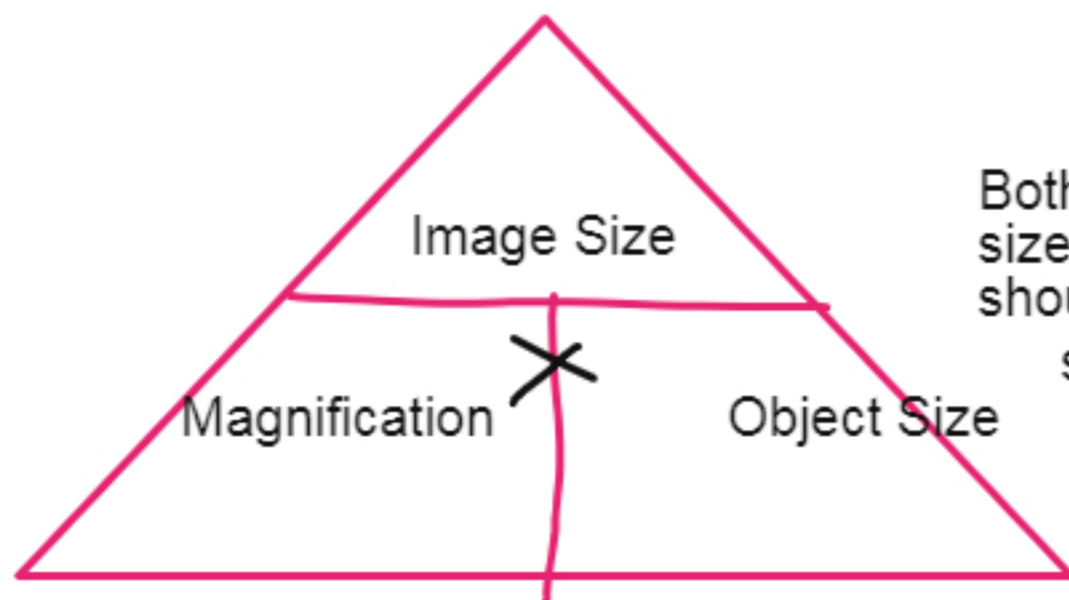
MICROSCOPES !!!

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Are the devices that use to see the cells which we cannot see by our naked eye.

MAGNIFICATION

The property of the microscope to enlarge the object.



Both image size and object size should be of the same unit.

RESOLUTION

The property of the microscope to distinguish between two closed placed objects.



Source: Vimeo.com

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LIGHT AND ELECTRON MICROSCOPES

| LIGHT MICROSCOPES | ELECTRON MICROSCOPES |
|----------------------------------------------|----------------------------------------------|
| Uses beam of light to focus on the object. | Use beam of electron to focus on the object. |
| It is easy to handle | It is not easy to handle |
| It is small and compact | It is big and non portable |
| It does not require much expertise to handle | It requires proper training to handle |
| It can view the live samples | Samples have to be dead |
| No special sample preparations are required | Special sample preparations are required |
| Lower resolving power $0.2\mu\text{m}$ | Greater resolving power 0.5nm |
| Small magnifying power $\times 1000 - 1500$ | Greater magnifying power $\times 100,000$ |
| Can form colour images | Form 2D or 3D black and white images |

MOVEMENT OF SUBSTANCE IN AND OUT OF THE CELLS !!!!

ACTIVE TRANSPORT

- Movement of particles from a region of low concentration to a region of high concentration.
- Particles move against the concentration gradient.
- It requires energy.
- Cells involved in active transport should have lots of mitochondria

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PASSIVE TRANSPORT

- Movement of particles from the region of high concentration to a low concentration.

— Particles move along the concentration gradient.

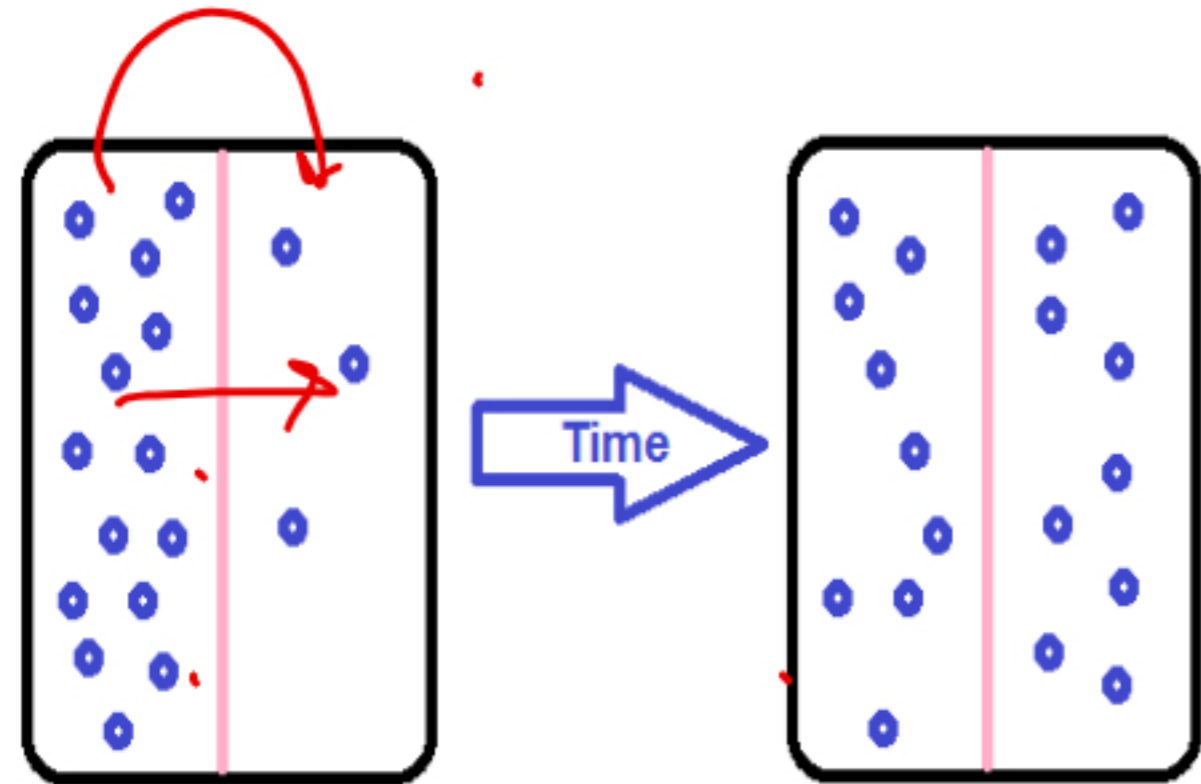
— It does not require energy

— Having numerous mitochondria is not a requirement

• DIFFUSION

• OSMOSIS

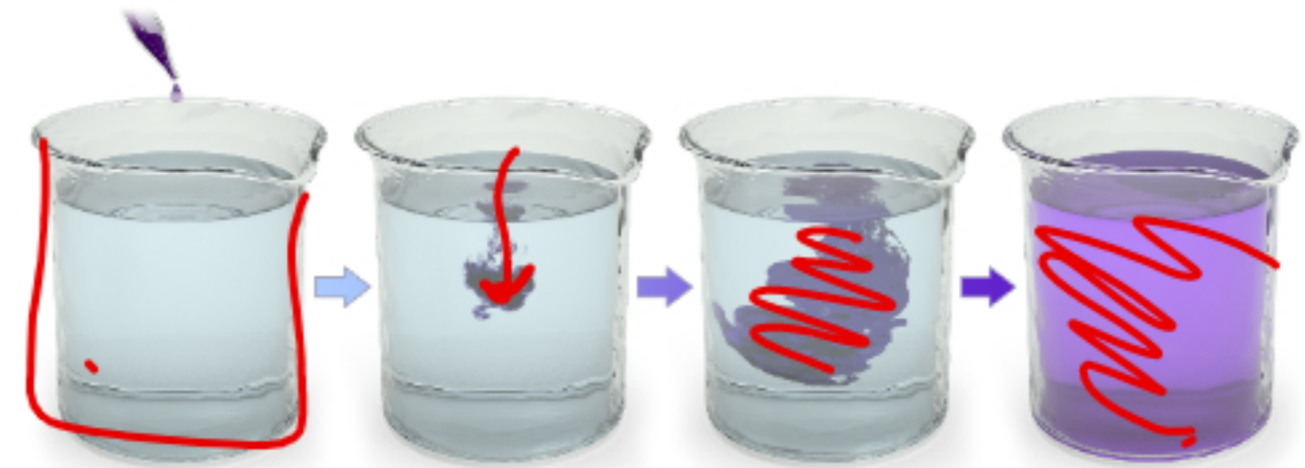
DIFFUSION



Source: Wikimedia Commons

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- ★ It is the net movement of particles from an area of higher concentration to an area of lower concentration.
- ★ It is a passive process
- ★ It happens along the concentration gradient
- ★ No use of energy.



Diffusion
Source: Wikimedia Commons



FACTORS AFFECTING DIFFUSION !!!

SURFACE AREA

Greater the surface area greater is the rate of diffusion as particle will get more room for movement.

All the exchange surfaces have greater surface area like root cells has root hairs and intestine cells has villi.

CONCENTRATION GRADIENT

Greater the difference in concentration in the two regions greater is the rate of diffusion.

All the exchange surfaces maintain steepest concentration gradient. Like root cells are closed to xylem and villi has rich blood supply.

DIFFUSION DISTANCE

Smaller the diffusion distance greater is the rate of diffusion as the particles have to travel a smaller distance.

All the exchange surfaces maintain a smaller diffusion distance by being one cell thick.

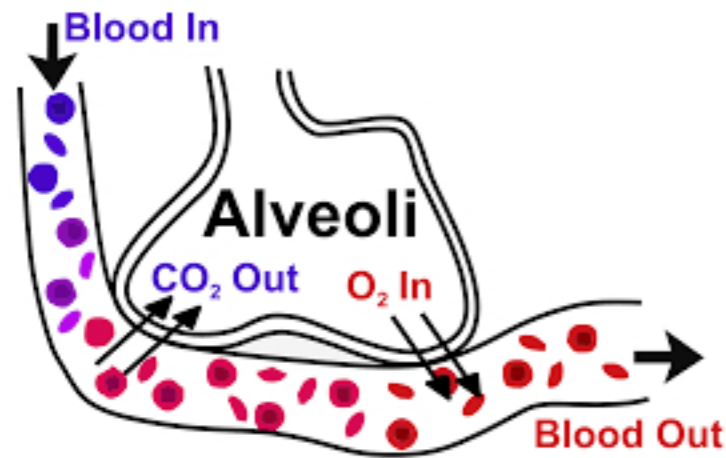
TEMPERATURE

Greater the temperature greater is the rate of diffusion as particles will get more kinetic energy for movement

Rate of diffusion = $\frac{\text{Surface Area} \times \text{Concentration gradient}}{\text{Diffusion distance}}$

DIFFUSION IN ANIMALS

In Lungs or Alveoli (diffusion of gases)

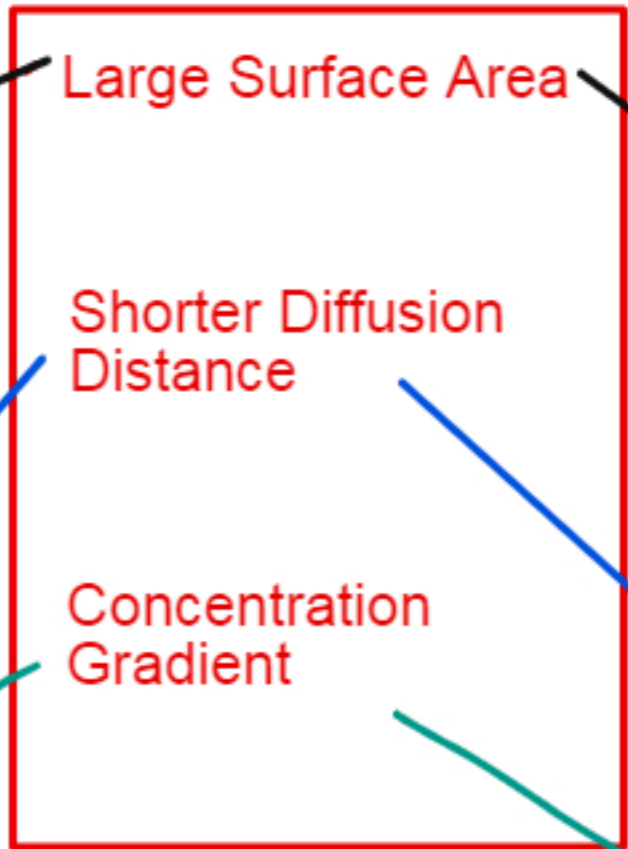


The lungs have millions of air sacs called alveoli which increases the surface area.

Alveoli are one cell thick

They have rich blood supply

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Large Surface Area

Shorter Diffusion Distance

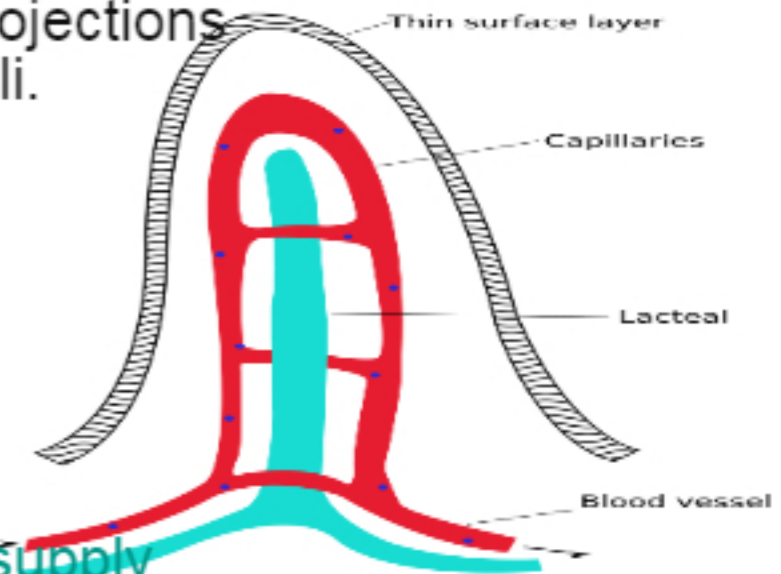
Concentration Gradient

In Small Intestine (diffusion of digested food)

The intestine wall is folded to form finger like projections called the villi.

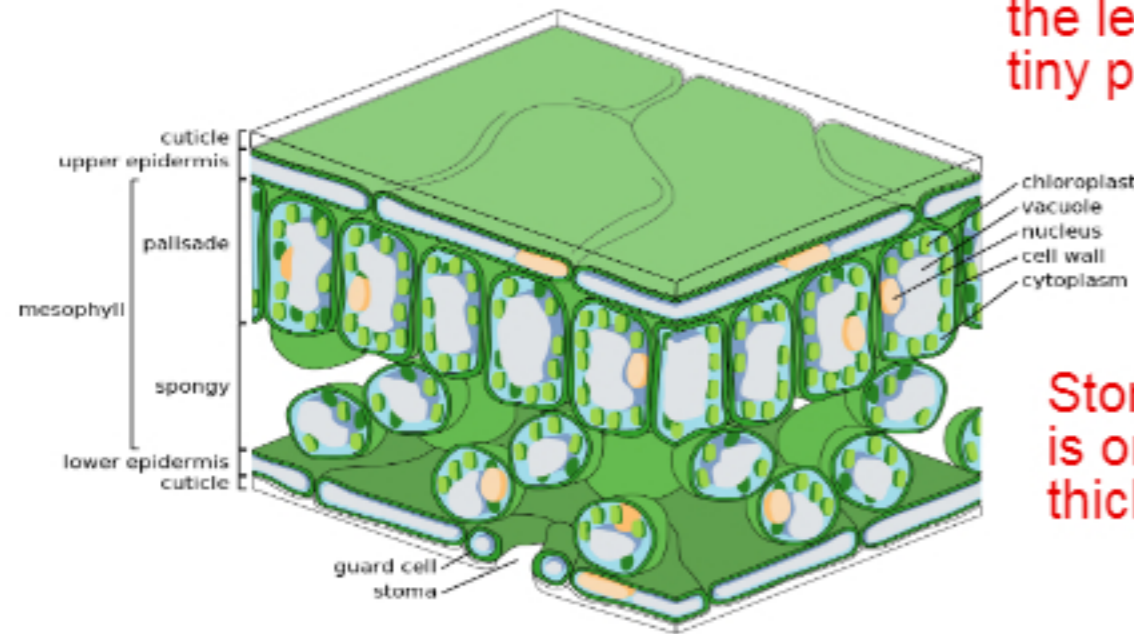
Villi are one cell thick

They have rich blood supply



DIFFUSION IN PLANTS !!!!

Diffusion of gases through the stomate



At the surface of the leaves tiny pores called stomata

Stomata is one cell thick

Photosynthetic cells are close to stomata

Greater Surface Area

Thin Diffusion Distance

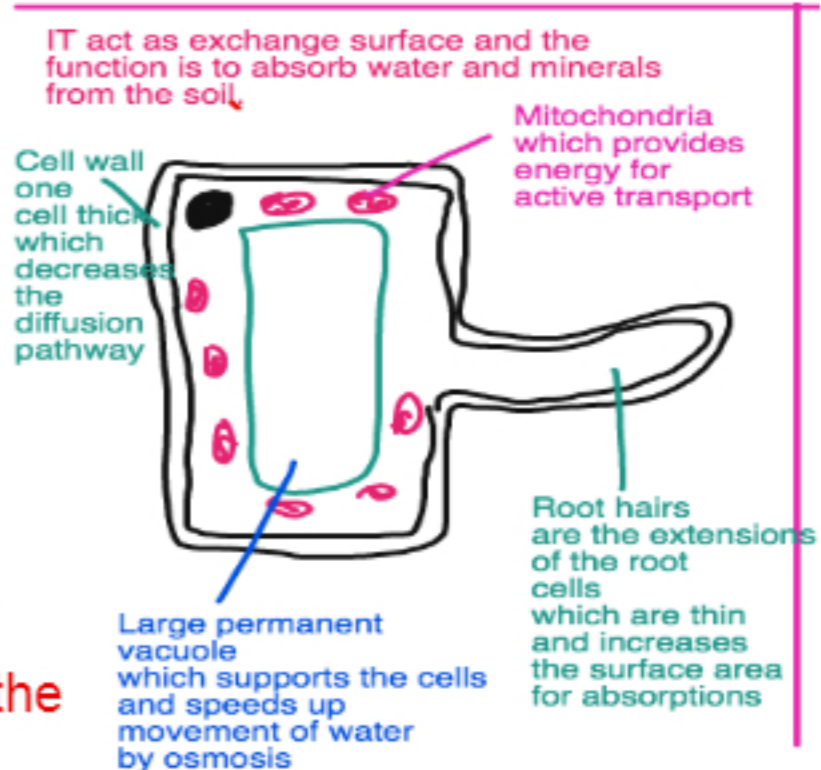
Steep Concentration Gradient

Diffusion of water and minerals through the root.

root cells project to form root hairs

Root hair cells are one cell thick

Xylem is located close to the root cells



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OSMOSIS

.....Special Case of Diffusion

Special Case:

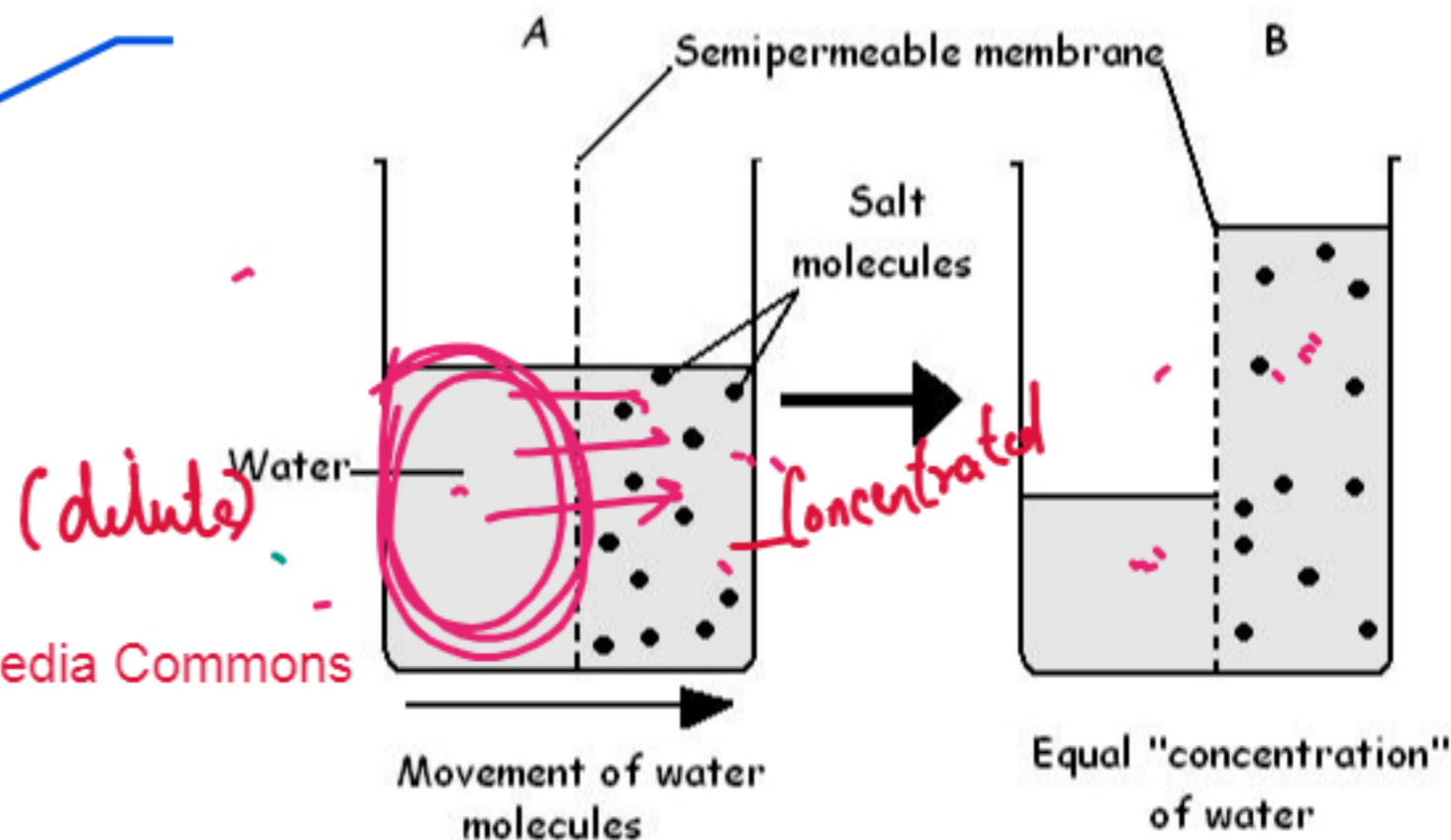
It is the diffusion of only water molecules

It required a semi permeable or partially membrane

membrane that allows only specific molecules to pass through like water.

Osmosis is the net movement of water particles from the region of high concentration of water particles to low concentration of water particles across a semi permeable membrane.

Movement of water from a dilute solution to a concentrated solution through a semi permeable membrane.



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Source: Wikimedia Commons

OSMOSIS IN PLANTS

The outer solution has a less concentration of water than inside the cell.

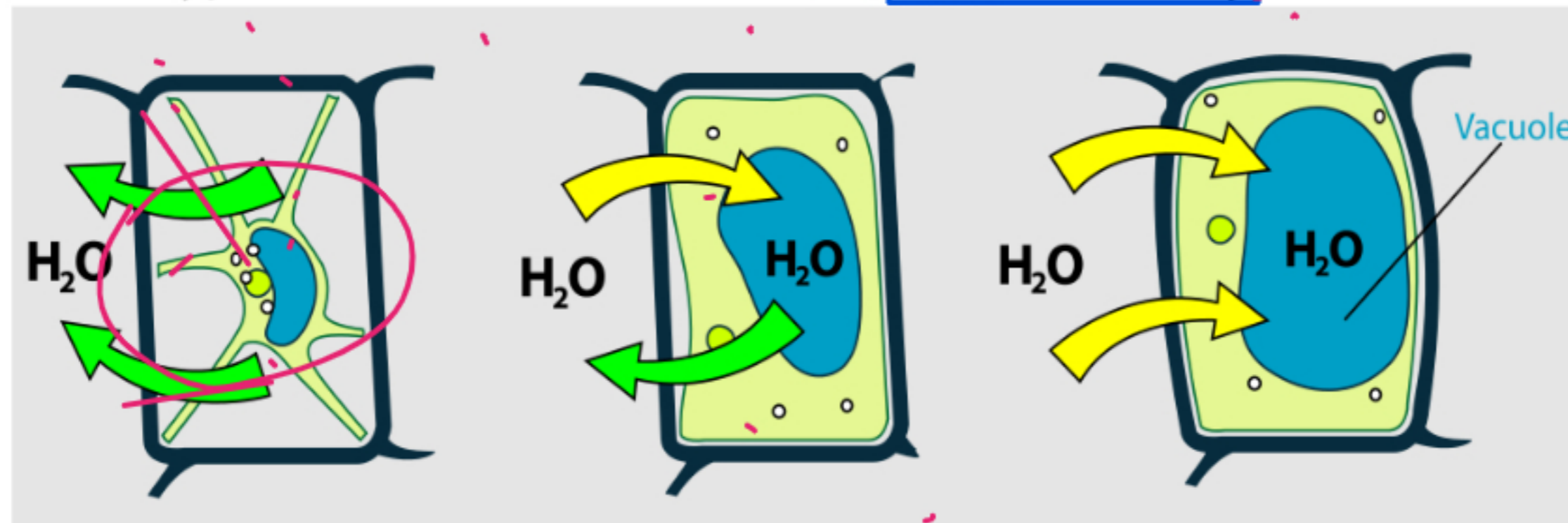
The outer solution has same concentration of water than inside the cell.

The outer solution has a greater concentration of water than inside the cell.

Hypertonic

Isotonic

Hypotonic



Plasmolyzed

Flaccid

Turgid

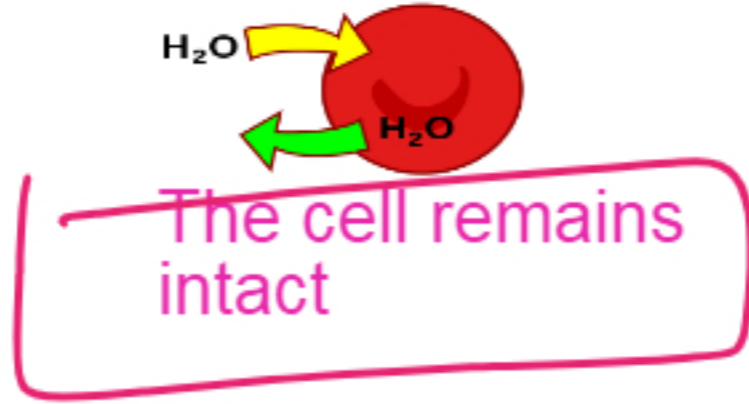
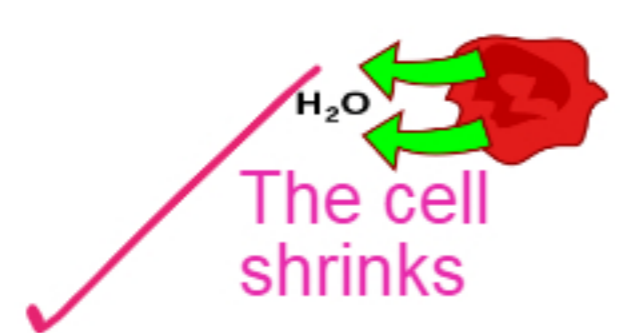
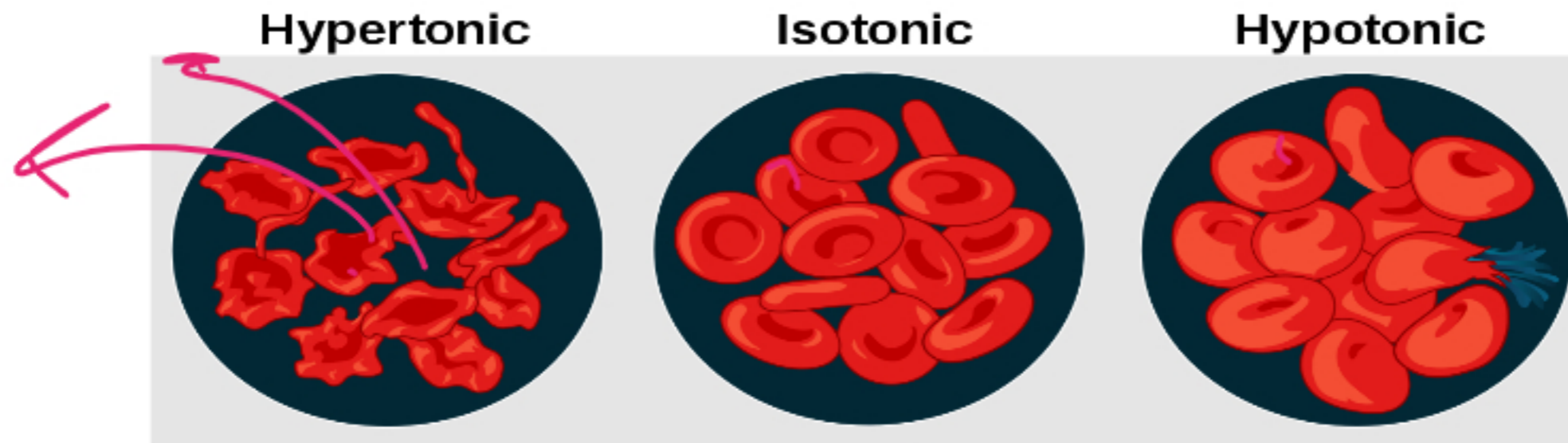
The water moves out of the cells due to osmosis due to higher concentration of water inside the cell than outside. The cell membrane recedes from the cell wall.

There will be no net water movement so no pressure on the cell. It will be flaccid.

The water moves into the cell due to osmosis due to higher concentration of water outside the cell. The water will create pressure called turgor pressure on the cell wall making cell rigid and turgid.

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OSMOSIS IN ANIMALS



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ACTIVE TRANSPORT

Movement of substances from the region of low concentration to a region of higher concentration with the use of energy.

Dependent on respiration as it requires energy. So the cells involved in active transport has lots of mitochondria.

In Plants water and minerals are absorbed by active transport to absorb maximum of water and minerals.

In animals, the digested food gets absorbed into the blood by active transport to ensure maximum absorption.

Salt glands are present in some marine organisms which removes the salt by active transport.

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CELL CYCLE

Interphase

It is the longest phase of the cell cycle

The cell grows in size and prepares all the proteins and enzymes needed for division.

Replication of DNA where DNA duplicates its content.

Mitosis

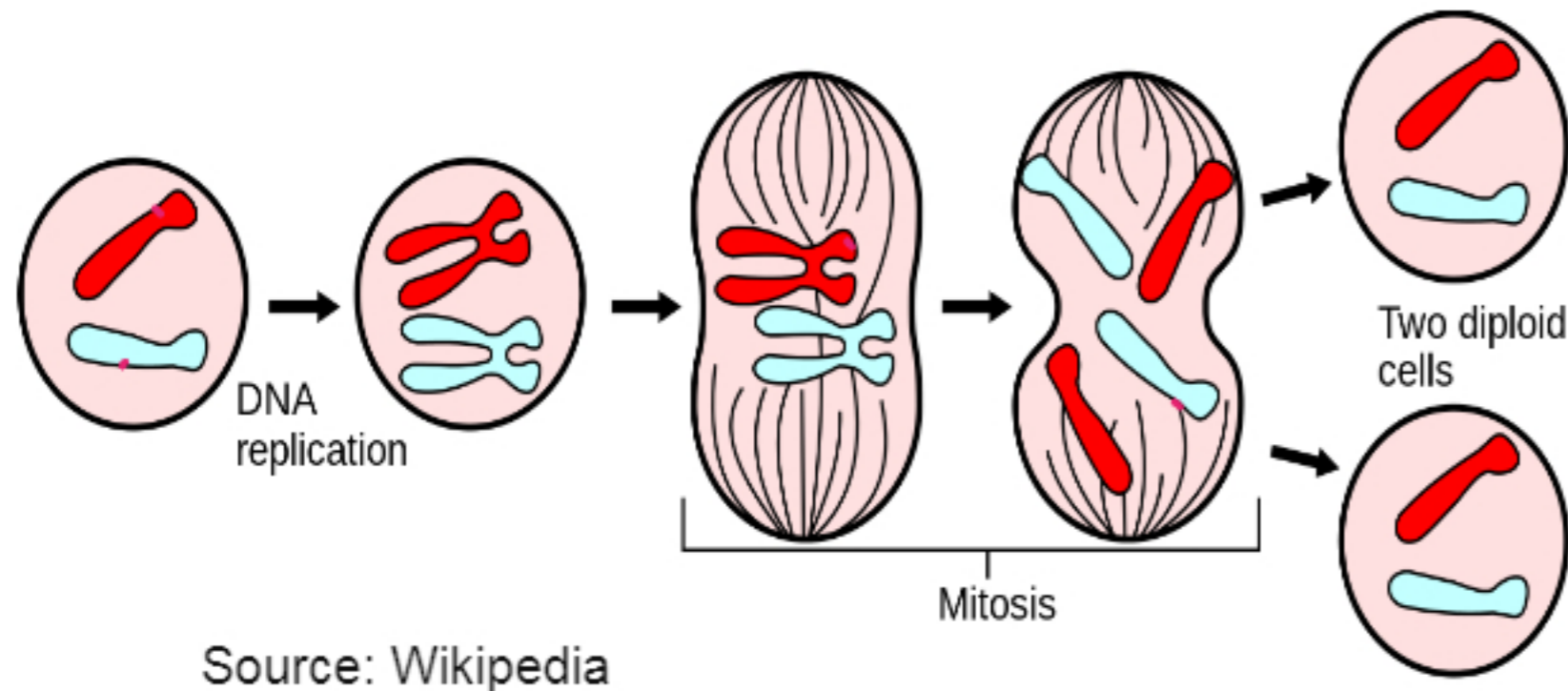
It is the division of the nucleus in which parent cell splits into two daughter nuclei containing same number of chromosomes as the parent cell.

Cytokinesis

It is the division of the cytoplasm which takes place after the division of the nucleus.

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MITOSIS



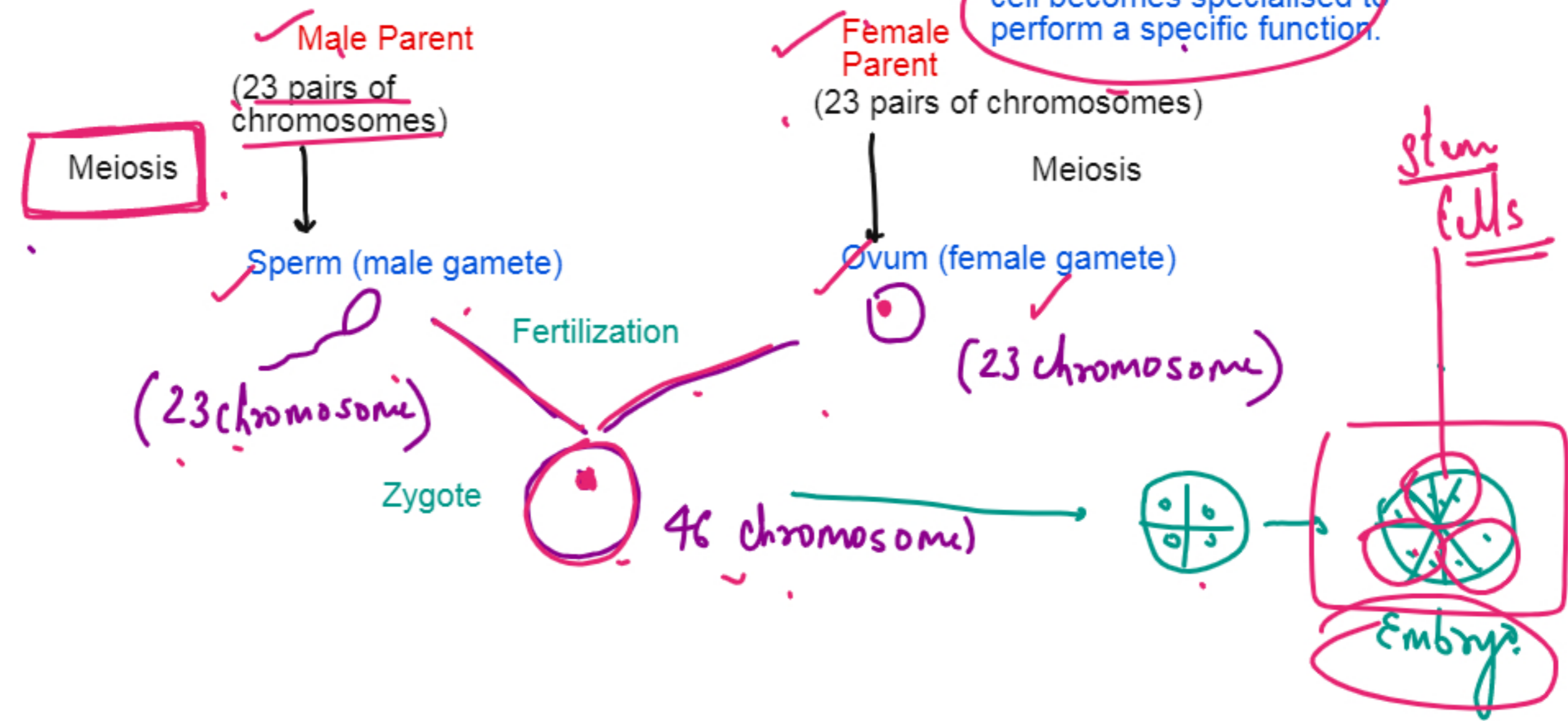
Source: Wikipedia

- ★ It is the type of cell division in which a parent nucleus divides to form two daughter nuclei with exactly the same number of chromosomes as that of the parent nucleus.
- ★ The daughter cells produced are genetically identical to the parent and are clones.
- ★ This division is important for growth, regeneration and repair.
- ★ Mitosis is also important in asexual reproduction.

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CELL DIFFERENTIATION

It is the process by which cell becomes specialised to perform a specific function.



In animals majority of the cells are differentiated at an early stage and different cells have specific functions like nerve cell, muscle cells.

Adult stem cells replaced the old and worn out cells in human but adult stem cells have limited specialization power.

Majority of the differentiation is permanent.

~~PLANT~~ DIFFERENTIATION

Animal

✓ Plants are the storehouse of stem cells

✓ Root meristems and shoot meristems are the parts of actively growing part of the cells which contains stem cells.

The plants can be cloned easily as it has many undifferentiate cells and differentiation is not permanent.

~~ANIMAL~~ DIFFERENTIATION

Plant.

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STEM CELLS !!!

Undifferentiate mass of cells that can differentiate into any cell type are known as stem cells.

Sources of Stem Cells : Embryo, left over remains of the embryo and the umbilical chord are the sources of embryonic stem cells.

Bone marrow is the source of adult stem cells.

Can solve the rejection problem if the transplanted organ is made from the person's own stem cells.

Can be possible cure of neuro-degenerative diseases.

Can be the potential cure of diabetes.

Therapeutic cloning.

Organ damage problem

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ISSUES AGAINST STEM CELLS

- ★ It can lead to cancer as the stem cells are rapidly dividing.
- ★ The stem cells can be contaminated and can cause unwanted diseases to the patient.
- ★ Research is still slow and expensive
- ★ Research happens on aborted embryos which is considered as a potential source of life and many religions have ethical concerns against it.
- ★ The knowledge of the genes switched on and off causing differentiation is still incomplete.

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KEY TERMS !!!!

Cells

Mitochondria

Nucleus

Cytoplasm

Ribosomes

Prokaryotic Cell

Eukaryotic cell

Cell Wall

Cell Membrane

Vacuole

Microscopes

Resolution

Magnification

TEST YOURSELF !!!

Xylem

Phloem

Diffusion

Osmosis

Plasmolysis

Turgid

Flaccid

Mitosis

Differentiation

Stem Cells

Therapeutic cloning

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Cells — Basic structural and functional unit of the living organism.

Mitochondria — The cell organelle which is the site of aerobic respiration.

Nucleus — The cell organelle which controls the activities of the cell.

Cytoplasm — The jelly like fluid which fills the cell and contains enzymes for chemical reactions.

Ribosomes — The cell organelle which is the site for protein synthesis

Prokaryotic Cell — The primitive cell without nucleus or membrane bound organelles.

Eukaryotic cell — The advanced cell type with nucleus and membrane bound organelles.

Cell Wall — The outer layer of the plant cell which provide shape and support

Cell Membrane — The layer that controls what goes in and out of the cell.

Vacuole — Organelle present in plant cell which has cell sap and make the cell turgid.

Microscopes — Devices that is used to see the object which are not visible by a naked eye.

Resolution — Ability to distinguish between closely placed objects.

Magnification — Ability to enlarge an object.

Xylem — Transport tissue in plants that transports water and minerals.

Phloem — Transport tissue in plants that transports food.

Diffusion — Movement of substance from a higher concentration to a lower concentration.

Osmosis — Movement of water from high concentration of water to low concentration of water across semi permeable membrane.

Plasmolysis — Shrinking of plant cell when placed in hypertonic solution.

Turgid — Fully swollen cell which has gained water by osmosis.

Flaccid — soft cell due to no net movement of water.

Mitosis — Cell division that produces identical daughter cells.

Differentiation — Cell specialisation

Stem Cells — Undifferentiated mass of cells that can specialise to any cell type.

Therapeutic cloning

Homeostasis and Response

Inheritance, Variation and Evolution

Ecology

Key Ideas

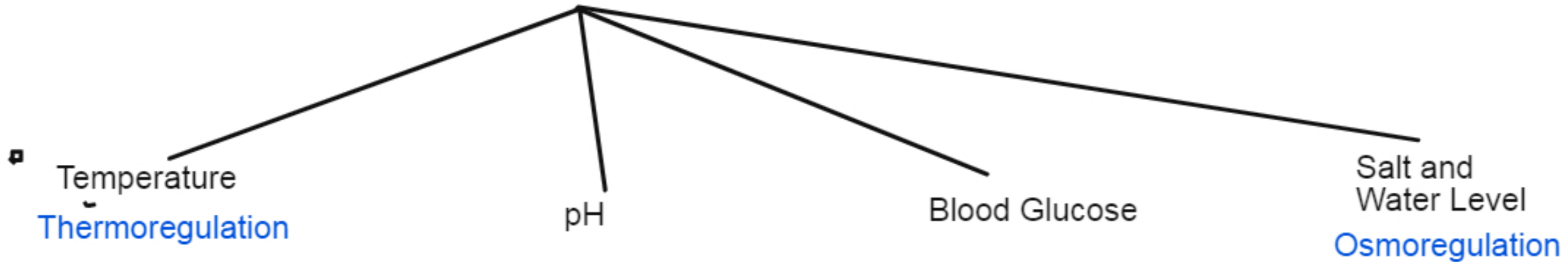
Structures and Functions in Living Organisms

Homeostasis
Human Nervous System
The Brain
The Eye
Thermoregulation
Endocrine System
Control of Blood Glucose
Osmoregulation
Human Reproduction
Contraception
Negative Feedback
Plant Hormones

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HOMEOSTASIS

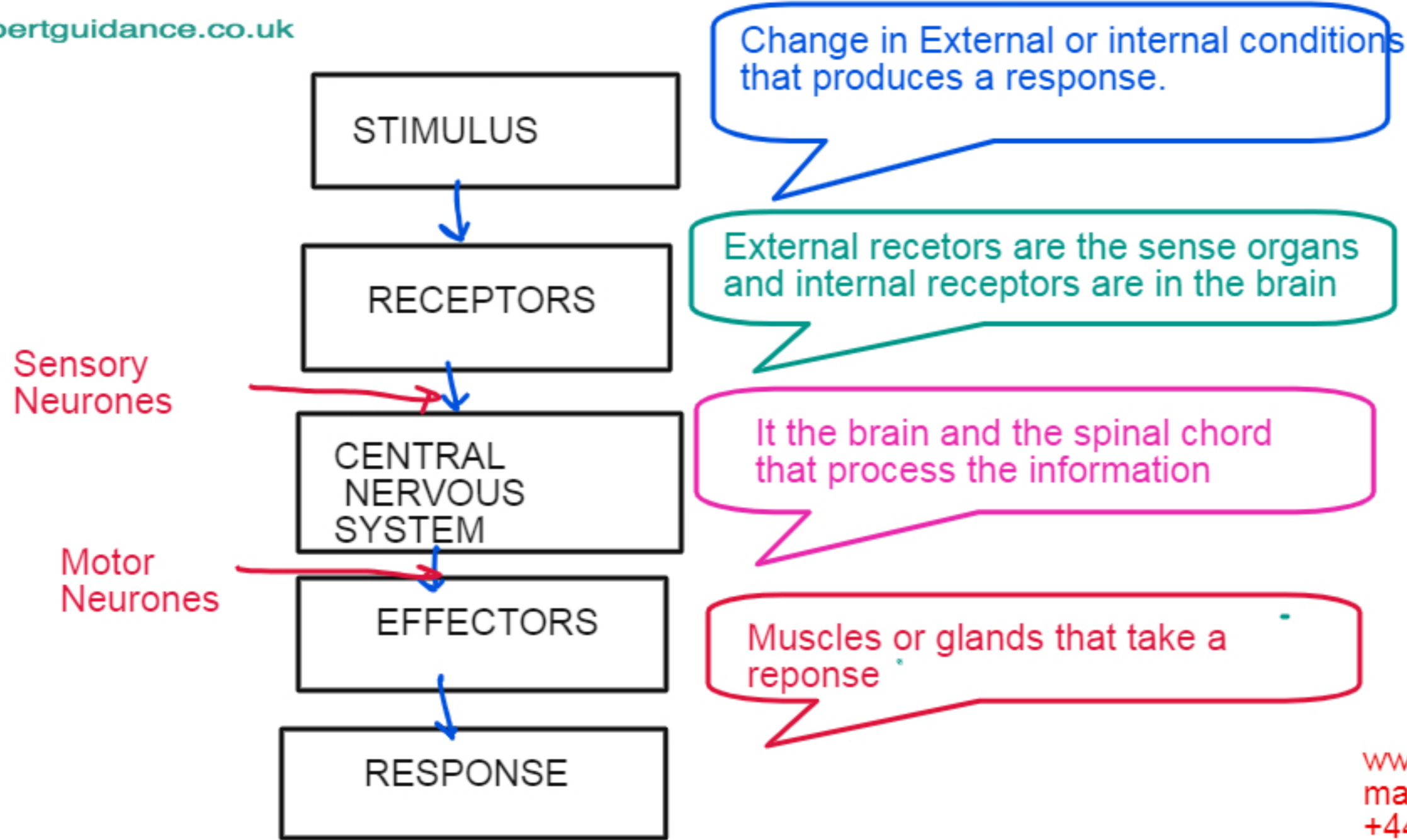
The process of maintaining the constant internal environment.



Nervous System and the Hormonal System

Homeostasis is important for the enzymes as the enzymes control all the reactions of the body and they need optimum condition to work.

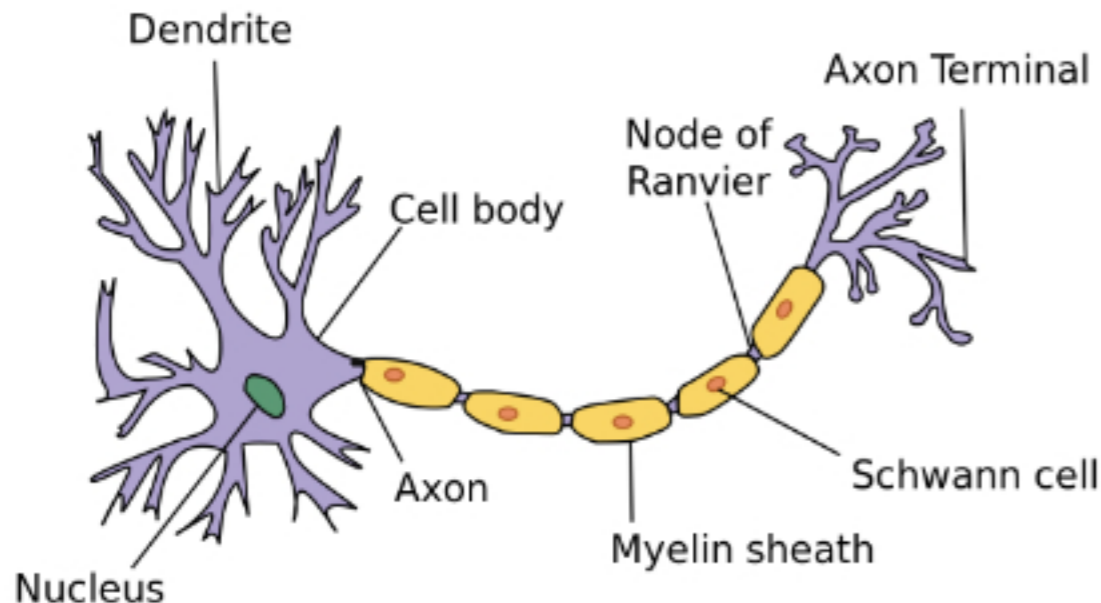
NERVOUS SYSTEM





Motor Neurone

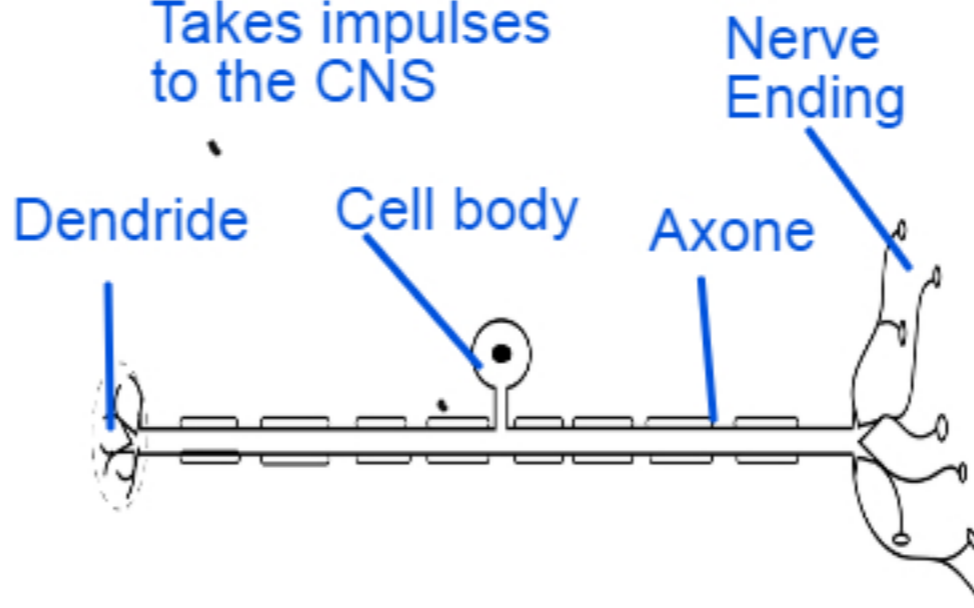
Takes impulses away from CNS



Motor neurones send the message from the central nervous system to the effectors.

Sensory Neurone

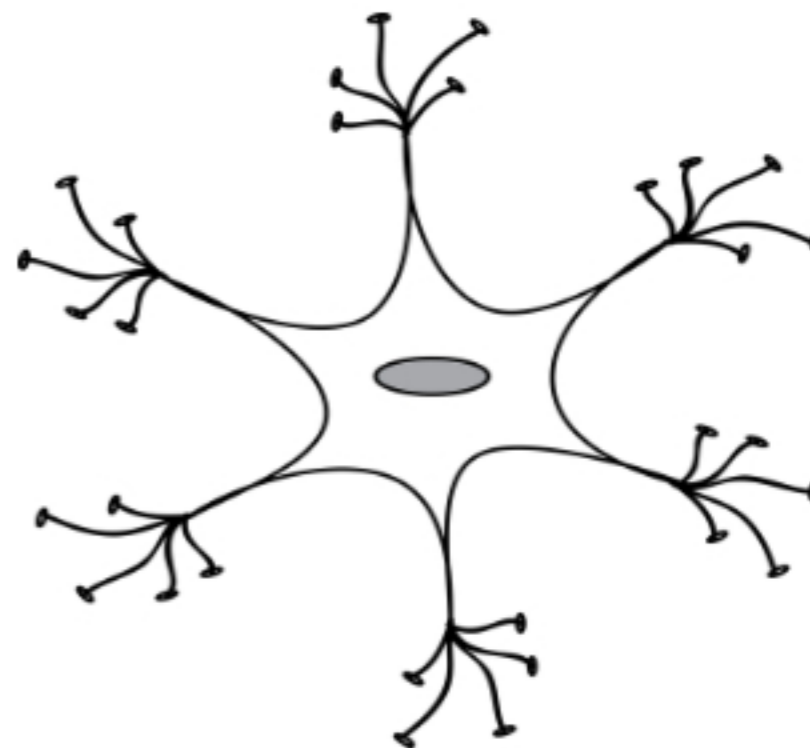
Takes impulses to the CNS



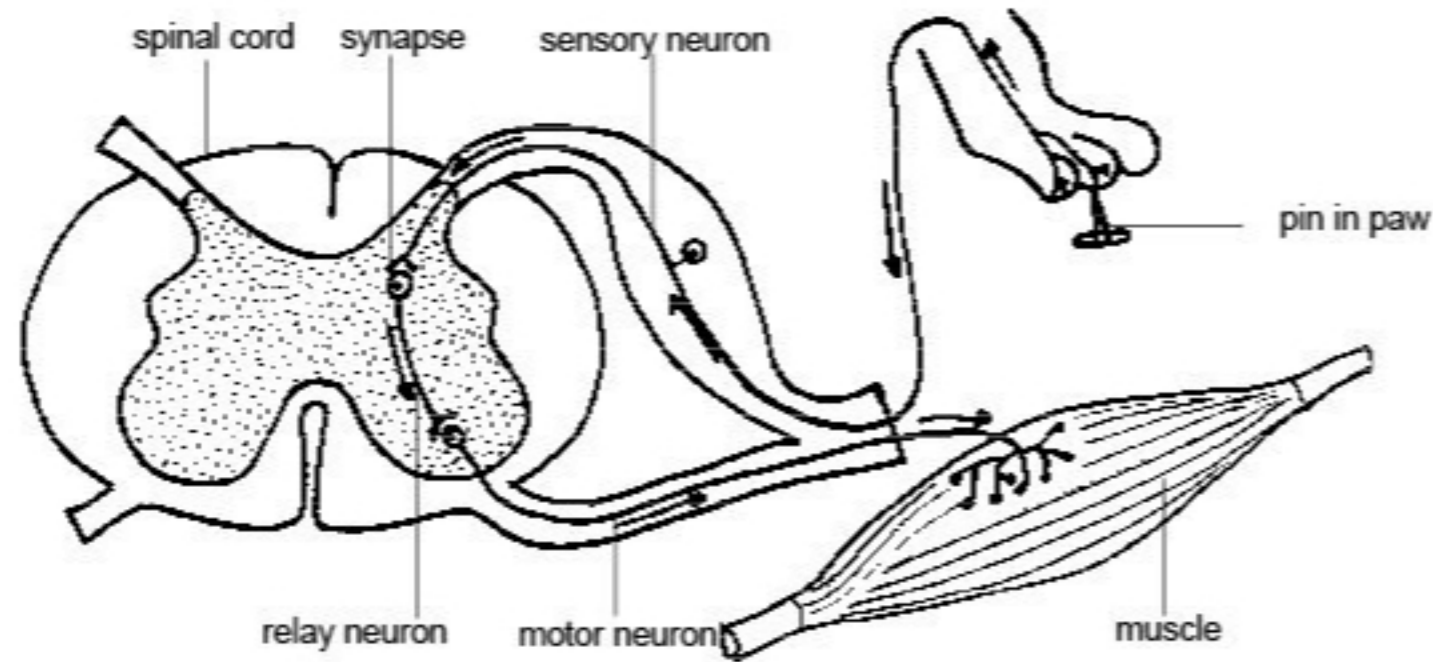
Sensory neurones send the message from the receptors to the central nervous system.

Relay Neurone

Found in CNS



Connect Sensory and Motor Neurones



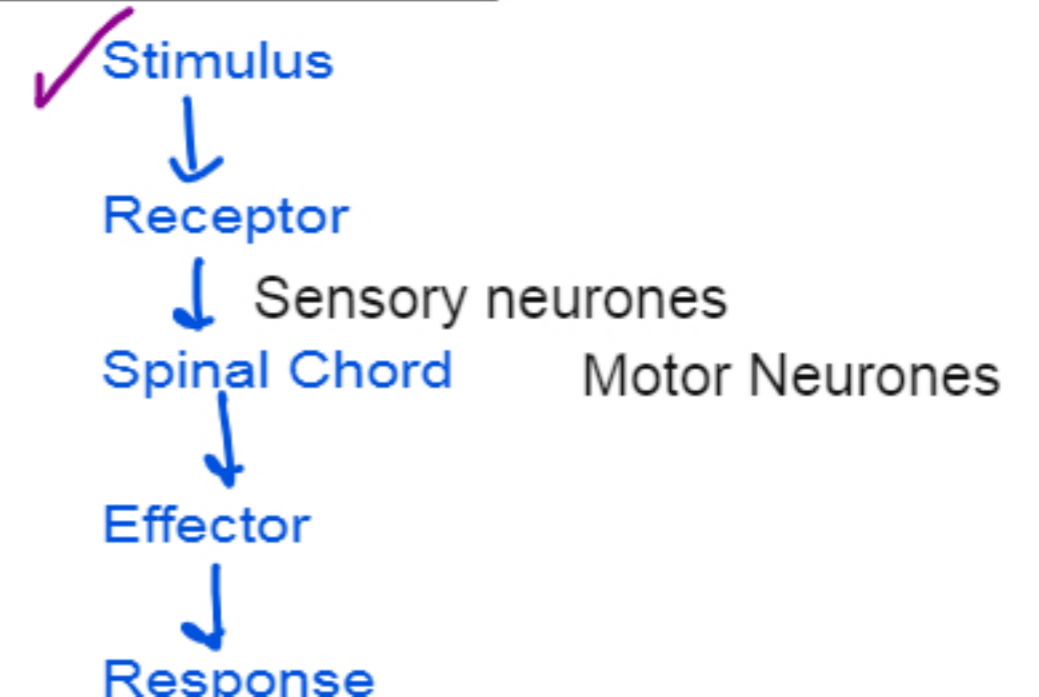
It is the automatic response of the body to a stimulus.

In reflex action the message from the sensory neurones is passed to the spinal chord instad of brain.

Spinal Chord sends the message to the effectors and produce a response.

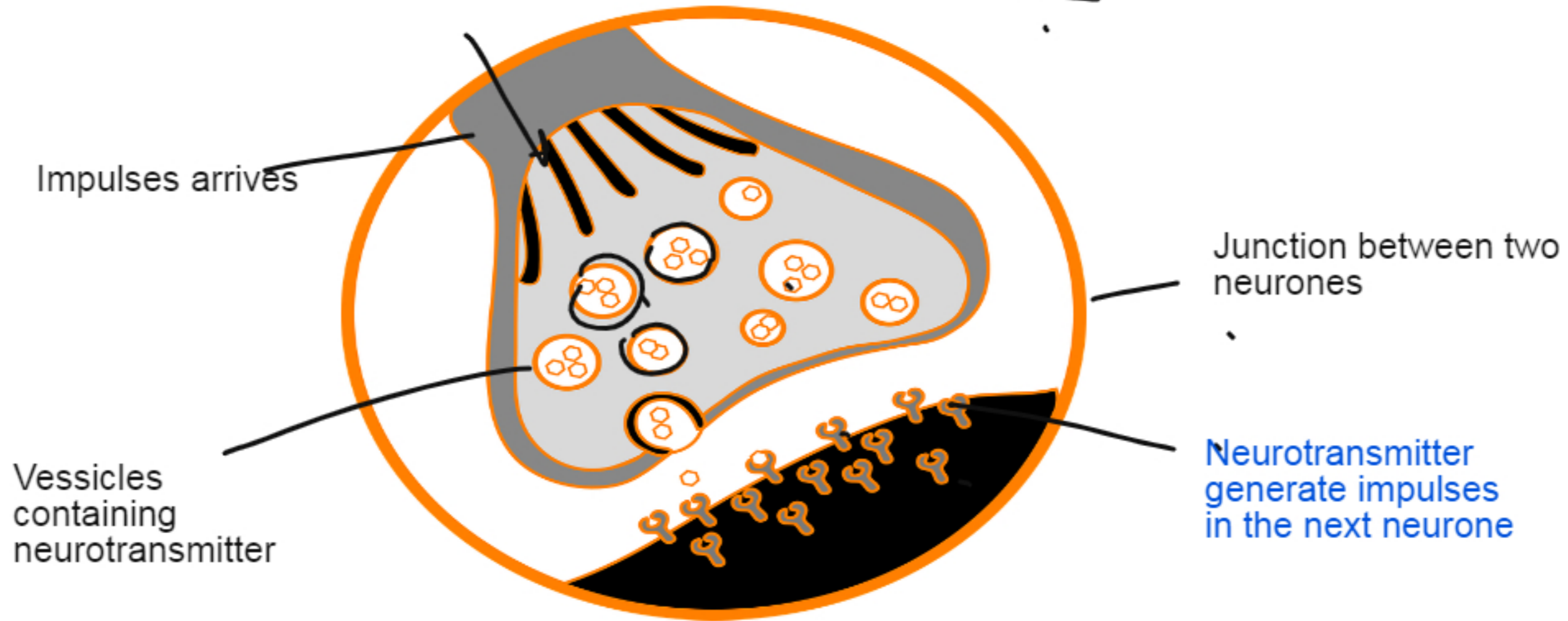
Example: Knee Jerk Reflexes,
Touching hot object,
Sudden closure of light with
bright light

It is rapid
It is quick
Automatic, Instantaneous
without consious thoughts

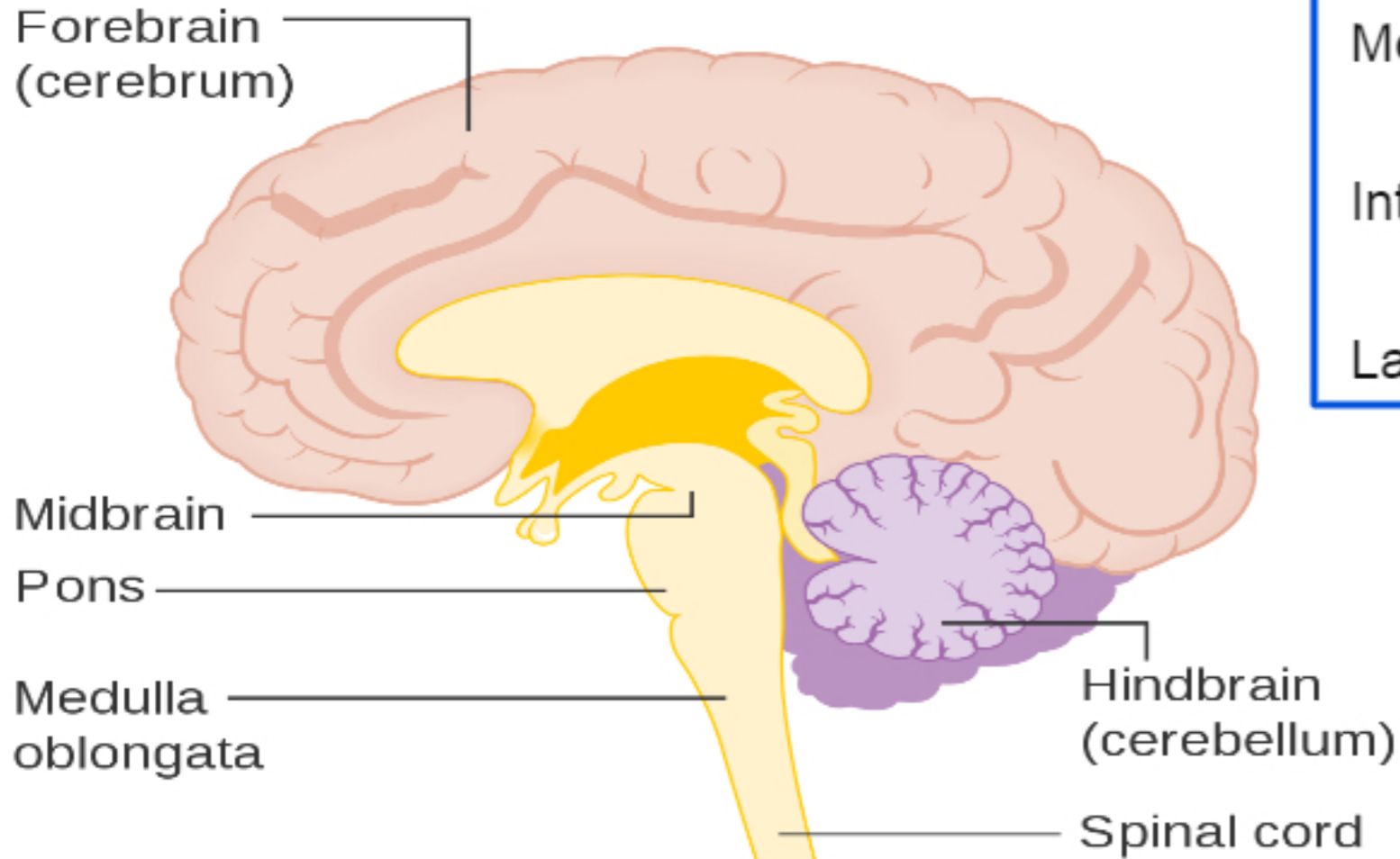


SYNAPSE

Message is transmitted by chemicals



Source: pixabay



Source: Wikimedia Commons

CEREBRUM

- Consciousness
- Memory
- Intelligence
- Language

CEREBELLUM

- Muscle Coordination
- Balance

MEDULLA OBLONGATA

- Unconscious Activities
like Heart Rate, Breathing.
- Gut Movement



Magnetic Resonance Imaging (MRI) helps to take the images of different parts of the brain and relating it with loss of functions of the individual

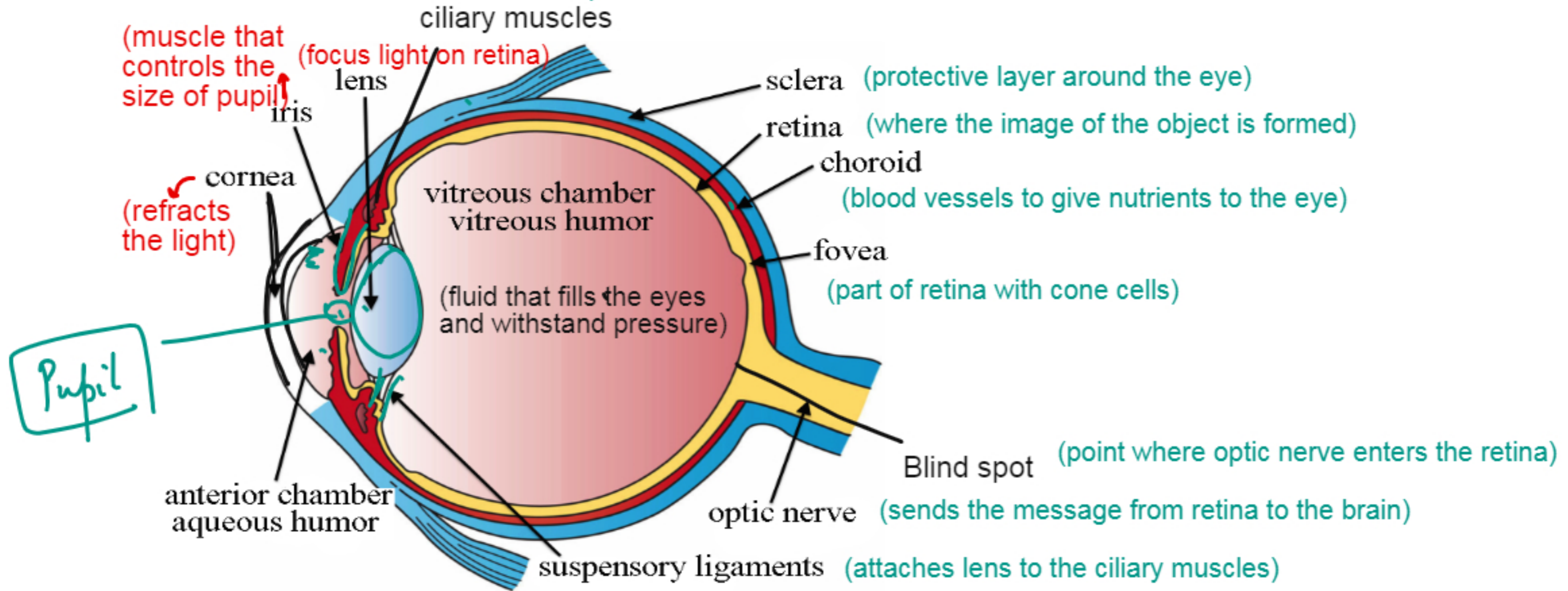
Problems

Brain is complex
Skull protects the brain
Thousands and neurones and neurotransmitter are involved
The functions of different parts is still not understood.
Drugs do not reach the brain



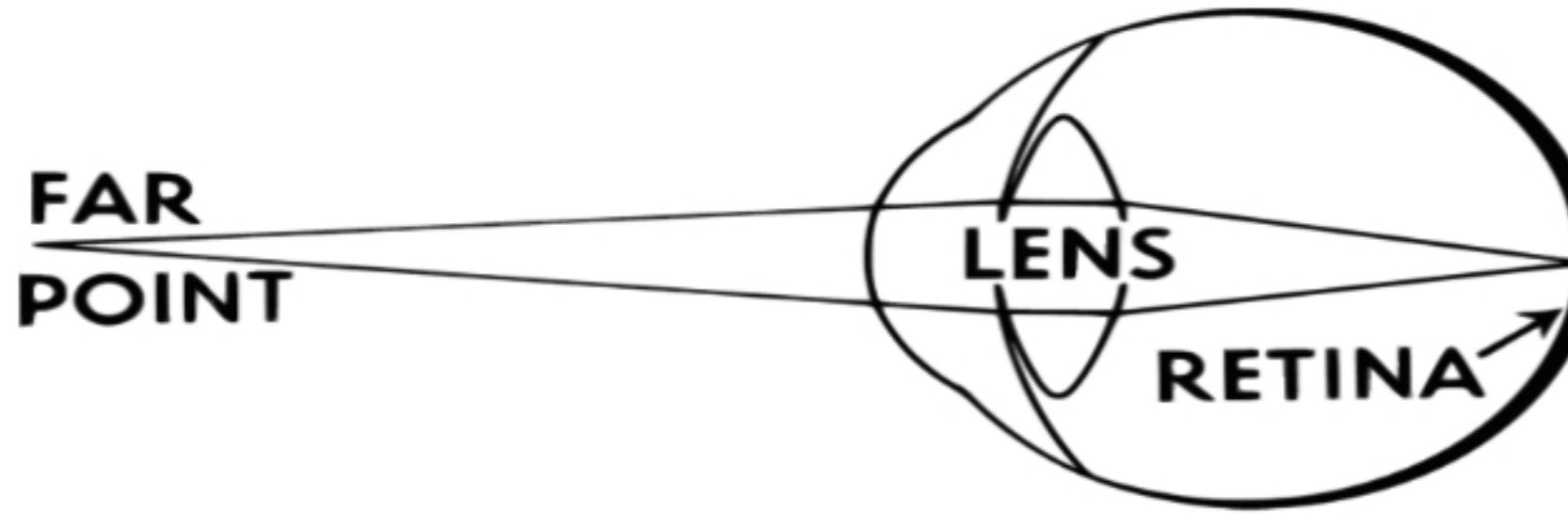
EYE

contracts and relaxes to change the shape of the lens.

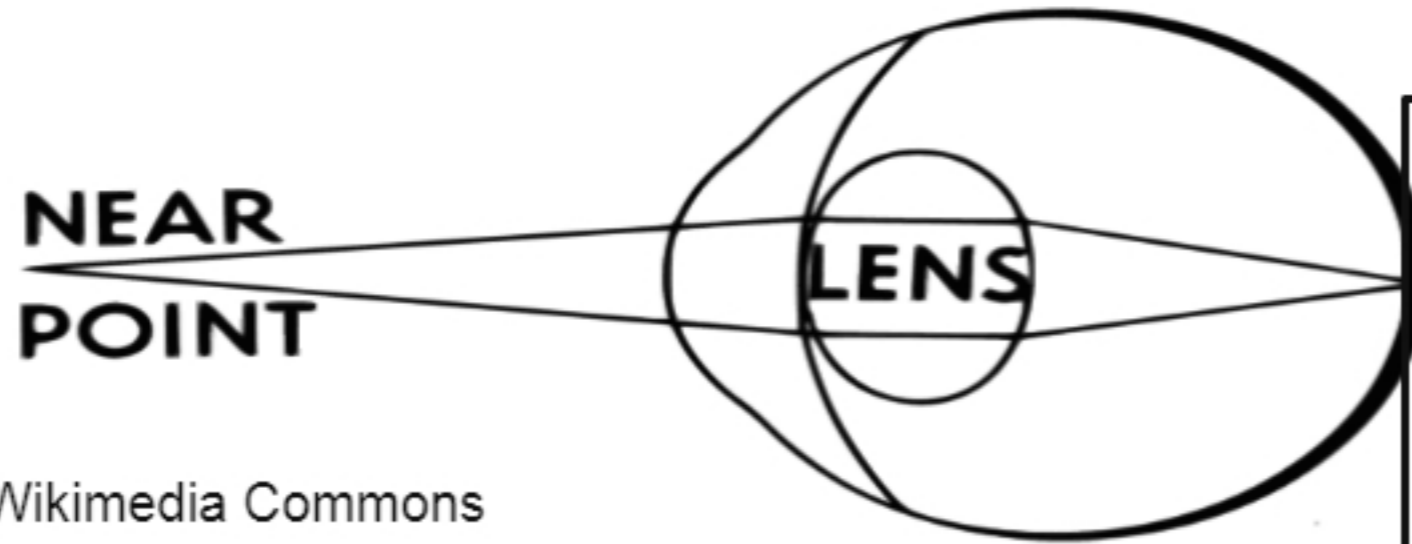


Source: Wikimedia Commons

ACCOMMODATION



For distant vision, ciliary muscle relax making the suspensory ligaments tensed which inturn make the lens thin so that the image is focussed on the retina.



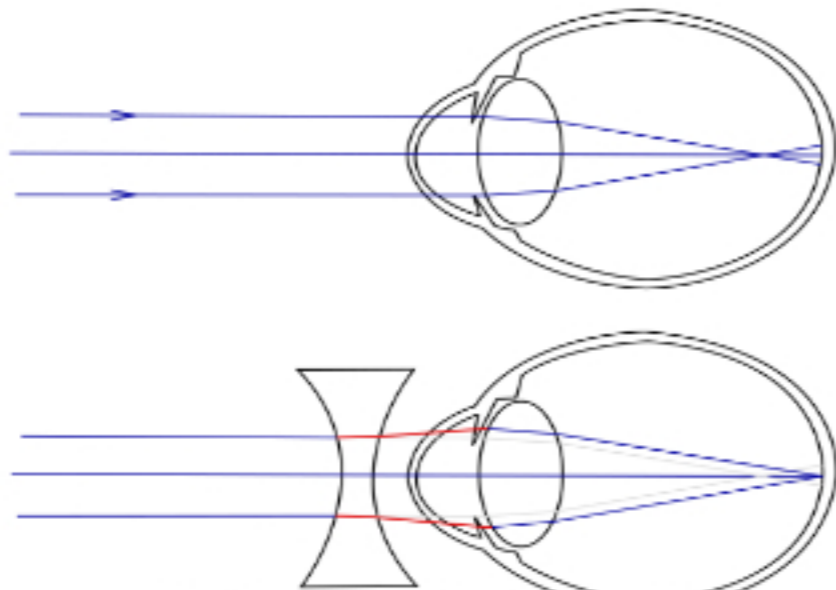
For near vision, ciliary muscle contract

Source: Wikimedia Commons

DEFECTS OF VISION

MYOPIA

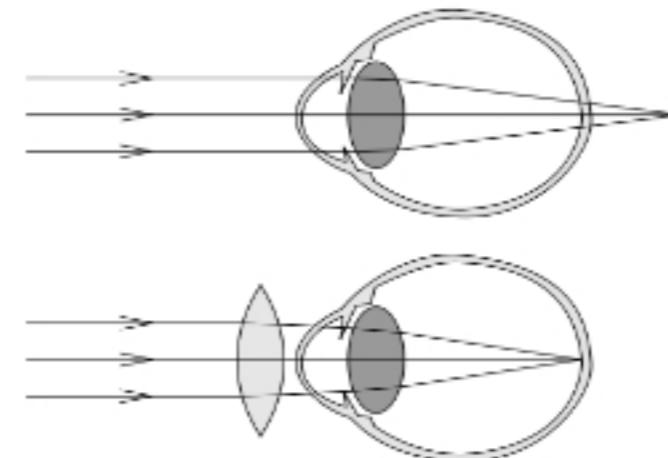
- Short sightedness
- The image falls in front of the retina of the eye.
- Eye ball gets elongated
- corrected by concave lens



Source: Wikimedia Commons

HYPEROPIA

- Long sightedness
- The image falls behind the retina of the eye.
- Eye balls gets shortened
- corrected by convex lens



Source: Wikimedia Commons

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Contact Lenses

- Lenses are placed on the surface of the eye.
- Includes soft, silk and disposable lenses
- Can be used by any person at any age

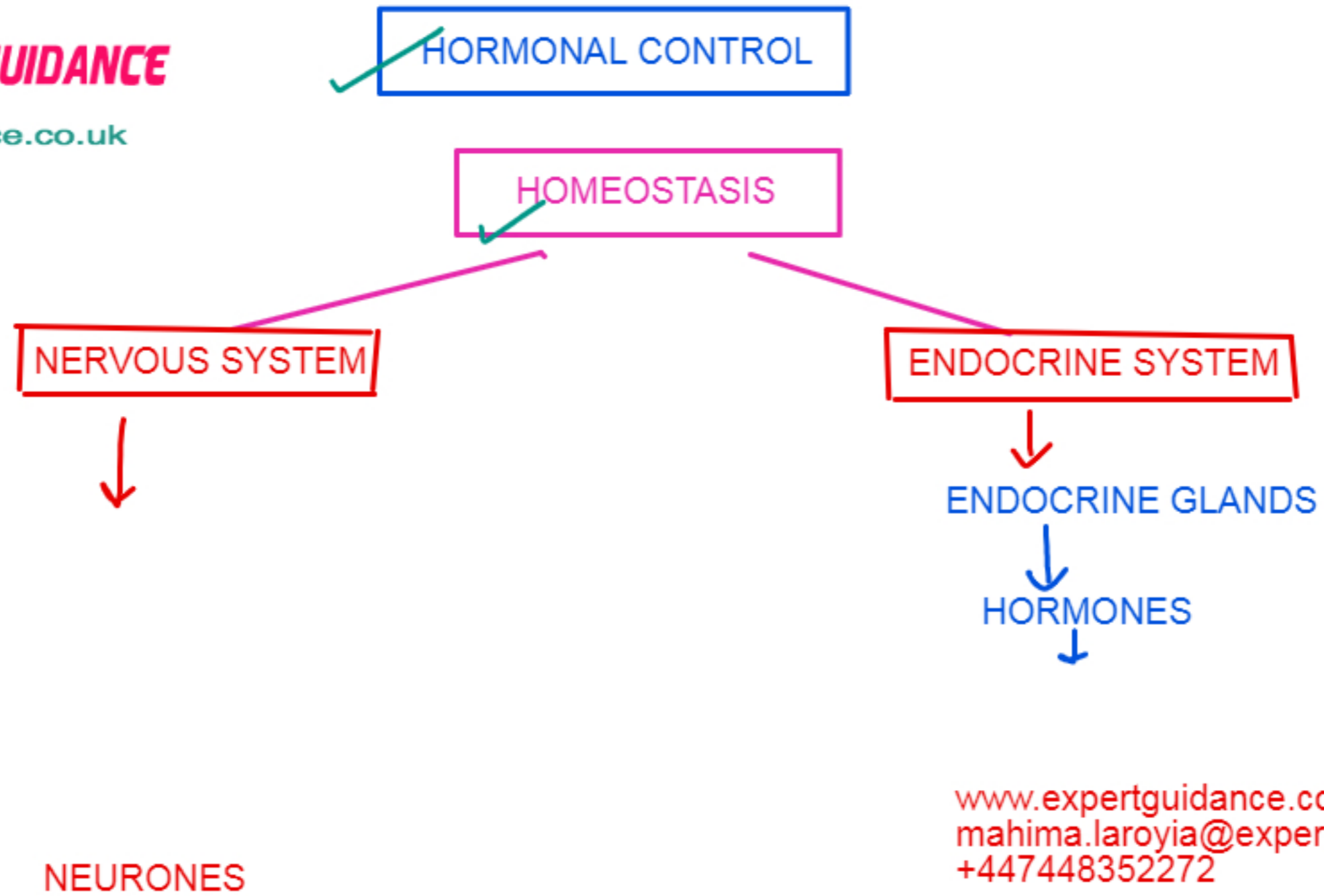
Laser Surgery

- Laser is used to change the thickness or the curve of the cornea so that defects of vision can be corrected.
- Can be done on adults after the growing age.

Replacement Lens

- It involves either replacing the faulty lens or inserting the correct one with the faulty one.
- Include damage risk to the eye.

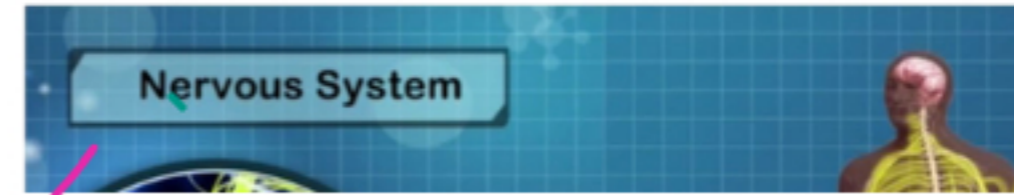
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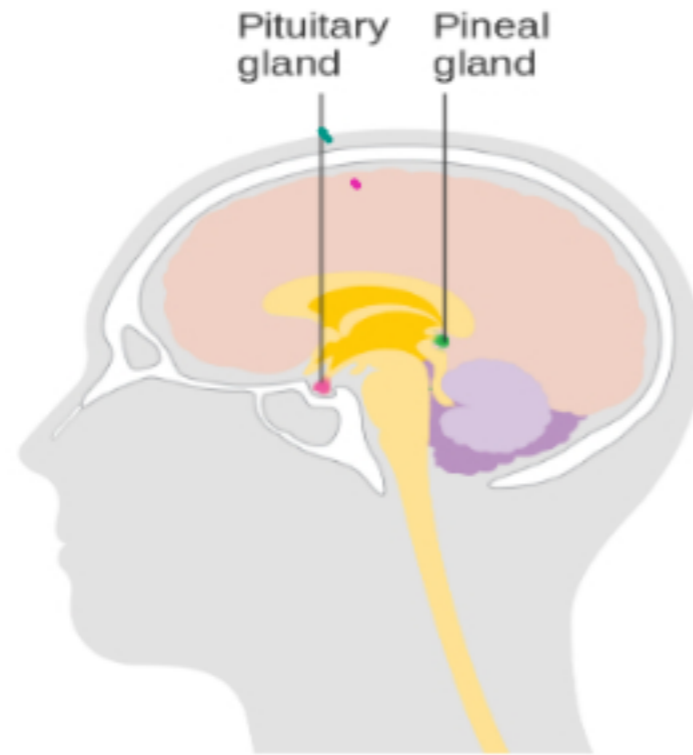
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- They are chemical messenger secreted by the endocrine glands
- they are secreted in the blood and travel to the target organ
- Target organ has receptors and hormones bind to the receptor and triggers a response
- It produces a slower but long term response



- Is the system of neurones which send electrical impulses to produce a response
- The message is transmitted via electrical impulses
- The response produced is localised and impulses do not travel large distances
- It produces quick but short term response



Source: Wikimedia

Master Gland

It controls other glands of the body

→ Follicle Stimulating Hormone

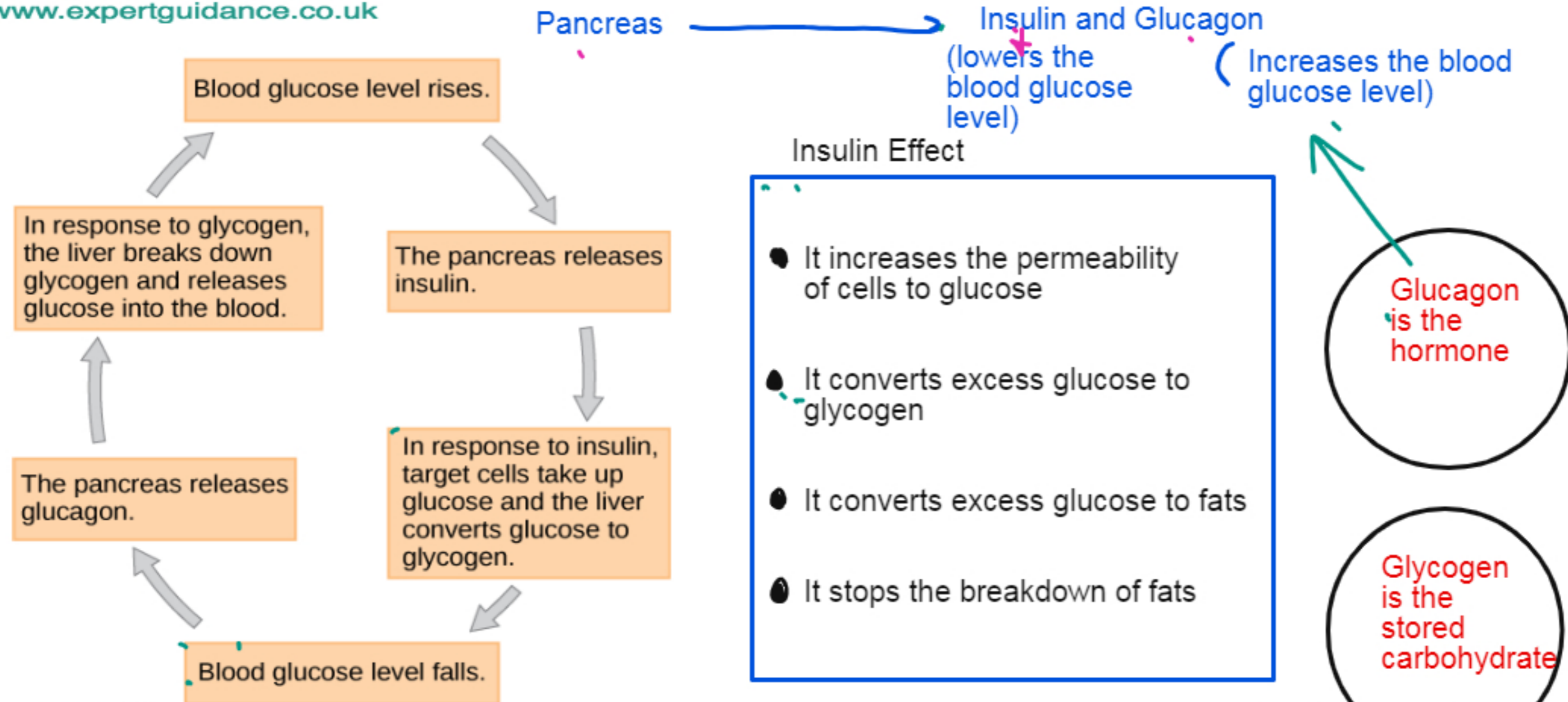
→ Antidiuretic Hormone

→ Thyroid Stimulating Hormones



| GLAND | HORMONE | TARGET ORGAN | EFFECT |
|---------------|------------------------------------|----------------------------|------------------------------------------------------------------------------------------------|
| Pituitary | Follicle stimulating hormone (FSH) | Ovaries | make the female sex hormones oestrogen |
| | Thyroid stimulating hormone (TSH) | Thyroid Gland | stimulate the gland to release thyroxine which controls metabolism |
| | Anti-diuretic hormone (ADH) | Kidneys | controls the water level by causing reabsorption of water |
| Thyroid Gland | Thyroxine | Liver and Kidneys | Controls the metabolism |
| Adrenal Gland | Adrenaline | Liver and Heart | Prepares for fight and flight |
| Testes | Testosterone | Male reproductive organs | Developes secondary sexual characteristics |
| Pancreas | Insulin | Liver | Decreases blood glucose levels |
| | Glucagon | Liver | Increases blood glucose levels |
| Ovaries | Oestrogen | Female reproductive organs | Controls the development of egg, menstrual cycle and develop secondary sexual characteristics. |
| | Progesterones | | |

CONTROL OF BLOOD GLUCOSE



Source: Wikimedia Commons

DIABETES

TYPE 1

TYPE 2

| Insulin dependent | Insuline independent |
|---------------------------------|----------------------------------------------------|
| Body does not produce insulin | Body is resistance to insulin |
| Caused by damage to pancreas | Caused by poor lifestyle and diet |
| Treated with insulin injections | Treated with lifestyle changes |
| Most common in young age | Common in obese people |
| It can be genetic. | It is mostly environmental. |
| Drugs might not be required | Drugs are given to make body to respond to insulin |

TYPE 1

- Insulin injections directly into the blood stream. Less taken orally as being a protein hormone it can get digested by stomach.
- The insulin converts excess glucose into glycogen and control the blood glucose level.
- Less intake of carbohydrates.
- Pancreatic Transplant
- Pancreatic Cell Transplant
- Using stem cells to regenerate pancreatic cells

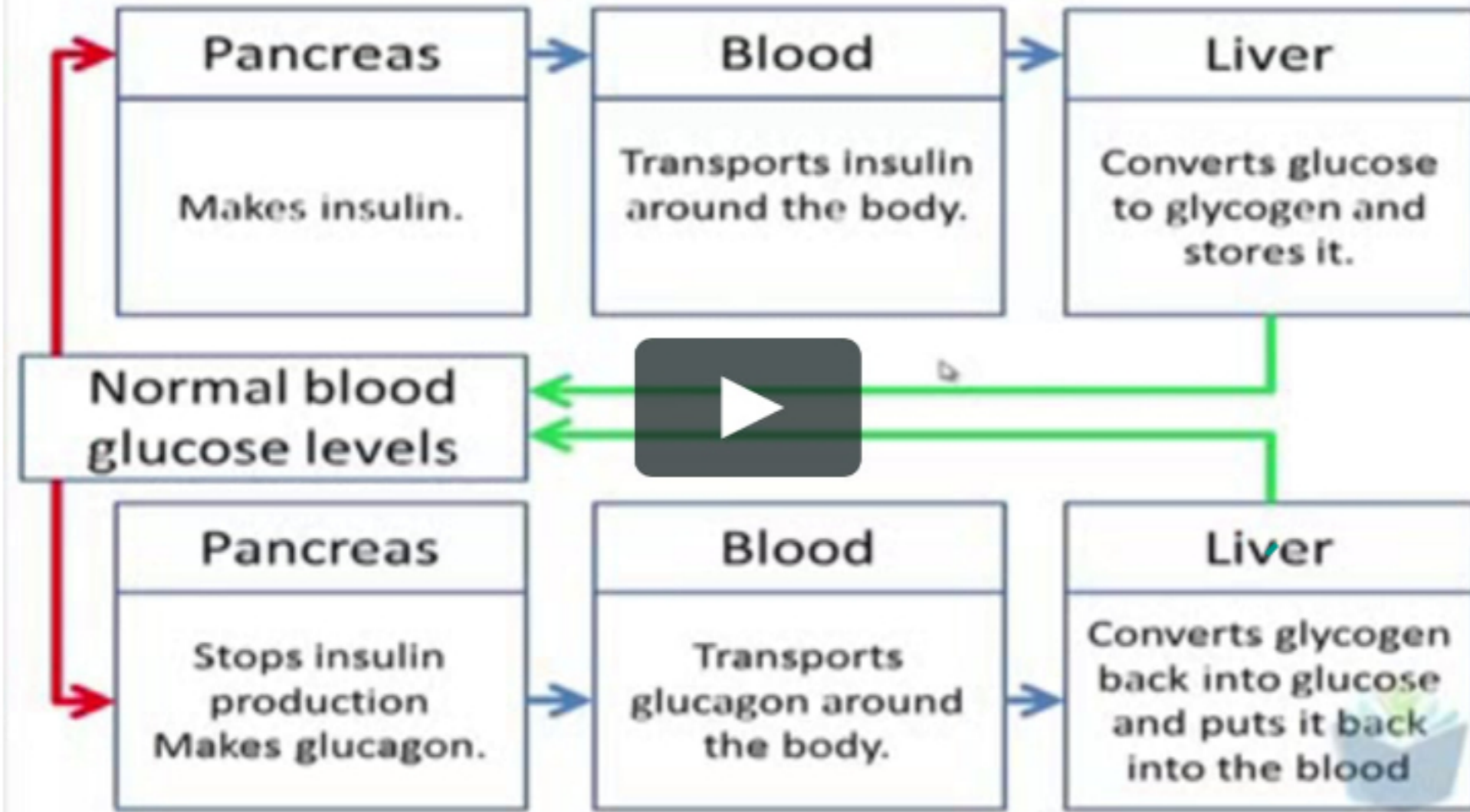
TYPE 2

- Balanced diet
- Regular Exercise
- Weight Management
- Drug to increase sensitivity of pancreas to insulin
- Insulin injections to increase the concentration of insulin to make them more responsive to insulin.

NEGATIVE FEEDBACK

When the level of any thing rises above optimum like glucose concentration, water concentration or temperature negative feedback decreases it

When the level of anything decreases below optimum the negative feedback raises it.



FIGHT OR FLIGHT HORMONE

Stress
Hormone

Increase
heart rate
Increase
breathing
rate

Dilate the
pupil

ADRENALINE

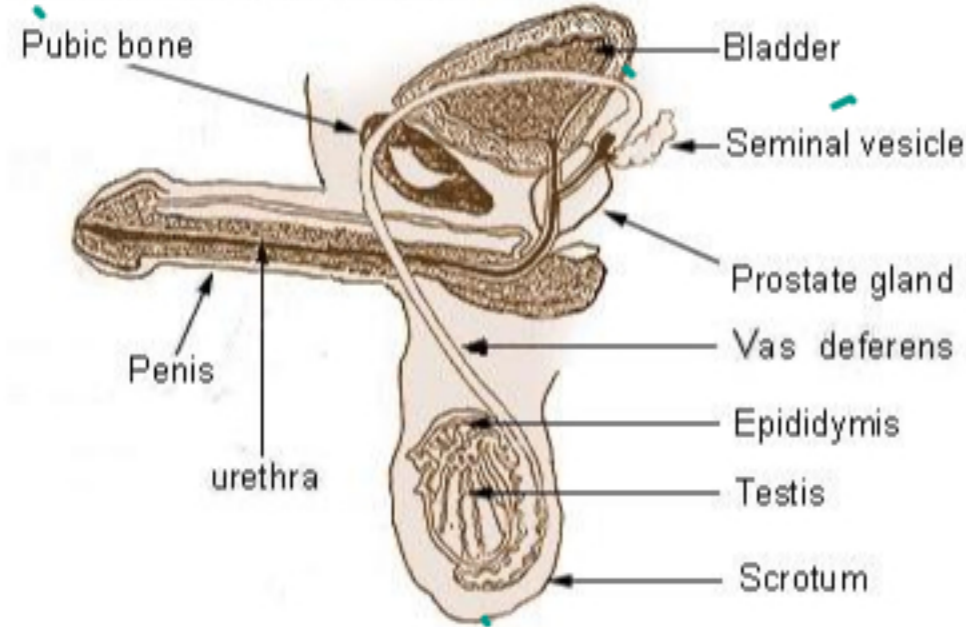
Divert
blood flow
away from
the gut

Emergency
Hormones

Increase
Blood Flow

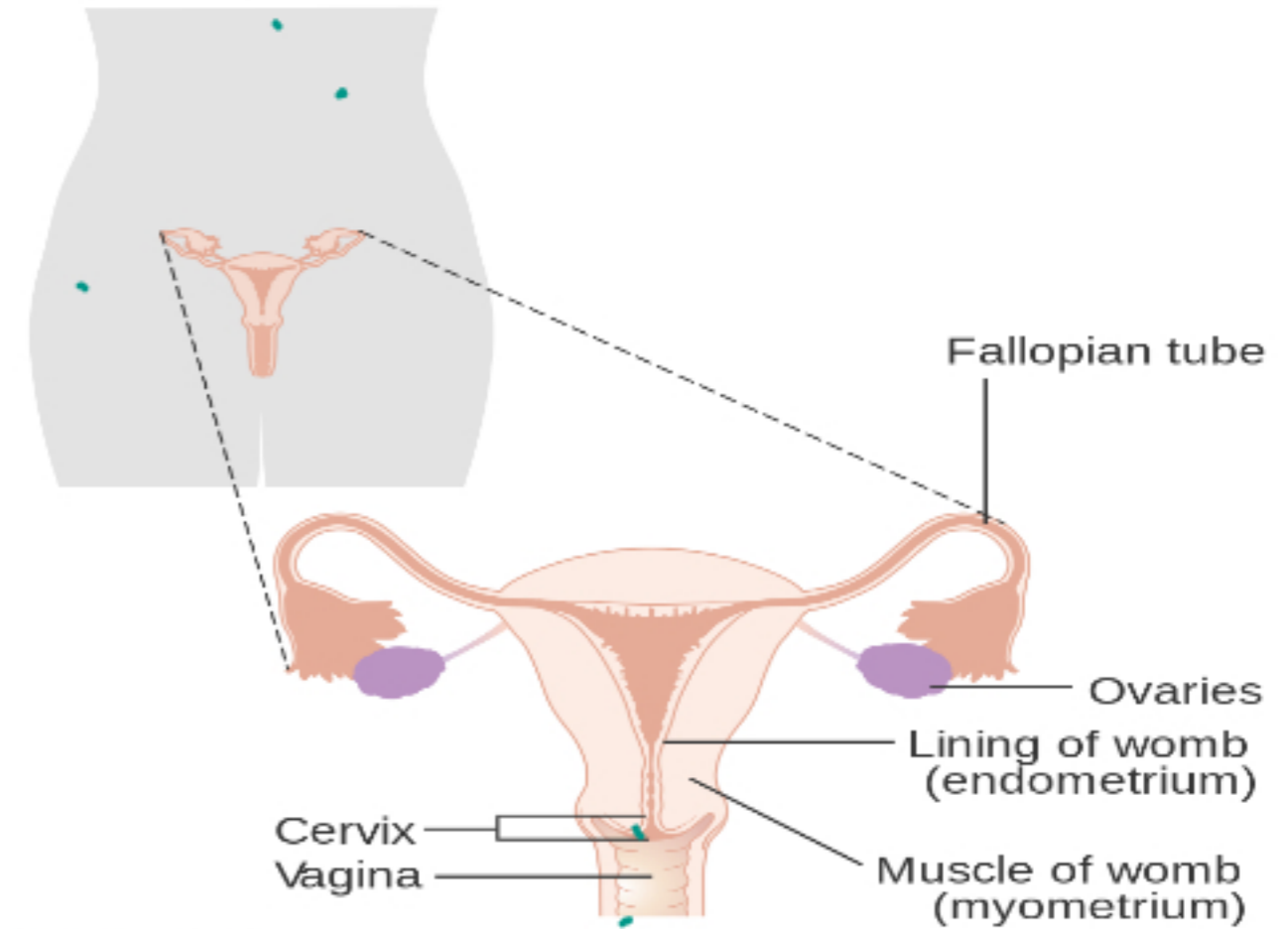
Increase the
flow
of oxygen
to the brain

Male Reproductive System



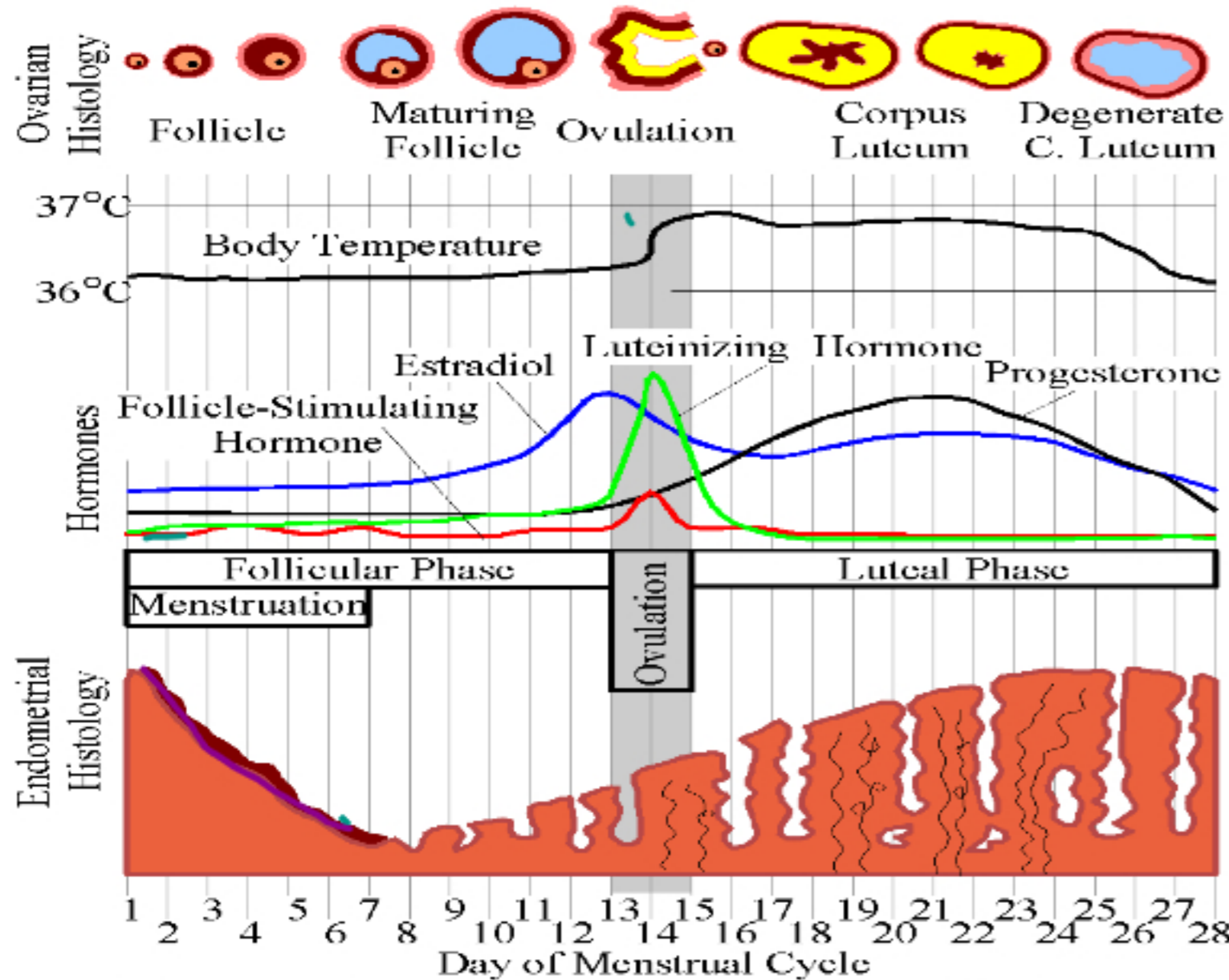
TESTOSTERONE

Male hormone responsible for secondary sexual characters



OESTROGEN

Female hormone responsible for secondary sexual characters



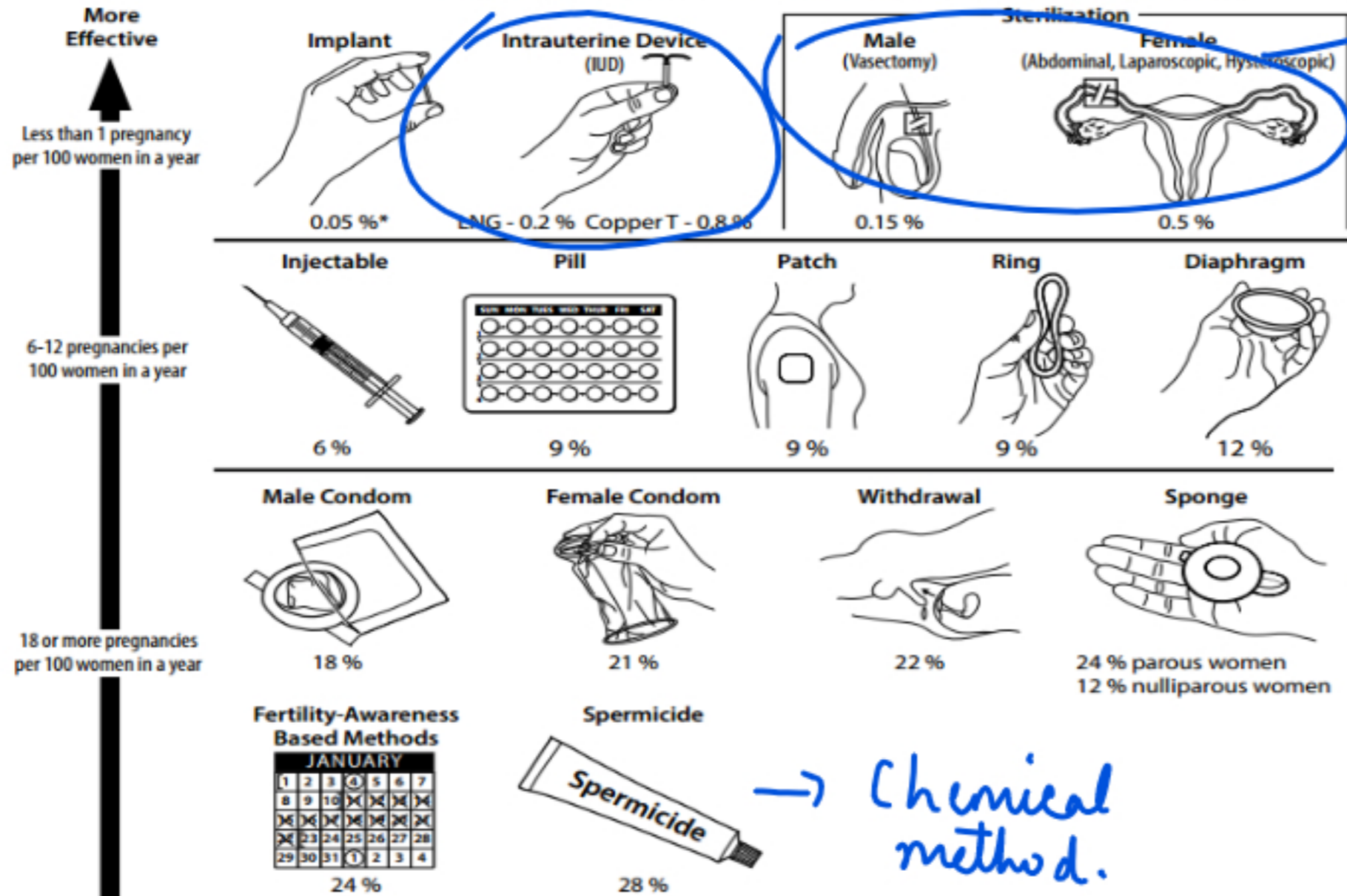
(Average values. Durations and values may differ between different females or different cycles.)

| Days | Phase | Development |
|---------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Day 1- Day 4 | Menstruation | Shedding of the uterus lining along with the egg. Progesterone falls |
| Day 5- Day 14 | Follicular Phase | Egg is matured in the ovary. Increase in FSH |
| Day 14 | Ovulation | Egg is released. Caused by Lutenizing Hormone |
| Day 14-Day 28 | Luteal Phase | Increase in progesterone and oestrogen which maintains the uterus lining and wait for eggs to fertilize. If not fertilize in next 14 days Linning breaks. |



| Hormone | Gland | Effective Days | Effect |
|------------------------------------|-----------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Follicle Stimulating Hormone (FSH) | Pituitary | Day 1-Day 14 | Maturation of egg in the follicle. Stimulate the production of oestrogen |
| Lutenizing Hormone (LH) | Pituitary | Day 14 | Cause Ovulation |
| Oestrogen | Ovaries | Day 14-Day 28 | Develops uterus lining. Stimulates LH and inhibit FSH |
| Progesterone | Empty egg follicle in the ovaries | Day 14- Day 28 | maintains lining of uterus and prepare for pregnancy. Inhibits both LH and FSH So no menstruation happen during pregnancy. |

Effectiveness of Contraceptive Methods



* The percentages indicate the number out of every 100 women who experienced an unintended pregnancy within the first year of typical use of each contraceptive method.

Surgical Methods

Preventing Sperms to reach the egg. Preventing the implantation of the zygote in the uterus.

Barrier Methods : Prevent the sperm to meet the eggs.

Hormonal Methods: Prevents the eggs to mature or prevent the implantation of eggs in the uterus.

Chemical Methods: Kills the sperm

Intrauterine Device: Prevent embryo from implanting

Surgical Method: It is permanent contraception.

Barrier Method

Chemical method.

Contraceptive Pills

- They contain the mix of femal hormones oestrogen and progesterone. -Mix PILL
- Prevent the release of FSH preventing the maturation of eggs.
- MAke thick mucus in the cervix to prevent the entry of sperms.
- Prevent the uterus lining development, preventing implantation.
- Some pills are progesterone only pills.
- A contraceptive implant is also inserted which slowly release progesterone in the uterus.
- A contraceptive patch also absorbs the mix of hormones into the blood.

Side Effects: blood pressure, has to be taken daily, changes in menstrual pattern.

Intra Uterine Device

- Copper T is inserted into the uterus.
- It releases copper ions which are toxic to sperms .
- The device also prevent the implanting of the embryo into the uterus.
- Some releases progesterones which works the same like contraceptive pills :-
- Prevent the release of FSH preventing the maturation of eggs.
- MAke thick mucus in the cervix to prevent the entry of sperms.
- Prevent the uterus lining development, preventing implantation.

Side Effects : Infection, Internal Bleeding

Surgical Methods

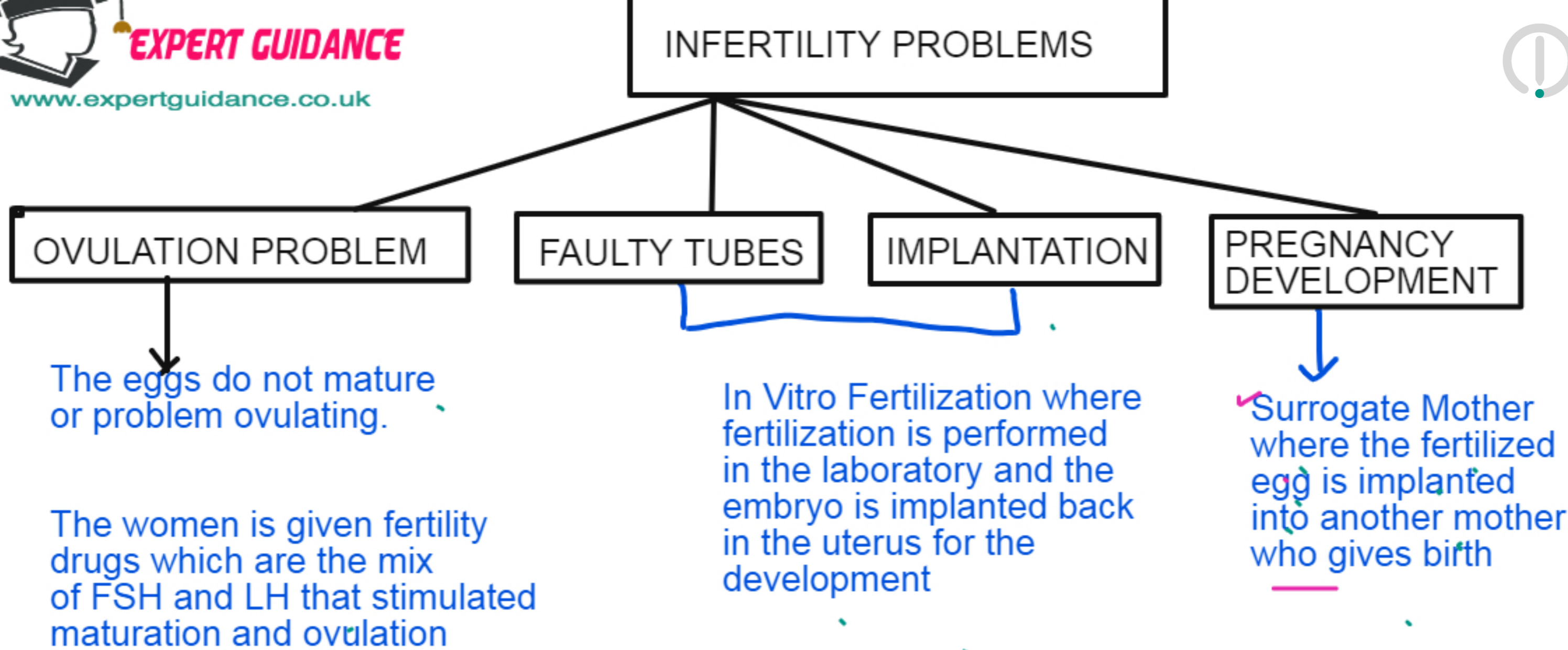
VASECTOMY: Male Sterlization

Sperms ducts are cut and sealed so that the sperms cannot enter the urethra preventing fertilization.

TUBECTOMY: Femal Sterlization

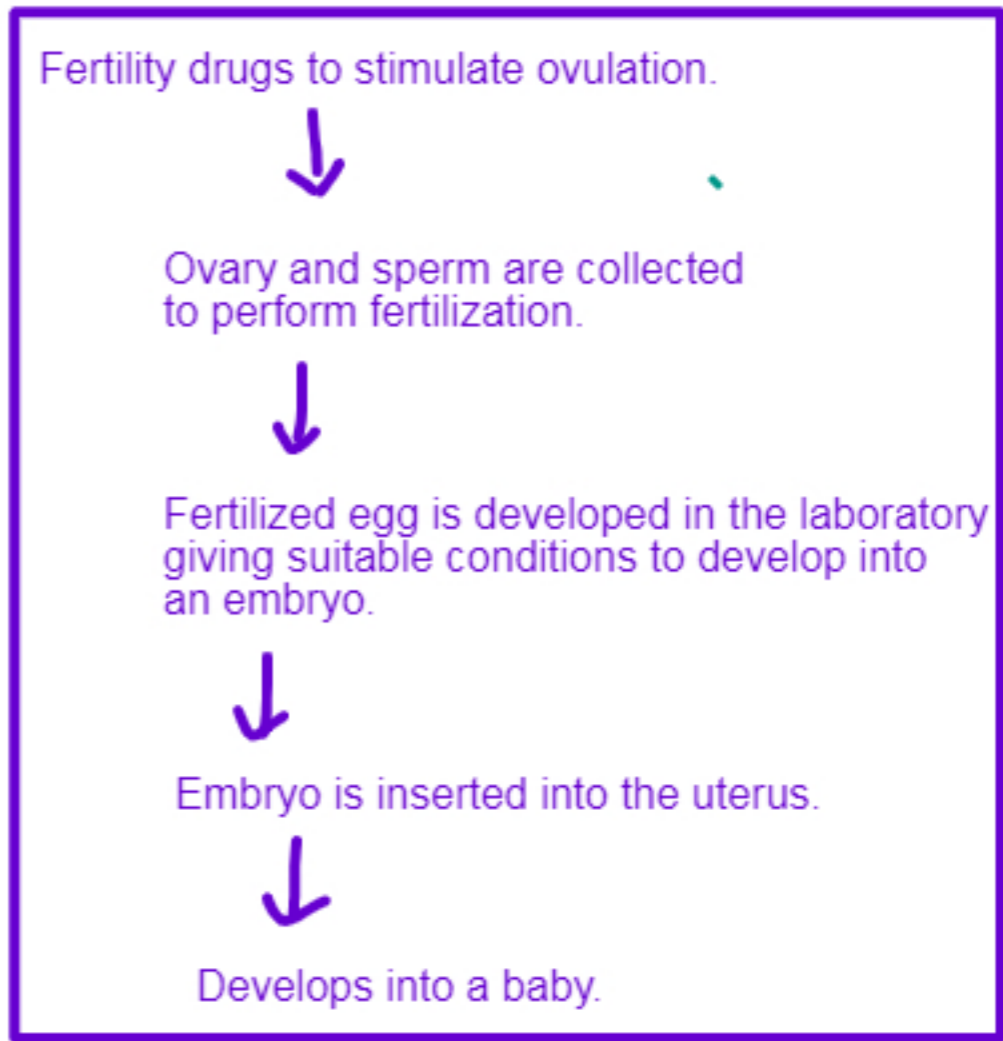
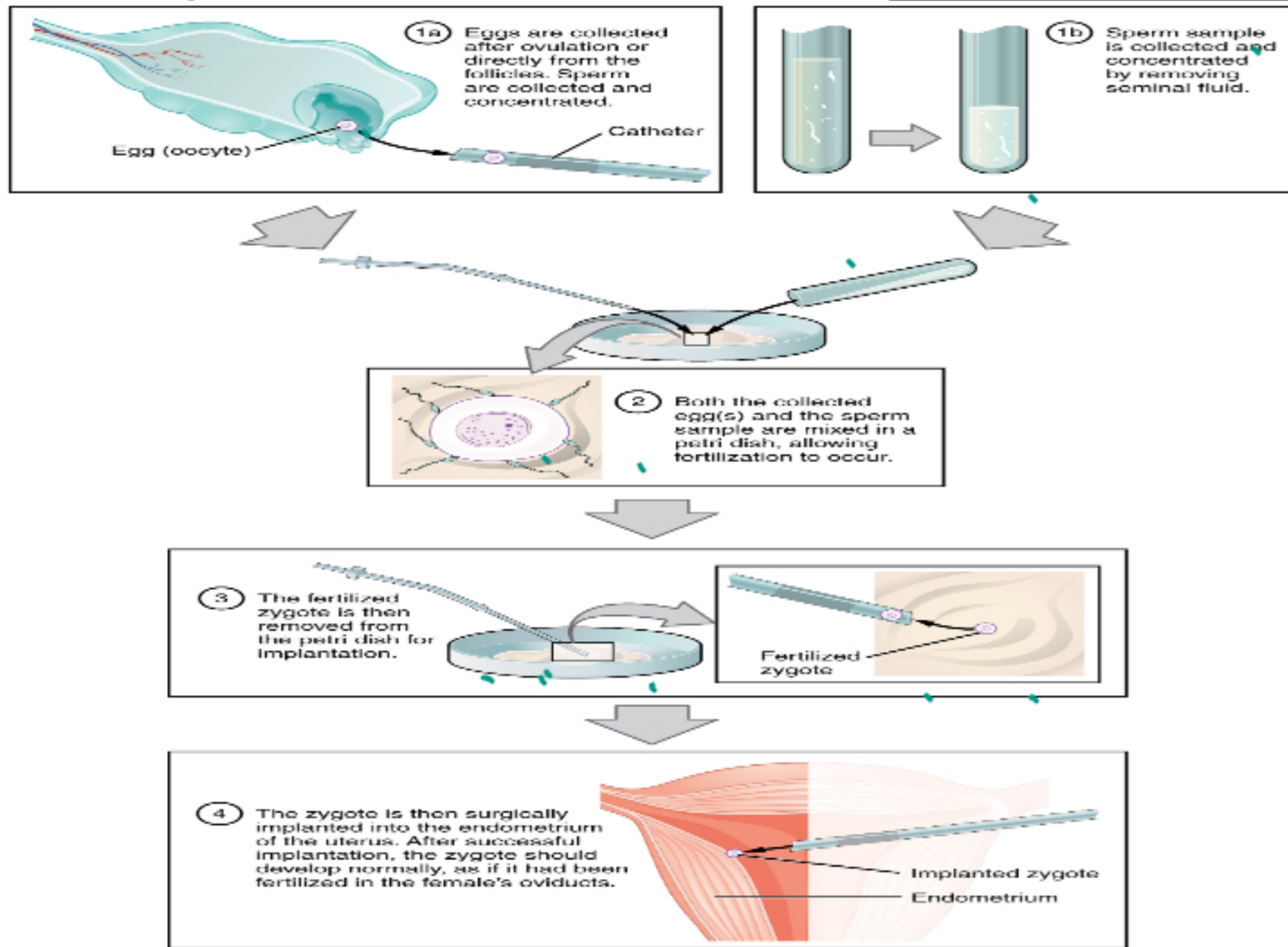
The oviducts are cut and tied to prevent the release of egg which prevent Sterlization.

Side Effects : It is permanent.

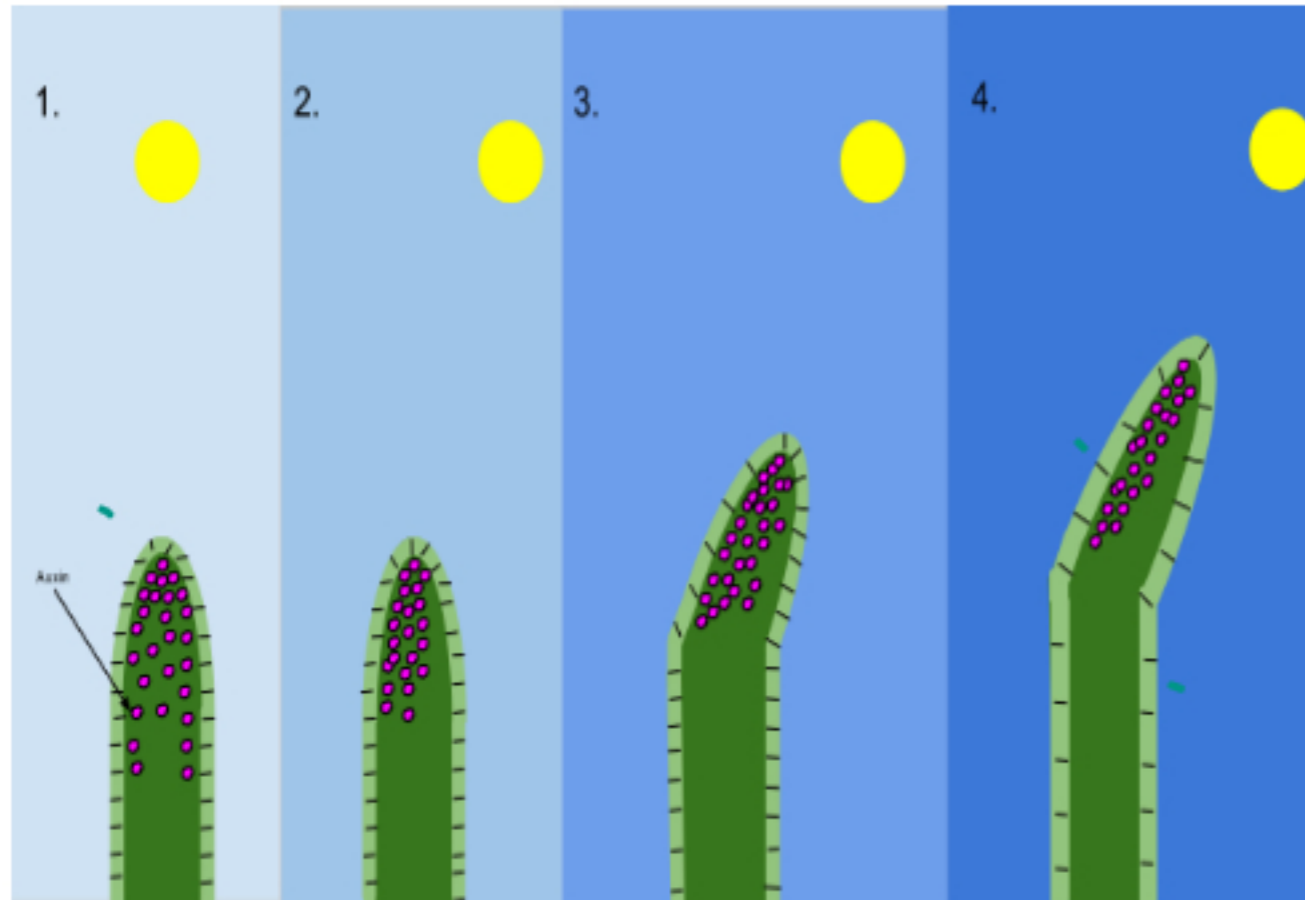


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Expensive
Results in multiple embryos
Premature births
Birth with disability
Not always successful



Phototropism

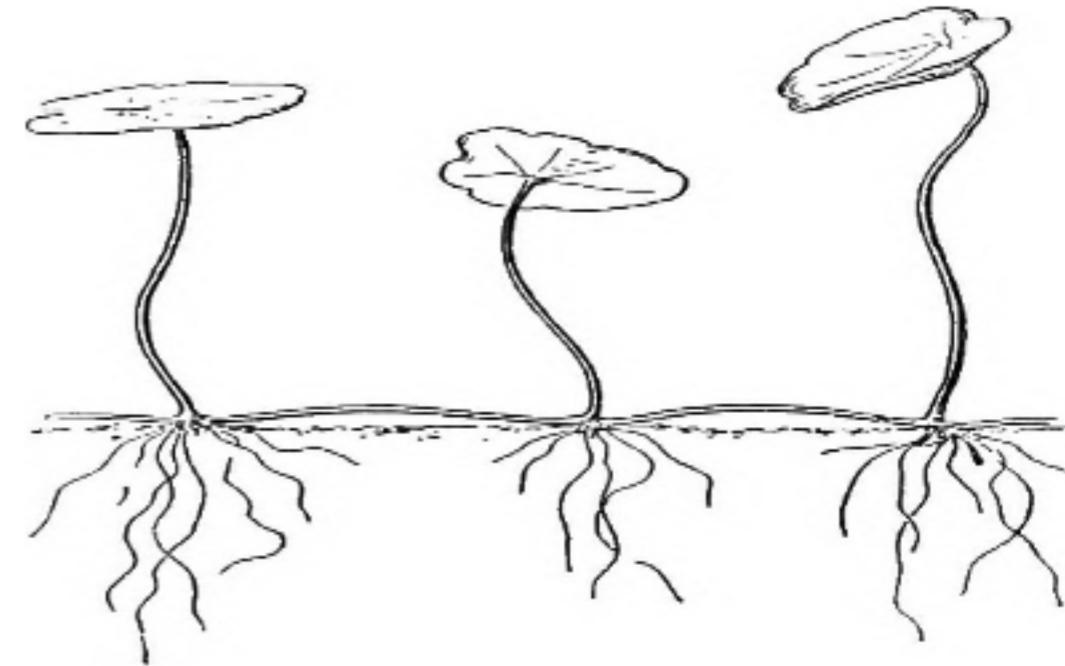


The movement of the shoot towards light.

It is caused by hormone auxin.

Auxin is produced in the shoot tip. When light falls on auxin it is displaced to the shaded side promoting growth of the shaded region resulting in growth of shoot towards light.

Gravitropism



It is also caused by auxin. In roots auxin inhibits the growth of the roots at the lower side resulting in bending of the root downwards. Auxin is displaced to lower side in response to gravity.

AUXINS

It stimulates cell division and growth of the plant

It is used to stimulate rooting in tissue culture.

Used as Weedicide causing excess growth of the weed and killing them.

GIBBERELINS

Seed germination
Promote flowering
End seed dormancy
Elongation of stem.

ETHENE

It is a gaseous hormone

It is involved in fruit ripening

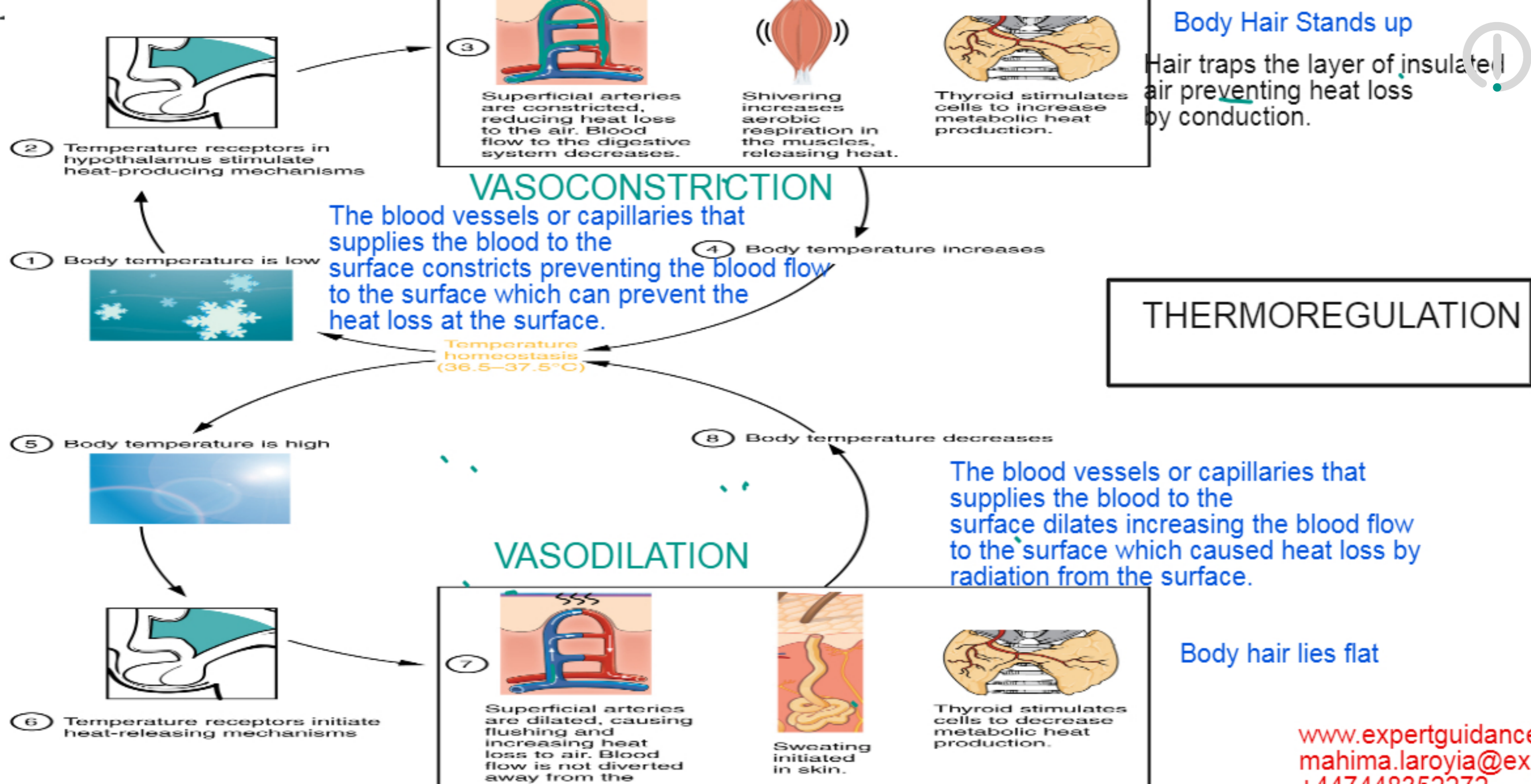
Allows transportation of raw fruit to long distances and then they can be riped by ethene.

Cytokinin

Caused Cell Division

Stress hormone prepared the plant for stress conditions

Abscisic acid



WASTE PRODUCTS

The products produced during metabolic reactions like respiration, digestion etc.

Carbon Dioxide

Produced during respiration.

Is excreted out through the lungs by the process of expiration

Carbon dioxide is harmful as it can alter the pH of the blood affecting enzyme activity.

Water

Produced during respiration and digestion process.

Is excreted through skin in the forms of sweating or some by breathing and by kidney in the form of urine.

Water can also disturb the osmotic balance and salt level of the body.

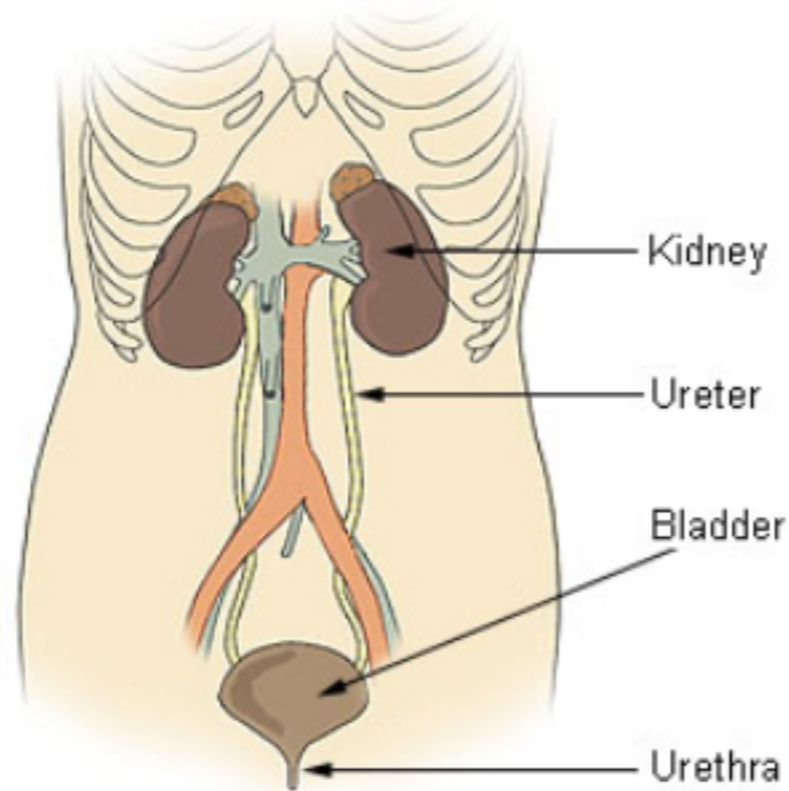
Urea

Produced by the liver by metabolising excess proteins as it is toxic and cannot be stored.

It is excreted by Kidney in the form of Urine.



Components of the Urinary System



Source: Wikimedia Commons

ULTRAFILTRATION

Kidneys filters the blood at a very high pressure. All the water, glucose, and useful components gets into the kidney filtrate. The blood cells and blood proteins due to their bigger size are not filtered.

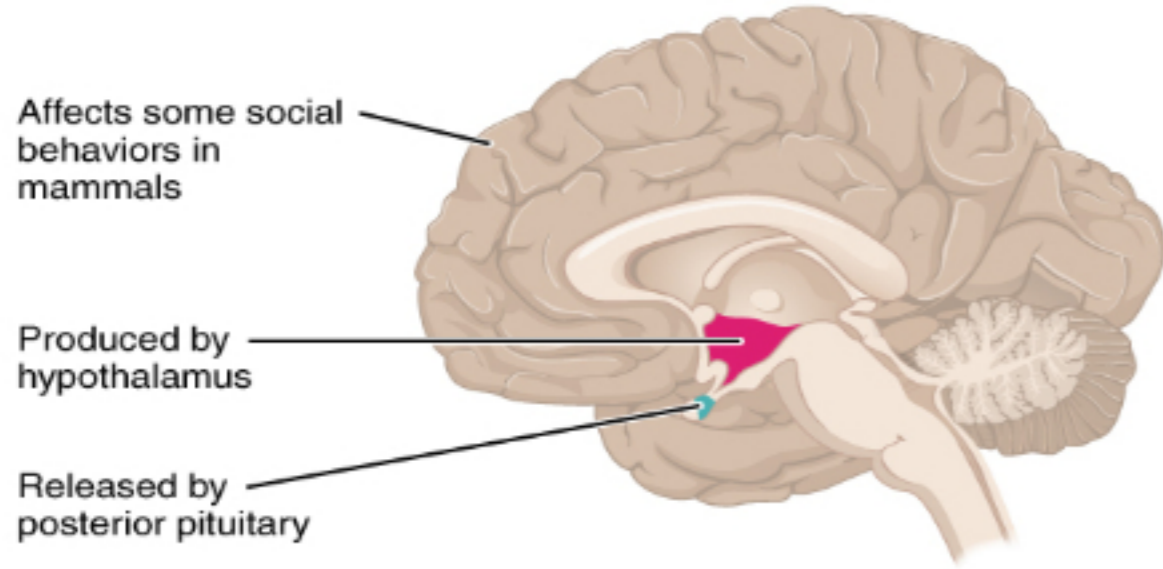
SELECTIVE REABSORPTION

Since the kidney contains useful substance in the filtrate it reabsorbs back them into the blood.

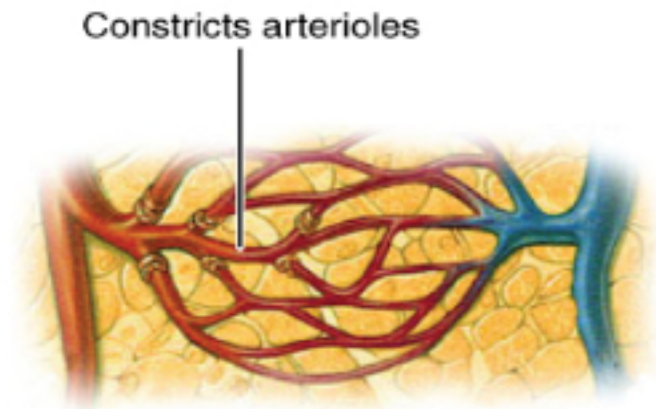
The water also gets reabsorbed depending on the needs of the body.

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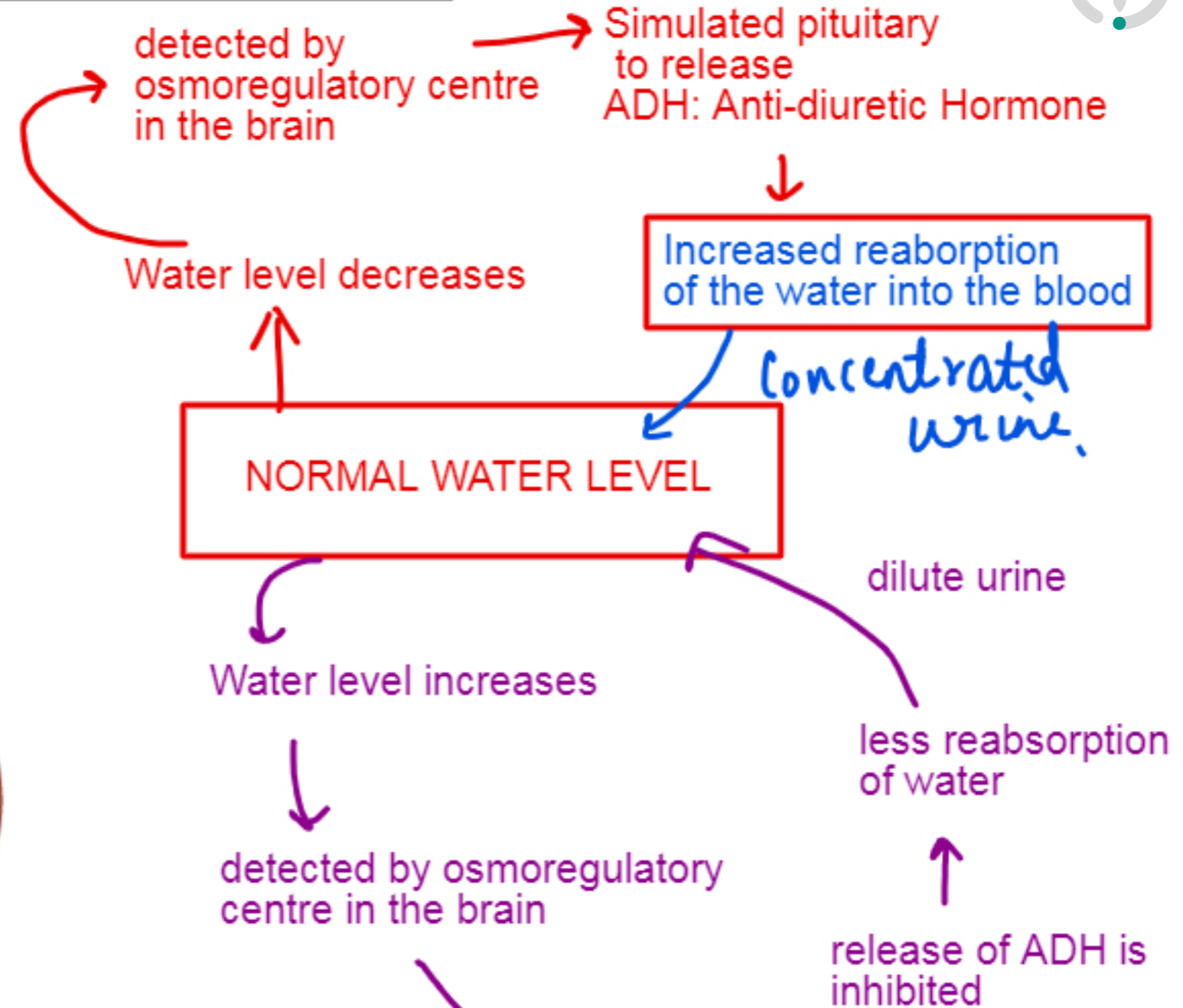
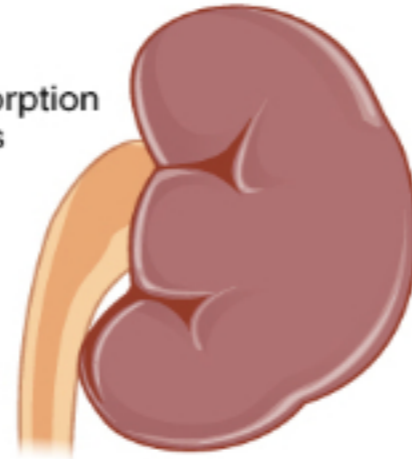
OSMOREGULATION

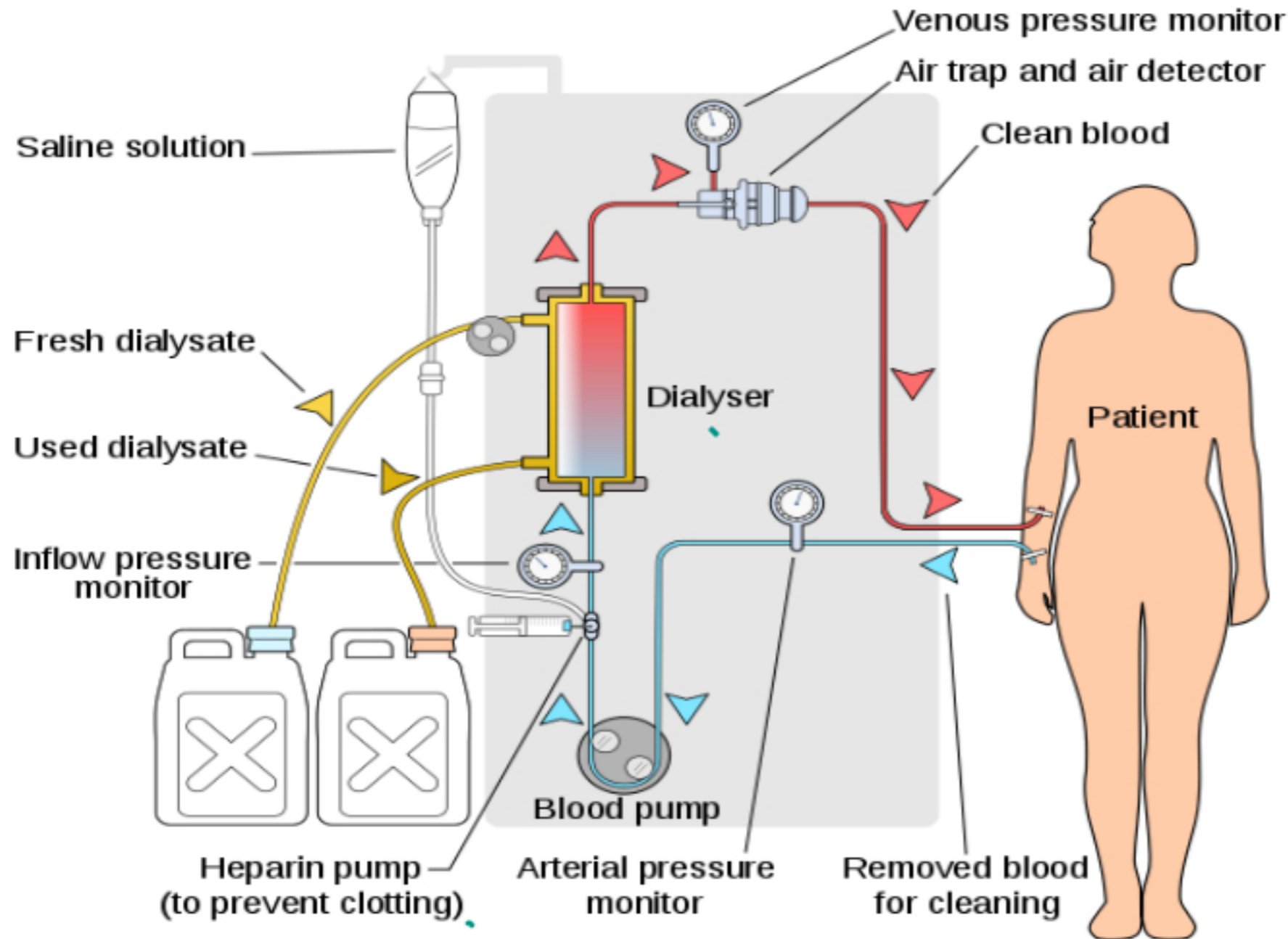


NEGATIVE FEEDBACK



Increases reabsorption of H₂O in kidneys





Artificial Kidney

blood flows into the dialysis machine which contains dialysis fluid.

Dialysis fluid contains the same concentration of essential minerals ions, as that of blood but no urea.

As blood flows into the dialysis fluid, urea is diffused out along the concentration gradient and excess salt is also removed maintaining the normal salt and mineral ions level.

The clean blood is then pumped back.

Lifestyle changes, regular visits, change in diet and regular expenditure are some of the disadvantages.

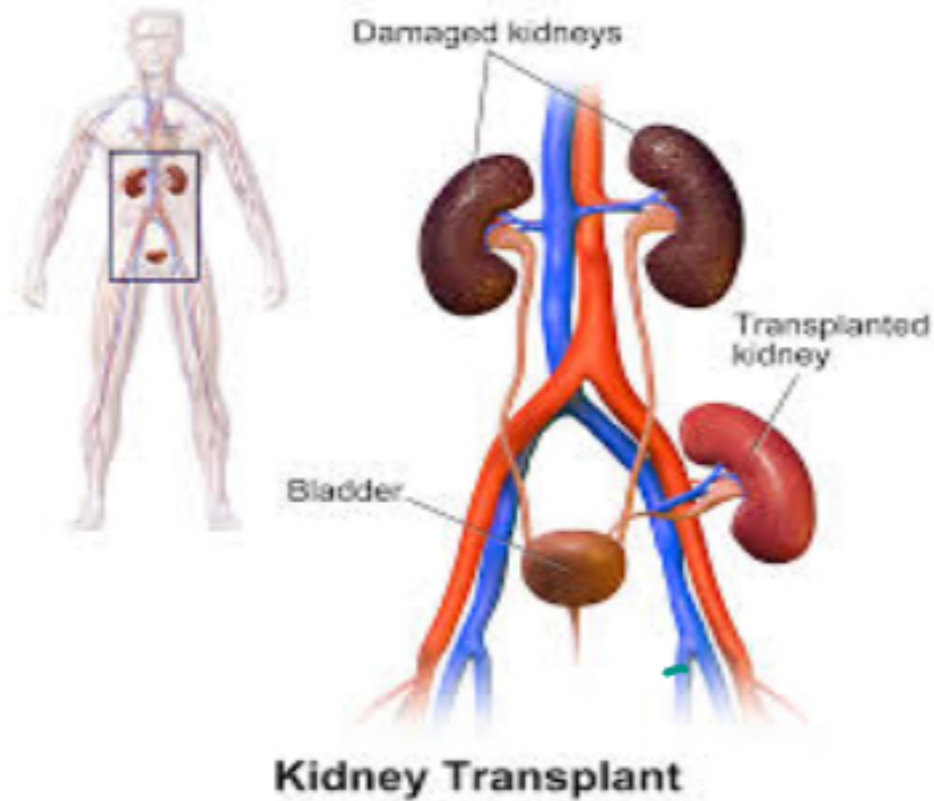
KIDNEY TRANSPLANT

Replacing diseased kidney with the healthy one.

The donor should be a close relative to prevent rejection.

The person has to be on immuno suppressant drugs so that the body immune system does not reject it.

Does not last long and person is prone to other infectious diseases due to immuno suppressant drugs.



Source: Wikimedia Commons

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DIALYSIS V/s KIDNEY TRANSPLANT

| | DIALYSIS | KIDNEY TRANSPLANT |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ADVANTAGES | <ul style="list-style-type: none"> No surgery No infection No immuno supressant drugs Easily available | <ul style="list-style-type: none"> No regular visit No lifestyle changes No diet restriction |
| DISADVANTAGES | <ul style="list-style-type: none"> Lifestyle changes Regular visits and long procedure Restricted Diet | <ul style="list-style-type: none"> Does not last forever Chances of rejection Immuno supressant drugs to be taken Person is more prone to infections. Finding a suitable donor is a problem . |

Homeostasis

Brain

Sclera

FSH

Phototropism

Receptors

Cerebral Cortex

Iris

LH

Gravitotropism

Effectors

Cerebellum

Pupil

Oestrogen

Auxins

Stimulus

Medulla

Accommodation

Progesterone

Gibberlins

Selective Reabsorption

Neurones

MRI

Myopia

Glucagon

Ethene

Central Nervous System

Eye

Hyperopia

Glycogen

Vasoconstriction

Sensory Neurones

Cornea

Endocrine System

Diabetes

Vasodilation

Motor Neurones

Retina

Hormones

Mensturation

Thermoregulation

Relay Neurones

Blind Spot

Adrenaline

Ovulation

Reflex Arc

Ciliary Muscles

Insulin

IVF

Dialysis

GCSE Biology Complete revision summary

Structures and Functions in Living Organisms

Cell Biology

Organisation

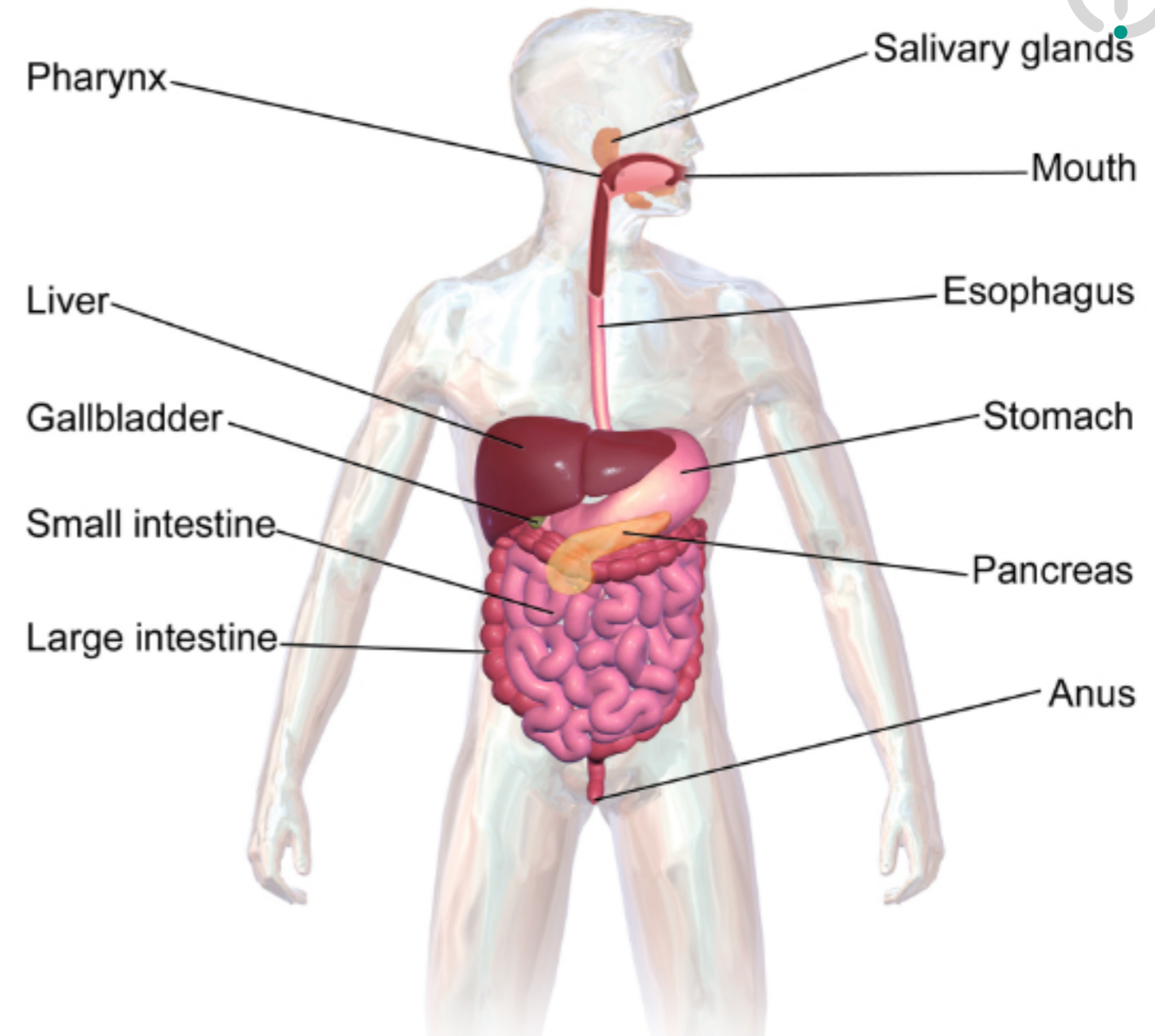
Infection

Bioenergetics

Organisation hierarchy
Human Digestive System
Circulatory System
Heart and the blood vessels
Blood
Coronary Heart Disease
Non Communicable Disease
Respiratory System
Plant Tissues
Plant Organ System
Transpiration

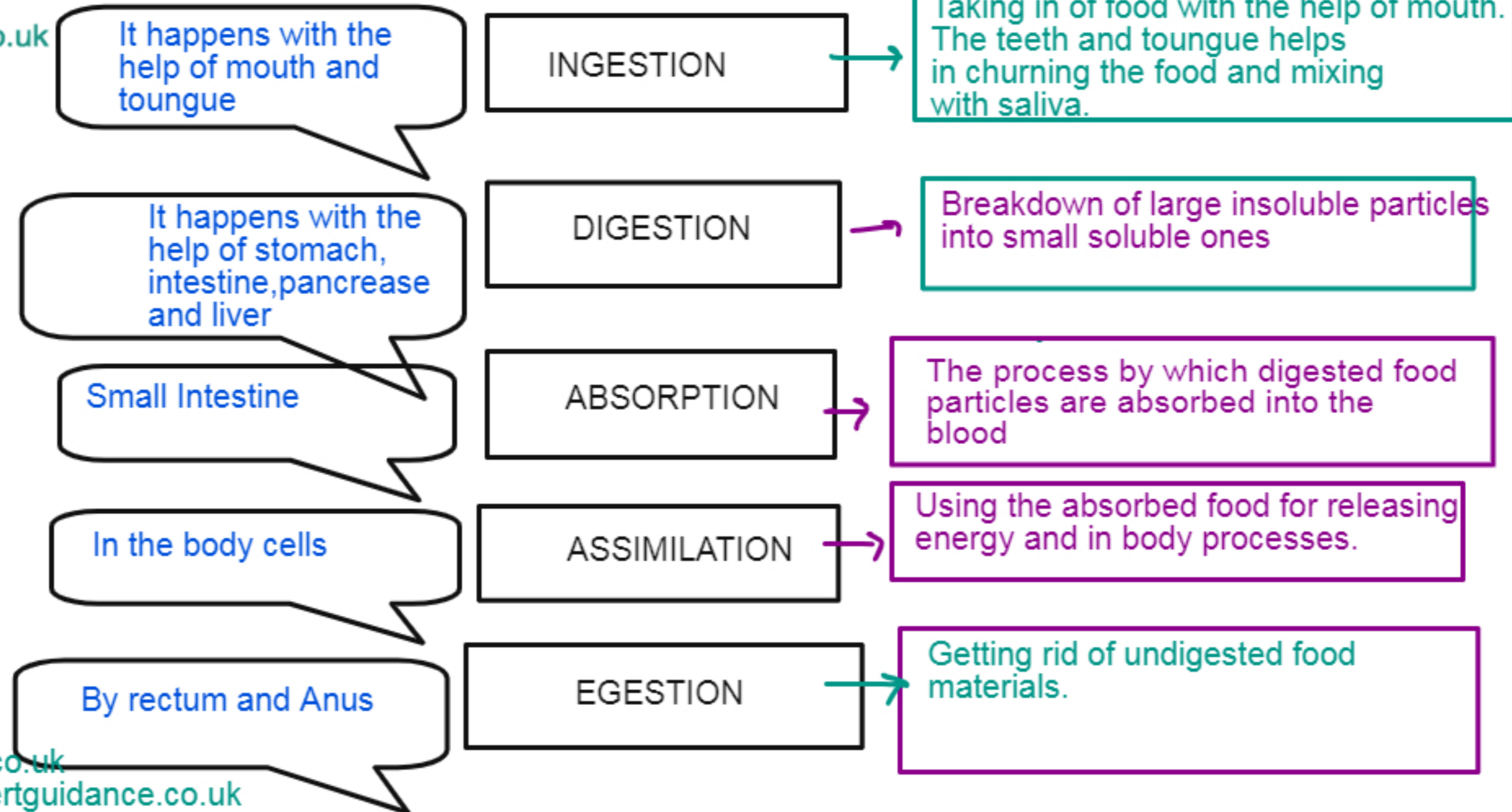
It is the process of breaking down large insoluble food particles in the food into soluble small particles which can then be absorbed into the blood

| Food Component | | Product of digestion |
|----------------|-----------------|--------------------------|
| Carbohydrates | carbohydrases → | Sugars |
| Proteins | proteases → | Amino Acids |
| Fats | lipases → | Fatty Acids and Glycerol |

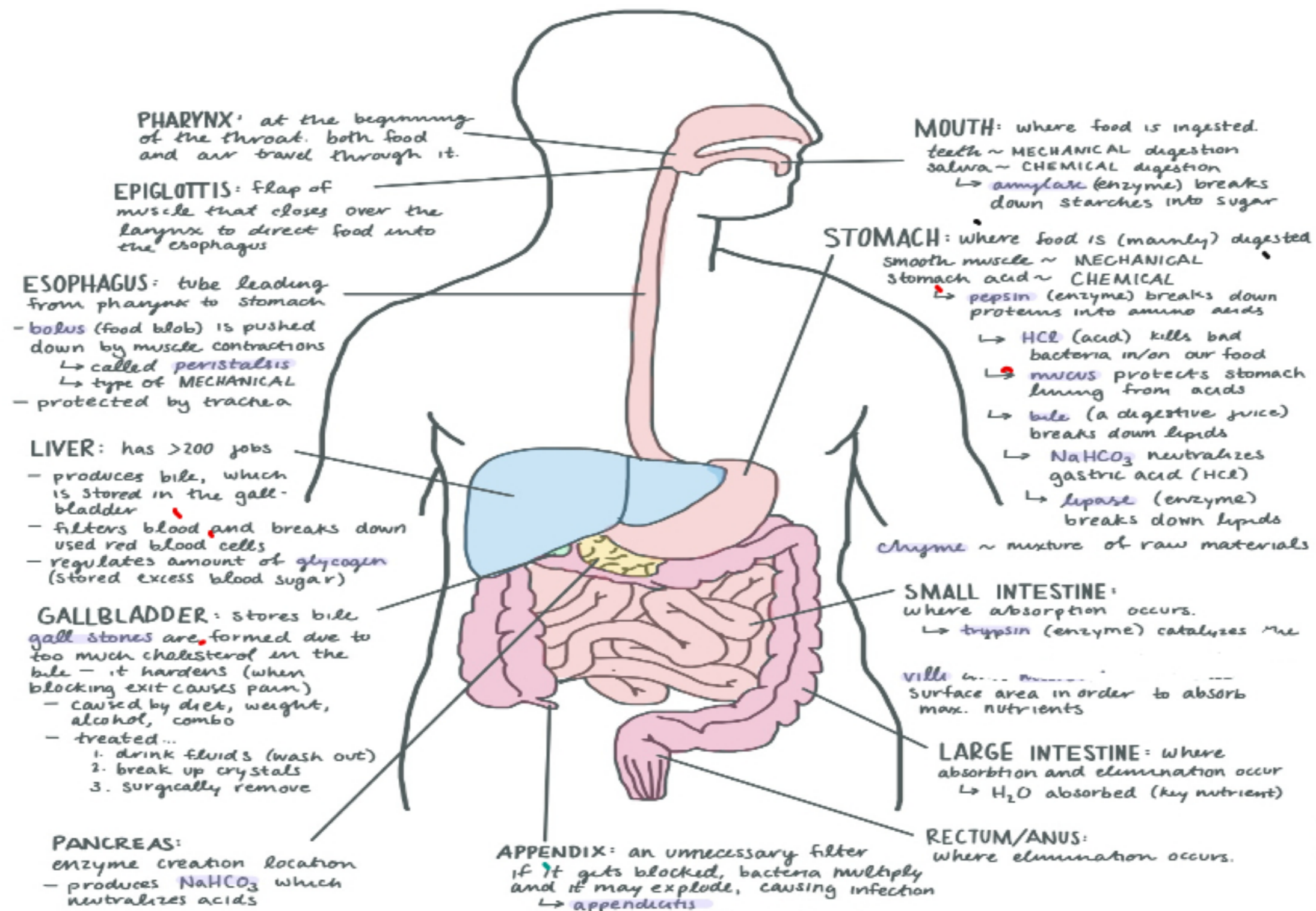


The Components of the Digestive System

DIGESTION PROCESS !!!



THE DIGESTIVE SYSTEM



LIVING SYSTEM HIEARARCHY !!!!

CELLS

Nerve Cell,
Muscle Cell

TISSUES

Muscular tissue,
Epithelial tissue
Glandular tissue

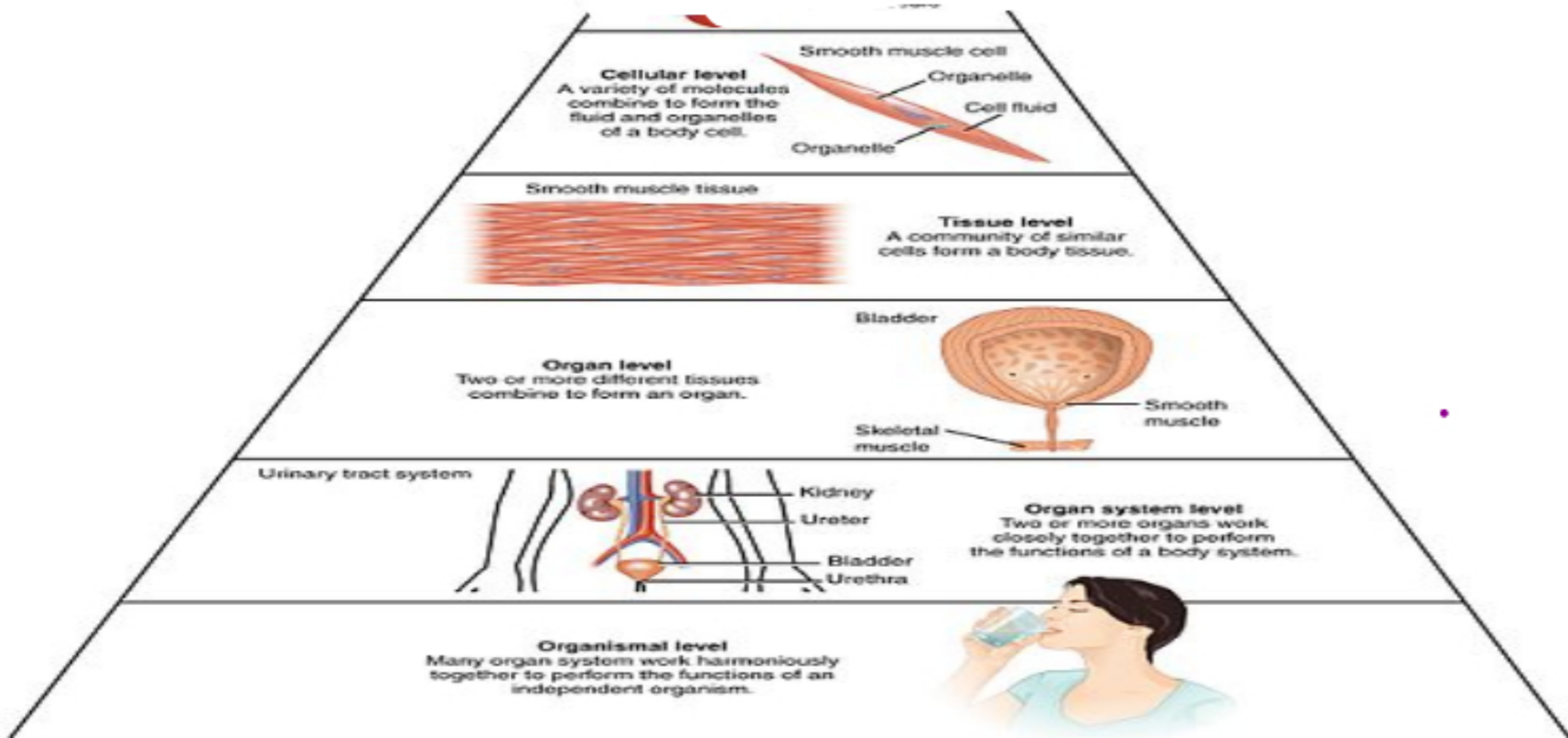
ORGANS

Stomach, kidney, liver
pancreas, Heart

ORGAN SYSTEM

Circulatory System,
Digestive System
Nervous System
Excretory System

ORGANISMS



BILE JUICE

It is the green yellow alkaline liquid which is produced in the liver and stored in the Gall Bladder.

It performs two major Functions:

NEUTRALIZATION

The food that comes from the stomach is acidic and the enzymes of the intestine can work in alkaline conditions.
The bile neutralizes the food that comes from the stomach and makes it alkaline so that the enzyme released in the intestine can work effectively.

EMULSIFICATION OF FATS

For lipase to work, the fat must be broken down into small droplets to increase the surface area for the lipase to function.
The bile perform this function of emulsification of fats for the efficient working of lipase.



COMPONENTS OF FOOD

| Food Component | Source | Monomer | Enzyme | Location | FUNCTION |
|----------------|---------------------------------------------------------|---------------------------|-----------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Carbohydrates | Breads, pasta, Cereals, Rice | Sugars | Carbohydrases eg Amylase | Mouth and small intestine | Principal source of energy Fuel for respiration Storage molecules like starch and glycogen Structure molecule like cellulose |
| Proteins | Pulses, chicken Meat, poultry Eggs, Beans Nuts | Amino Acids | Protease | Stomach and small intestine | Components of muscles. Required for growth and repair. components of enzymes Hormones like insulin |
| Fats | Butter, Oil, Margarine, | Fatty Acids + Glycerol | Lipase | Small Intestine | Insulates the body Reserve source of Energy components of cell membrane |

ENZYMES

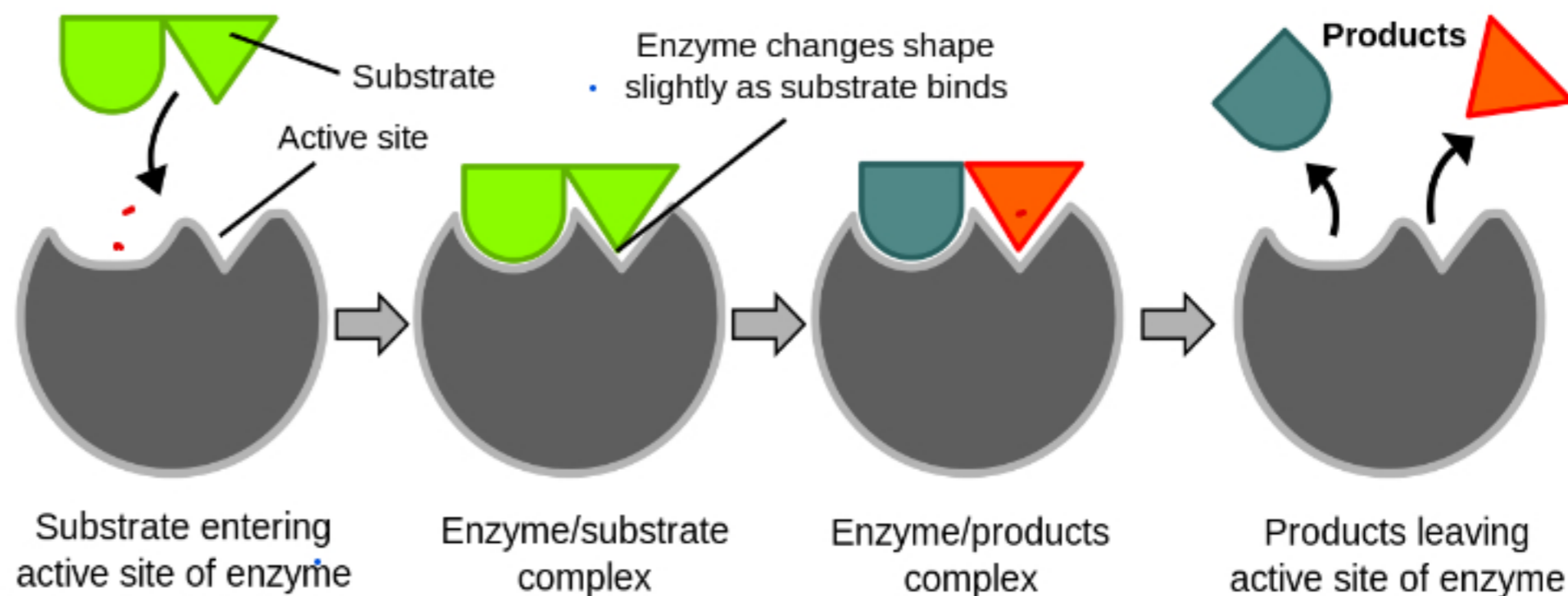
They are biological catalyst that increases the rate of a biological reaction without being used up.

They are protein in nature so they are sensitive to heat and pH.

They increases the rate of the reaction by providing an alternative route that works by lowering the activation energy.

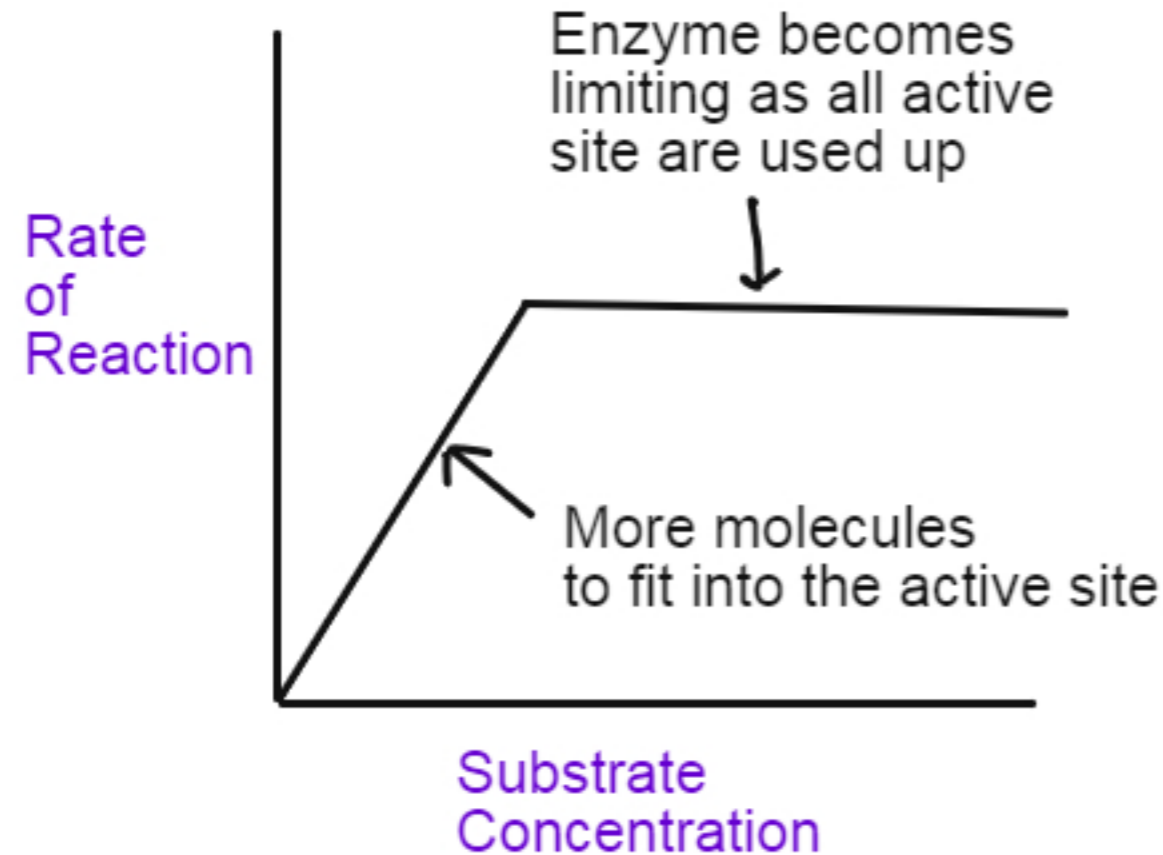
LOCK AND KEY MODEL

Enzymes are highly specific due to the active site. As the active site has a shape complimentary to the substrate. So the specific substrate molecule can fit into the active site of the enzyme.

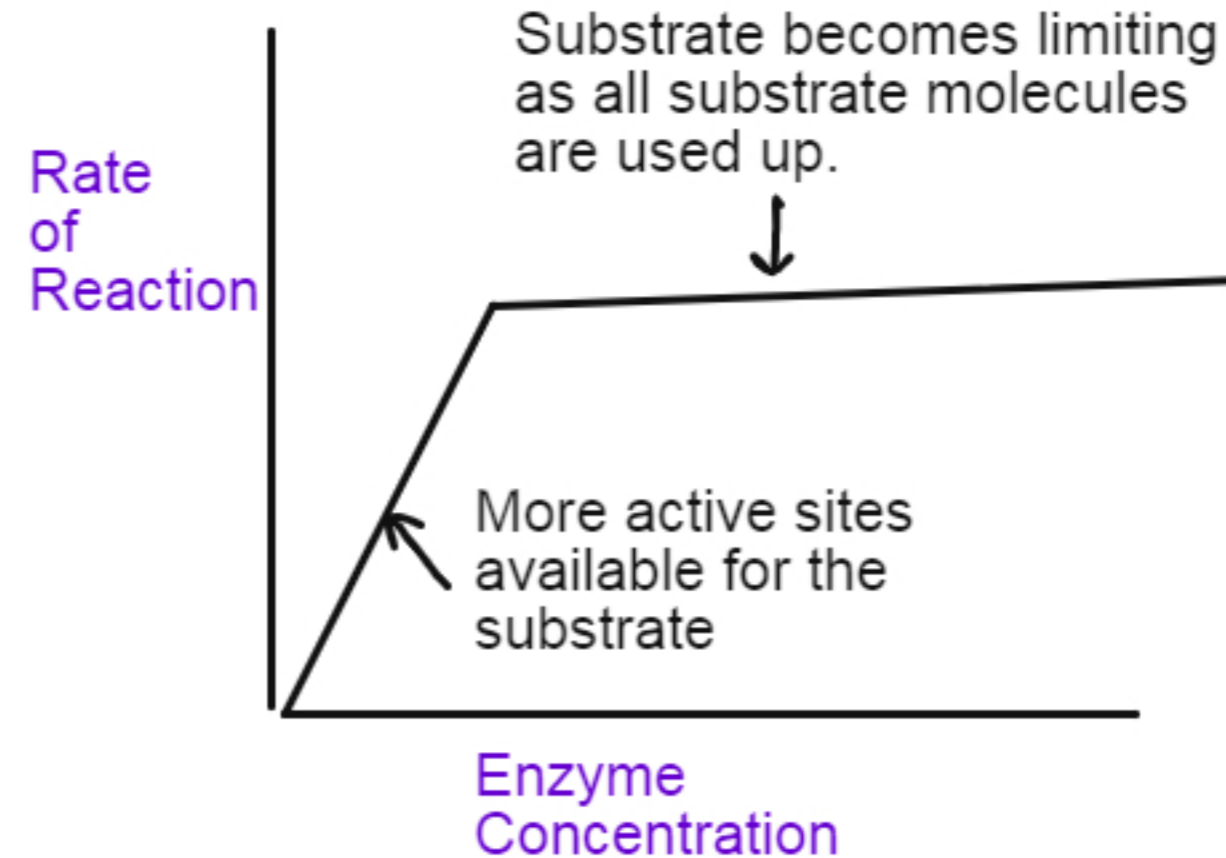


Source: Wikimedia Commons

SUBSTRATE CONCENTRATION



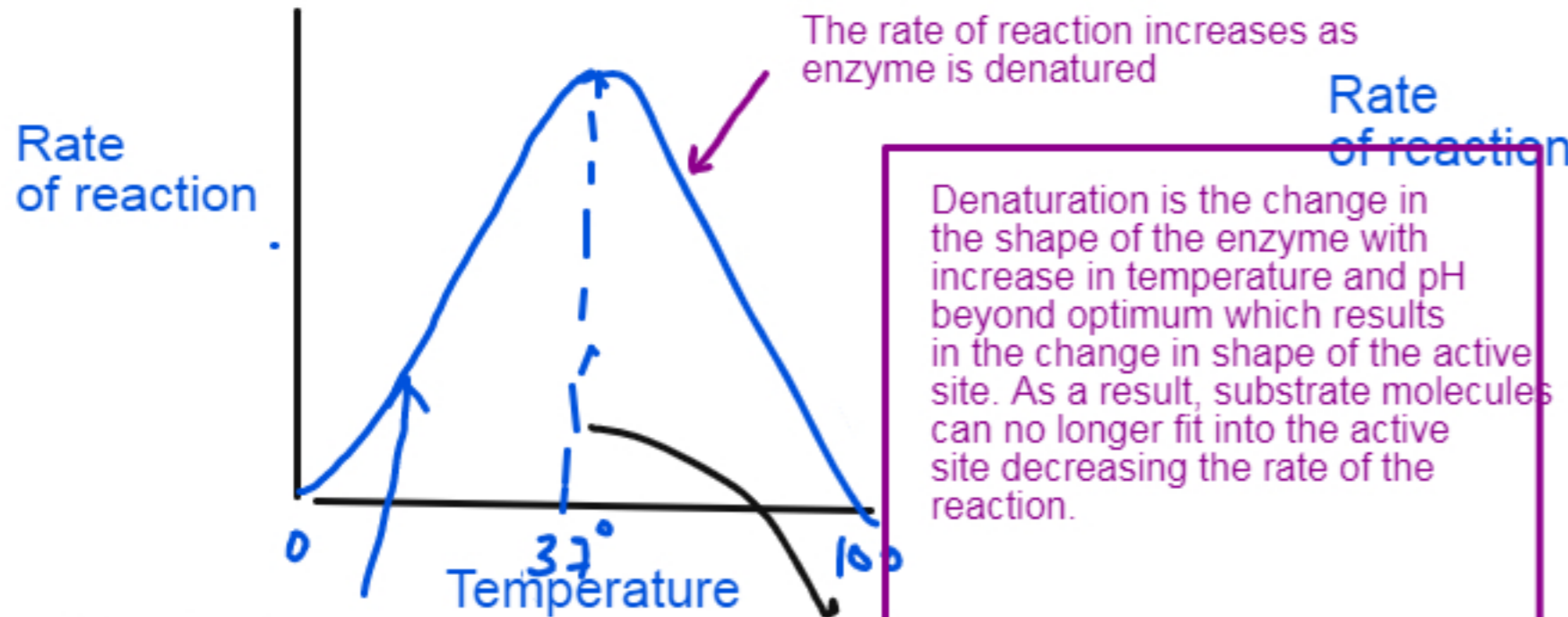
ENZYME CONCENTRATION





FACTORS AFFECTING ENZYME ACTIVITY

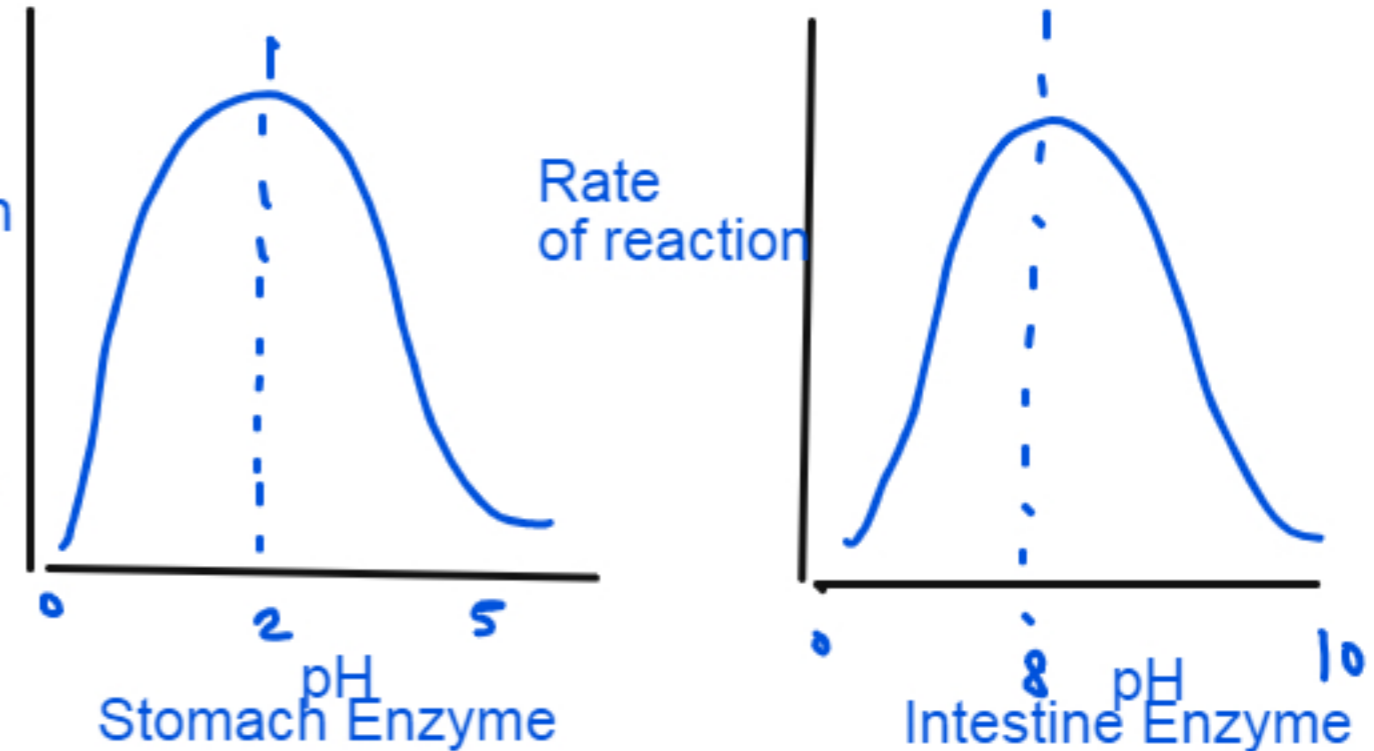
Temperature



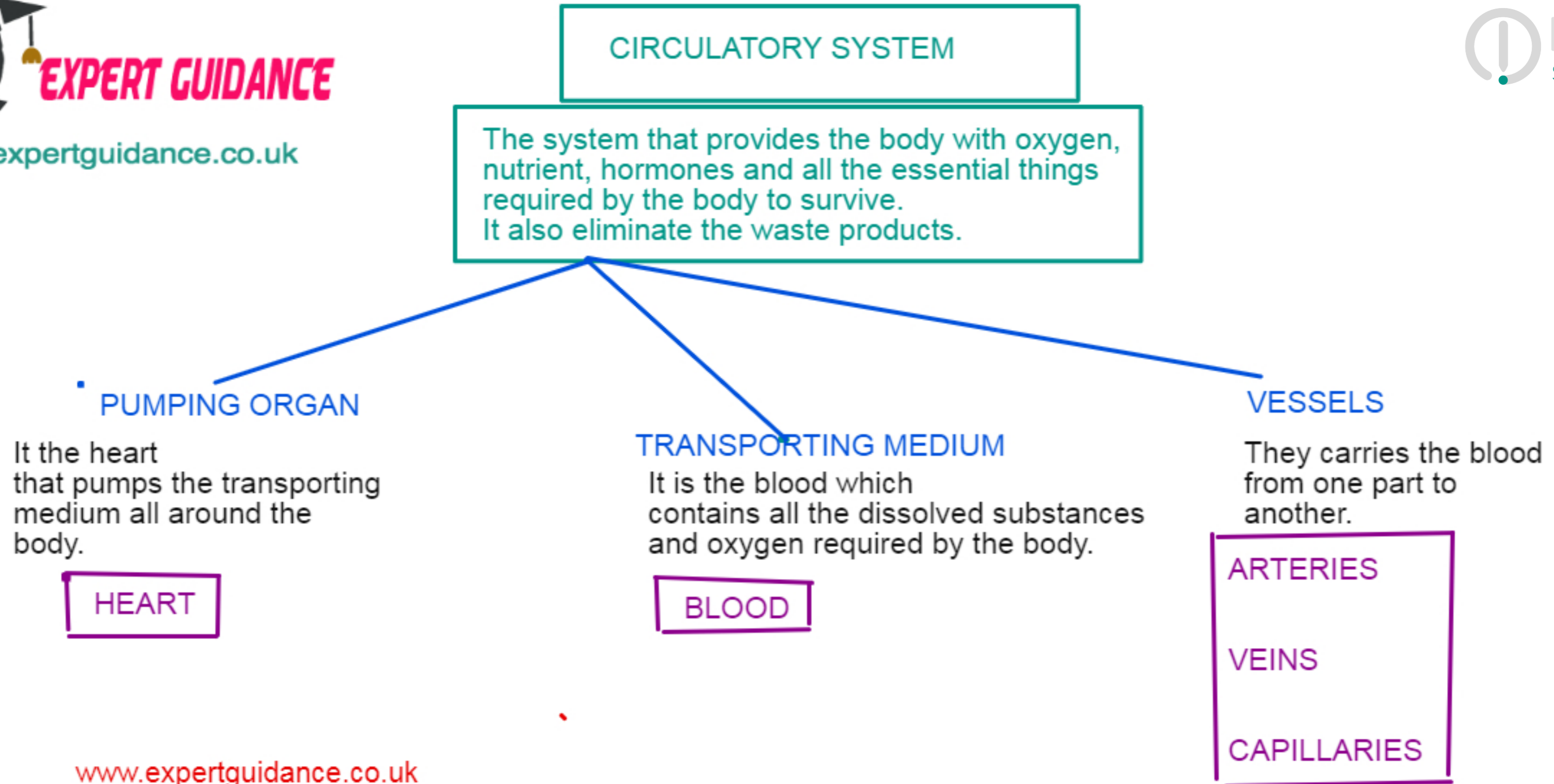
Rate of reaction increases as particles gain kinetic energy and they collide more increasing rate

The optimum temperature. It is the point where the enzyme activity is the highest.

pH



Different enzymes has different pH optimum. Stomach enzymes works in acidic conditions which are maintained by hydrochloric acid. Intentional enzymes works in alkaline pH maintained by bile.



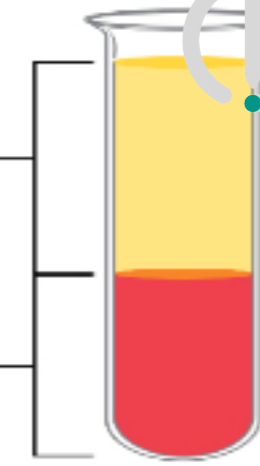


The blood is about...

55% plasma

and

45% cells



BLOOD

BLOOD PLASMA

It is the liquid component of the blood.
It makes 55% of the blood.
It is composed of :-

- a) Glucose
- b) Amino Acids
- c) Hormones
- d) Waste Products like Urea
- e) Carbon Dioxide

BLOOD CELLS

RED BLOOD CELLS

It transport oxygen all around the body. It is a specialised cells

→ **Biconcave disc**

Increases the surface area for oxygen transport

→ **No nucleus**

To provide more room for oxygen

→ **Contains haemoglobin**

Binds with oxygen to carry it around the body

WHITE BLOOD CELLS

They are soldiers of the cells

They protect the body from infections

They are made up of lymphocytes which produce antibodies.

They also have phagocytes which engulf the pathogen

PLATELETS

They are involved in blood clotting.

They have fibrin proteins which forms the mesh around the blood.



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NEED FOR CIRCULATORY SYSTEM

LOW SURFACE AREA TO VOLUME RATIO

Multicellular organisms due to their bigger size have very low surface area to volume ratio.

As a result, diffusion alone is not effective to meet the demands of the cell so it requires a circulatory system.

METABOLICALLY ACTIVE

The multicellular organisms are metabolically active. So they need constant supply of oxygen and food and constant removal of waste products.

MULTICELLULAR

Being multicellular many cells are deep and the diffusion distance is larger.

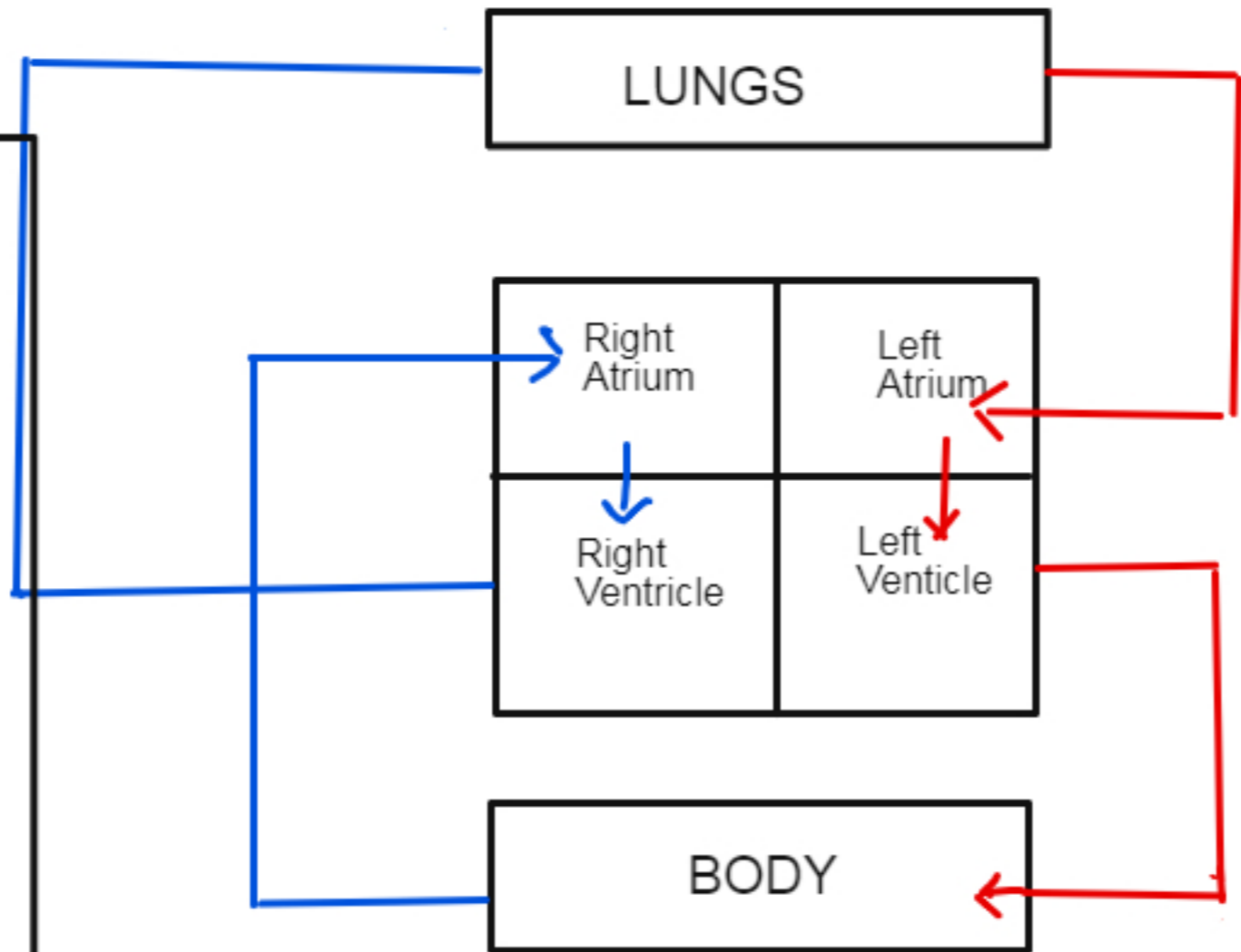
So they need a circulatory system that transport substance deep inside the cells.

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DOUBLE CIRCULATION

- In One complete cycle the blood is pumped into the heart twice.
- It involves two circulation:
Pulmonary: Circulation between Lungs and Heart
- Systemic Circulation: Circulation between heart and the body.
- Double circulation makes the circulation more efficient by preventing the mixing of oxygenated blood and helps to alter the pressure from the different chambers of the heart.



Pulmonary
Systemic
Double

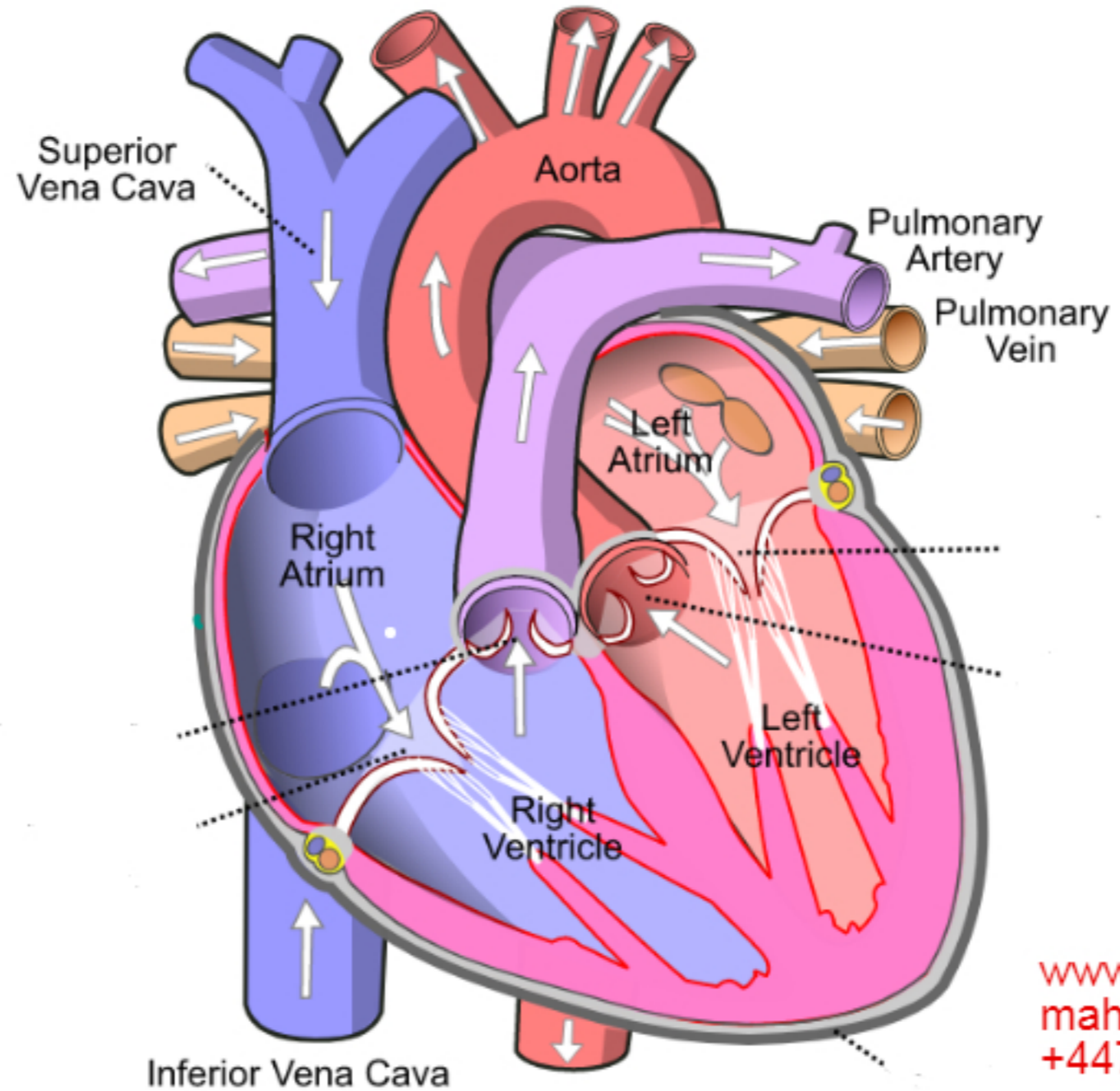


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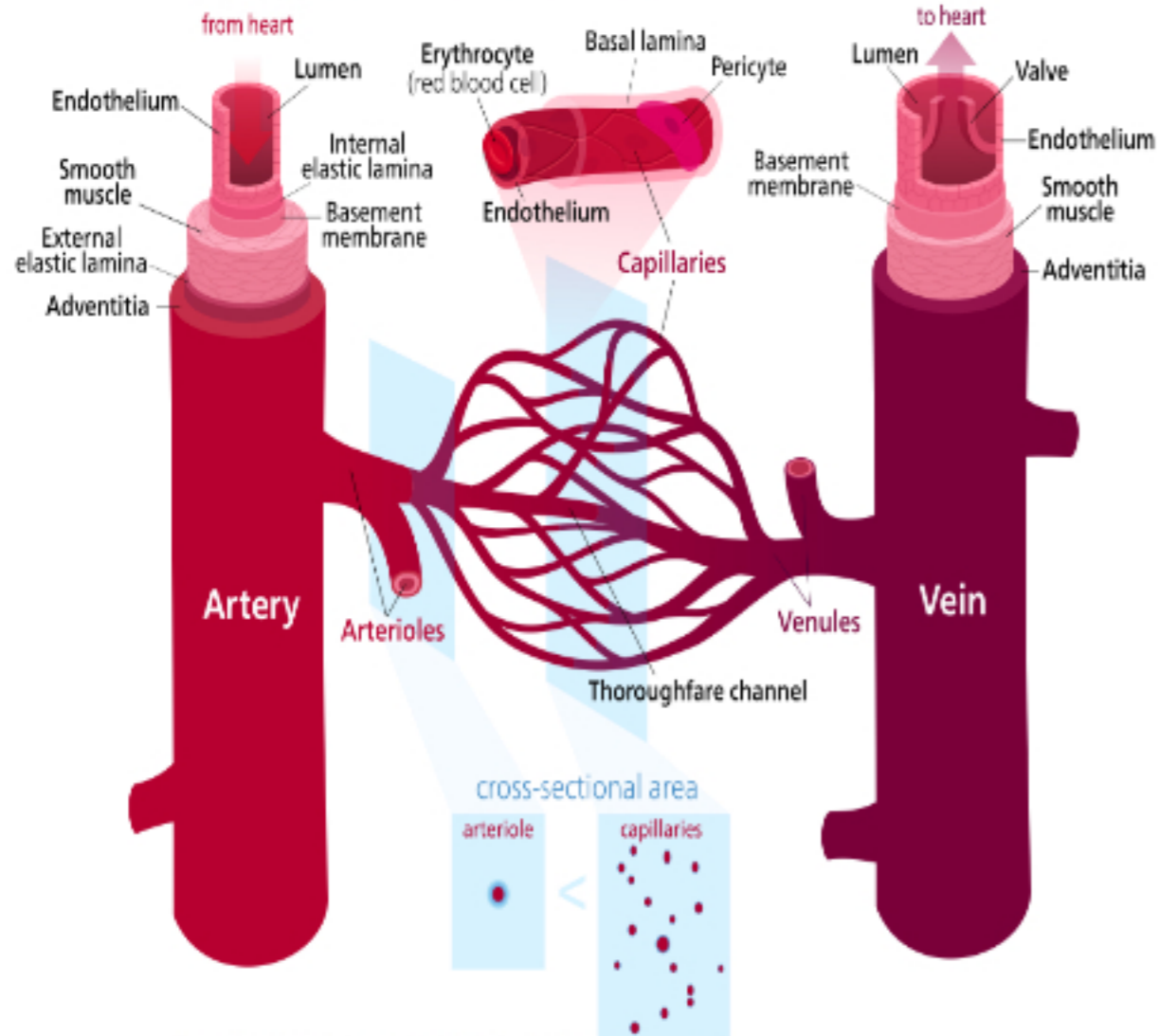
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- Heart is the pumping organ
- Working all day and night
- It has four chambers
- Atrium are at the top and Ventricles are at the bottom.
- Ventricles have thicker wall than the atrium.
- Left Ventricle have the thickest wall amongst all other chambers.

Heart



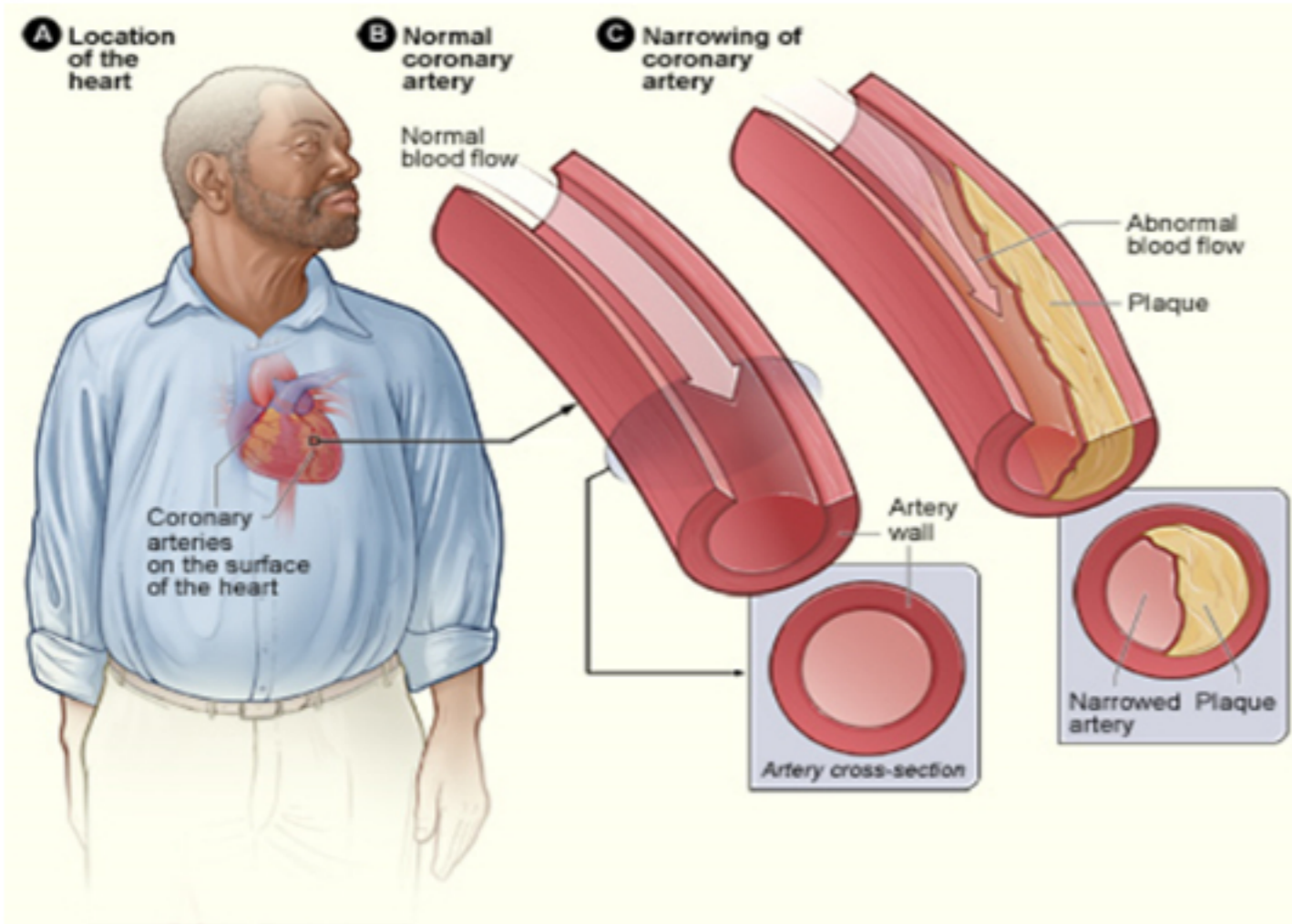
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Source: Wikimedia_Commons

BLOOD VESSELS

| ARTERIES | VEINS | CAPILLARIES |
|------------------------------------------------------|------------------------------------------------------|----------------------------------------------------|
| Carries the blood away from heart | Carries the blood to the heart | Connects arteries and veins |
| Has thick muscular elastic wall | Thin elastic wall | Once Cell thick |
| Narrow Lumen | Wider Lumen | Very small Lumen |
| They do not have valves | They have valves | They do not have valves |
| The blood flows at a high pressure | The blood flows at a lower pressure | The blood flows at a lower pressure. |
| They carry oxygenated blood except pulmonary artery. | They carry deoxygenated blood except pulmonary vein. | They carry both oxygenated and deoxygenated blood. |



Source: Wikimedia Commons

Coronary Artery that supplies the blood to the arteries become narrow.

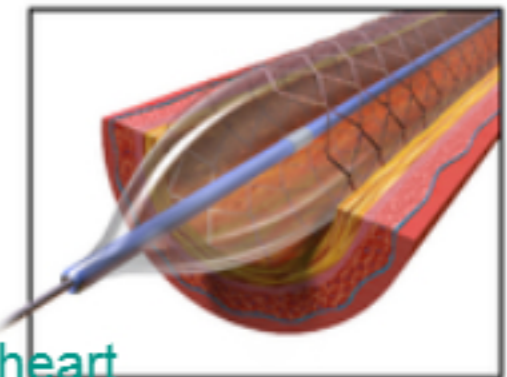
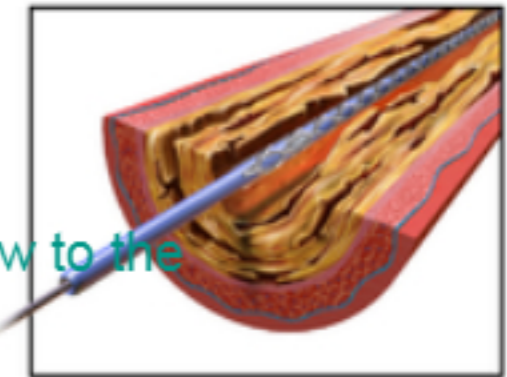
The fatty materials like cholesterol gets deposited and narrow the artery.

The narrowed artery reduced the blood flow to the heart.

The blood flow to the heart is reduced.

The heart do not get enough oxygen.

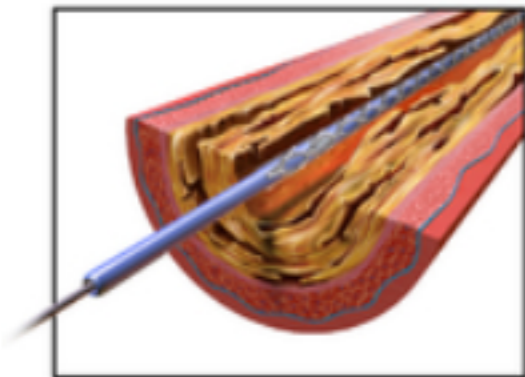
This causes heart pain, chest pain and heart attack.



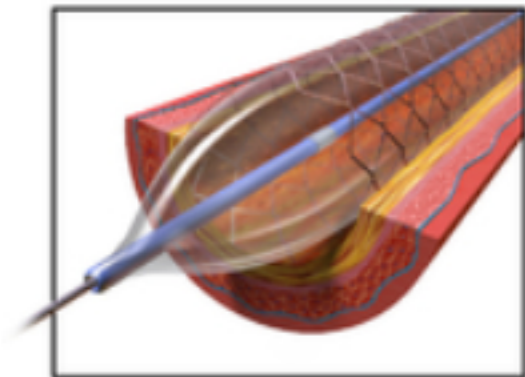
ANGIOPLASTY



→ A Sent is placed with the baloon in the blocked artery.



→ The blocked artery is opened by inflating the baloon.



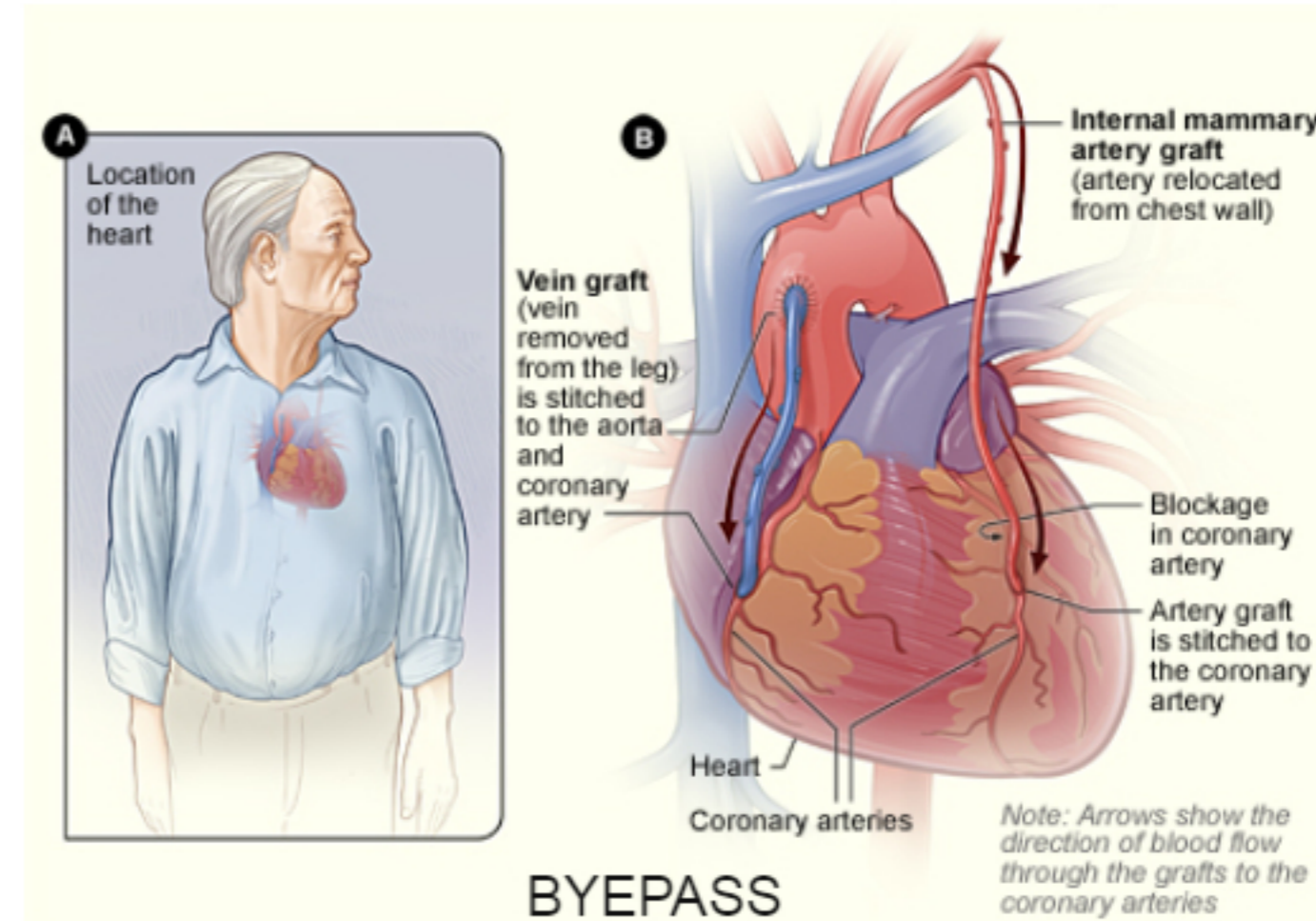
→ The metal mesh stent keep the stend in place.

→ This resumes the blood flow.

ANGIOPLASTY

→ People can also be given statin which lowers the blood cholesterol and prevent the deposition of the cholestrol.

The blood flow to the narrow artery is byepassed to the graft taken from another part of the body.



BYEPASS

Source: Wikimedia Commons



PROBLEMS TO THE HEART

LEAKY VALVES

Due to increases pressure of blood flow the valves start to leak.

VALVE REPLACEMENT

The valves made up of metal or polymers or the biological valves from animals can be used to replace the faulty valve

IRREGULAR HEART BEAT

The natural pacemaker which are the group of cells at the top of the right atrium that regulates the heart beat do not function properly.

ARTIFICIAL PACEMAKER

Electrical devices called the artificial pacemaker takes over the function of natural pacemaker.

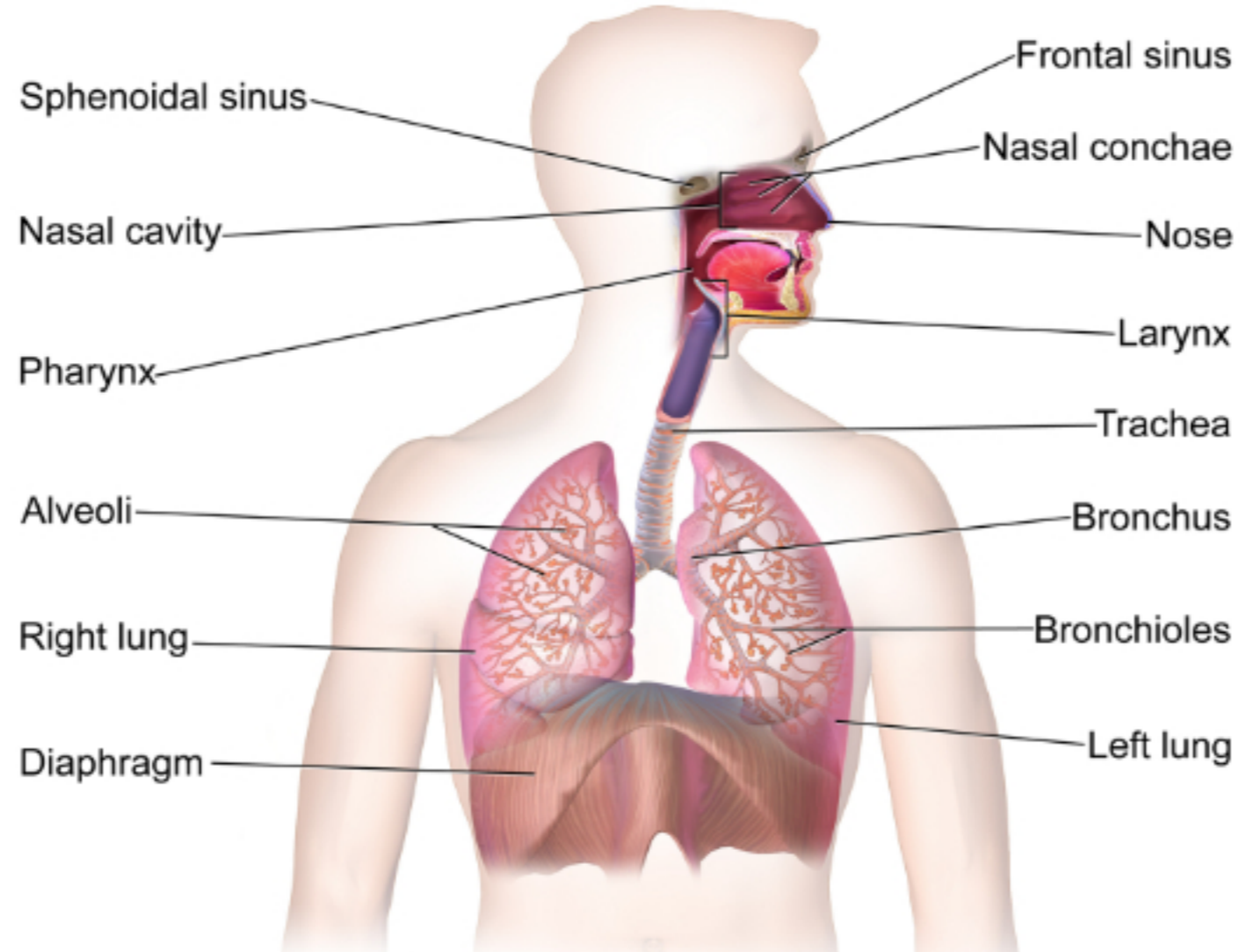
HEART FAILURE

When the heart do function properly

HEART TRANSPLANT OR ARTIFICIAL HEART

Artificial heart or heart transplant from the donor.

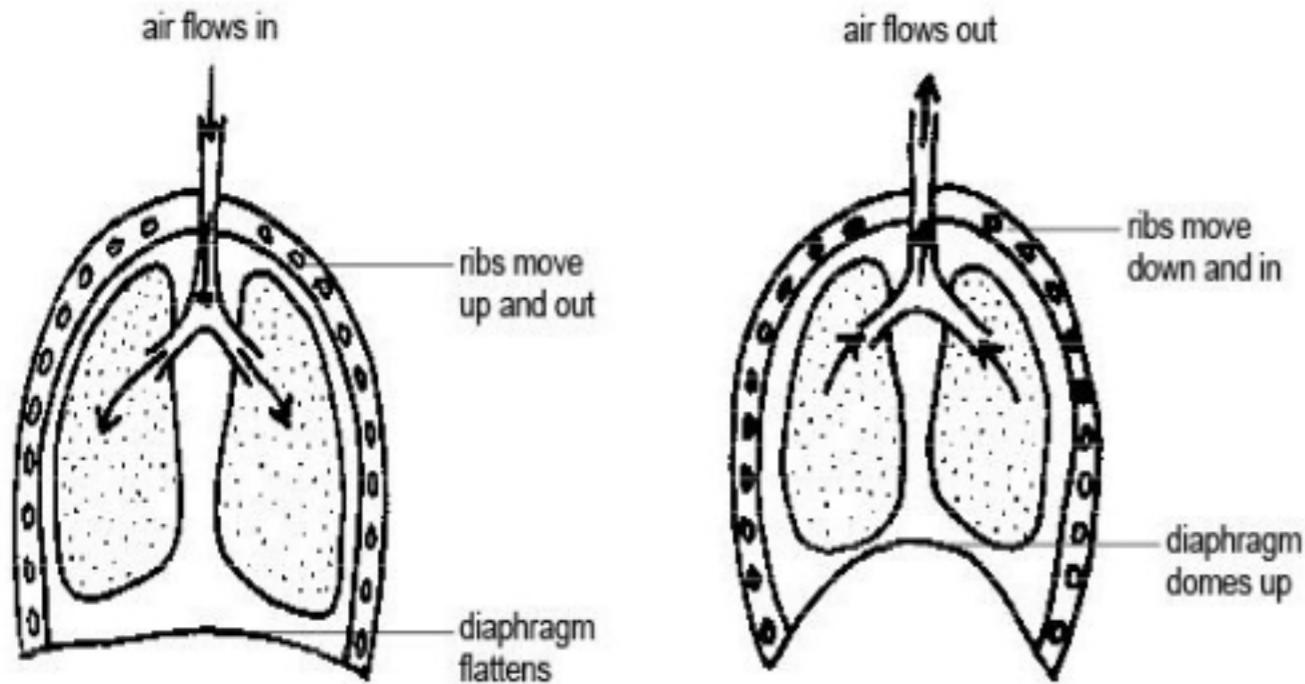
HUMAN GAS EXCHANGE SYSTEM



The Respiratory System

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MECHANISM OF BREATHING



Source: Wikimedia Commons

| INSPIRATION (Inhale) | EXPIRATION (Exhale) |
|------------------------------------------|-----------------------------------------|
| Pressure inside the lungs is low | Pressure inside the lungs is high |
| Volume of the lungs increases | Volume of the lungs decreases |
| Muscles contract and ribs moves outwards | Muscles relaxes and ribs move downwards |
| Diaphragm flattens | Diaphragm domes up |
| Air moves in | Air moves out |

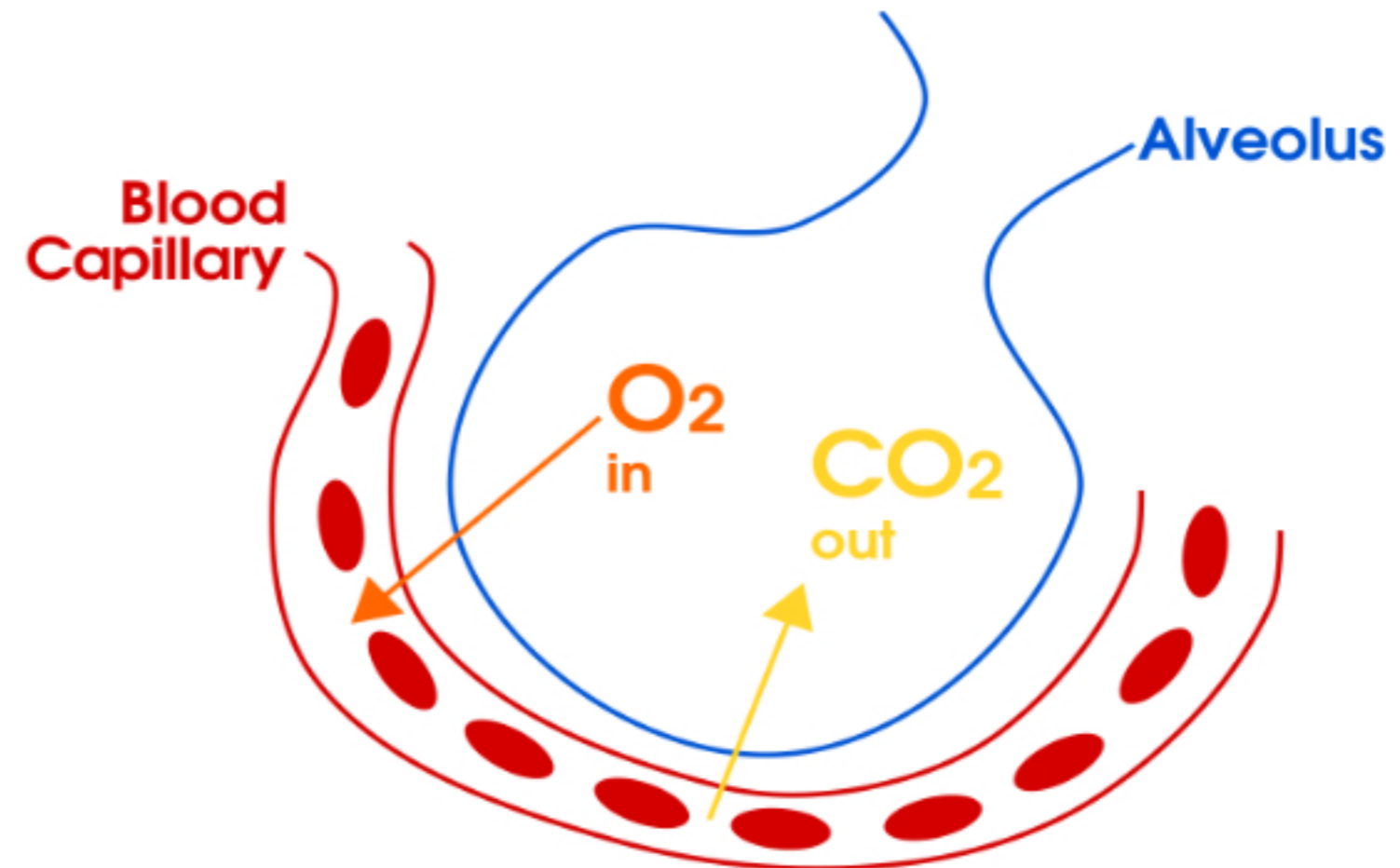
GAS EXCHANGE

ALVEOLI

GREATER SURFACE AREA

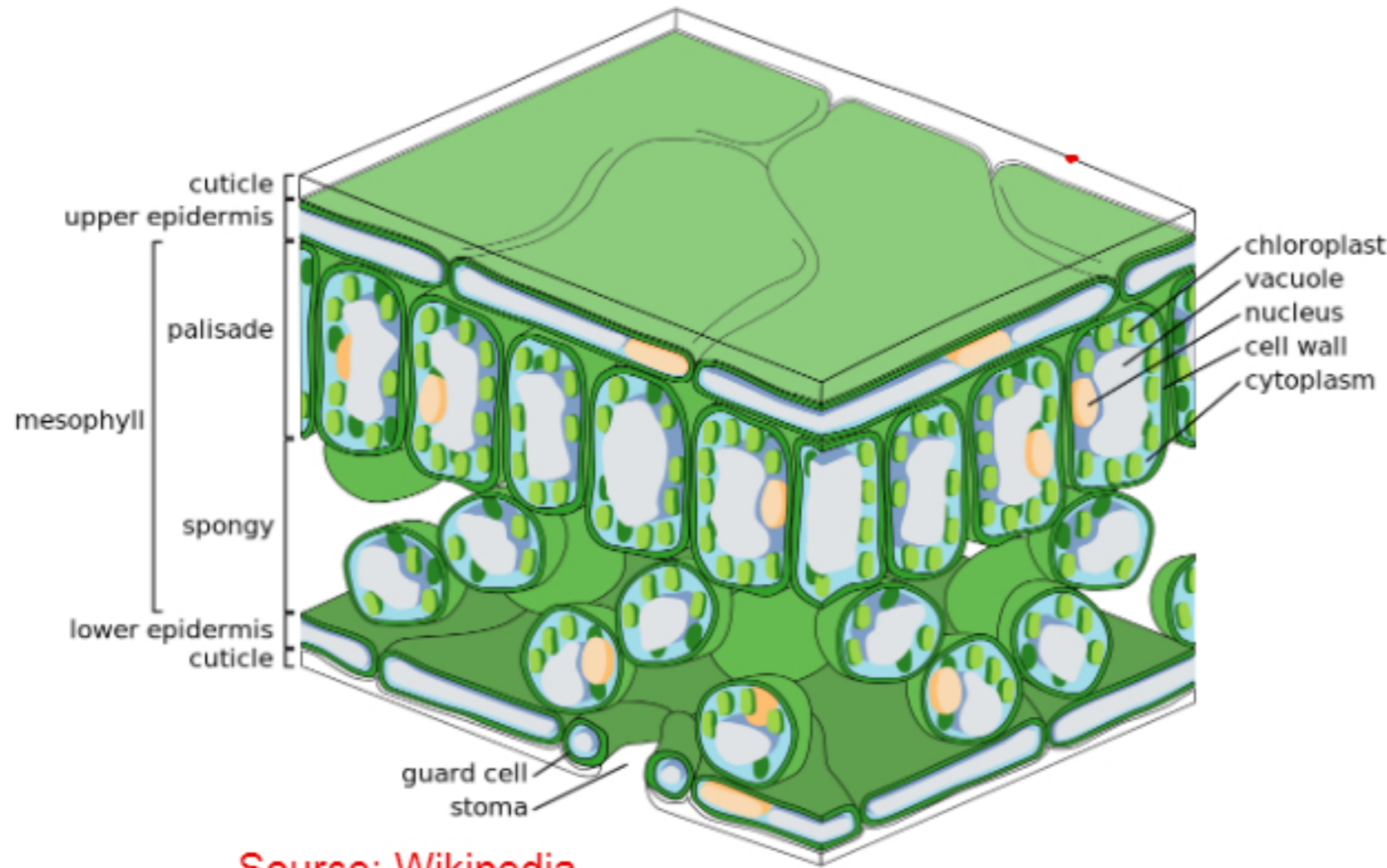
SHORTER DIFFUSION DISTANCE

STEEP CONCENTRATION GRADIENT

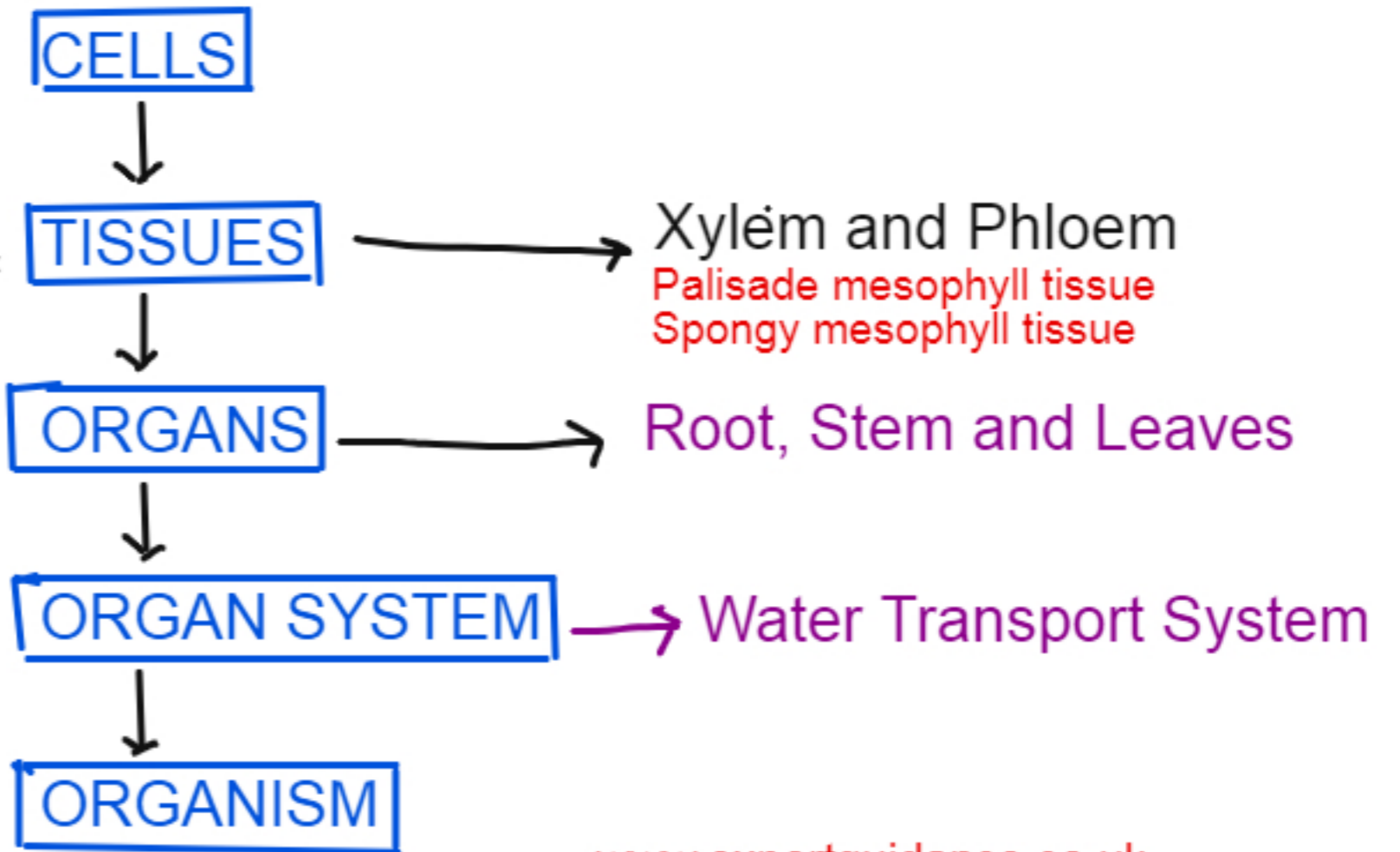


Source: Wikimedia Commons

ORGANISATION IN PLANTS



Source: Wikipedia

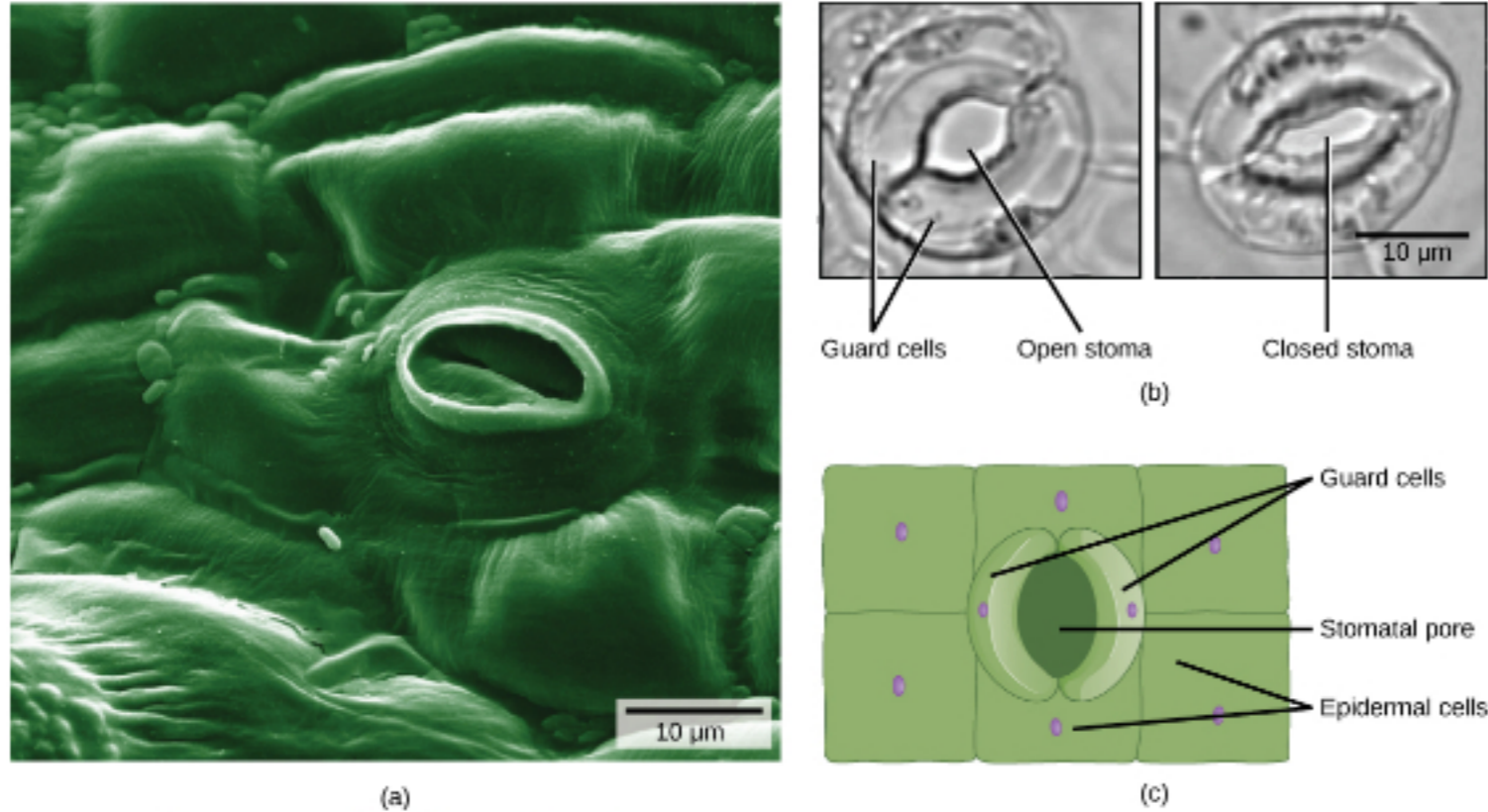


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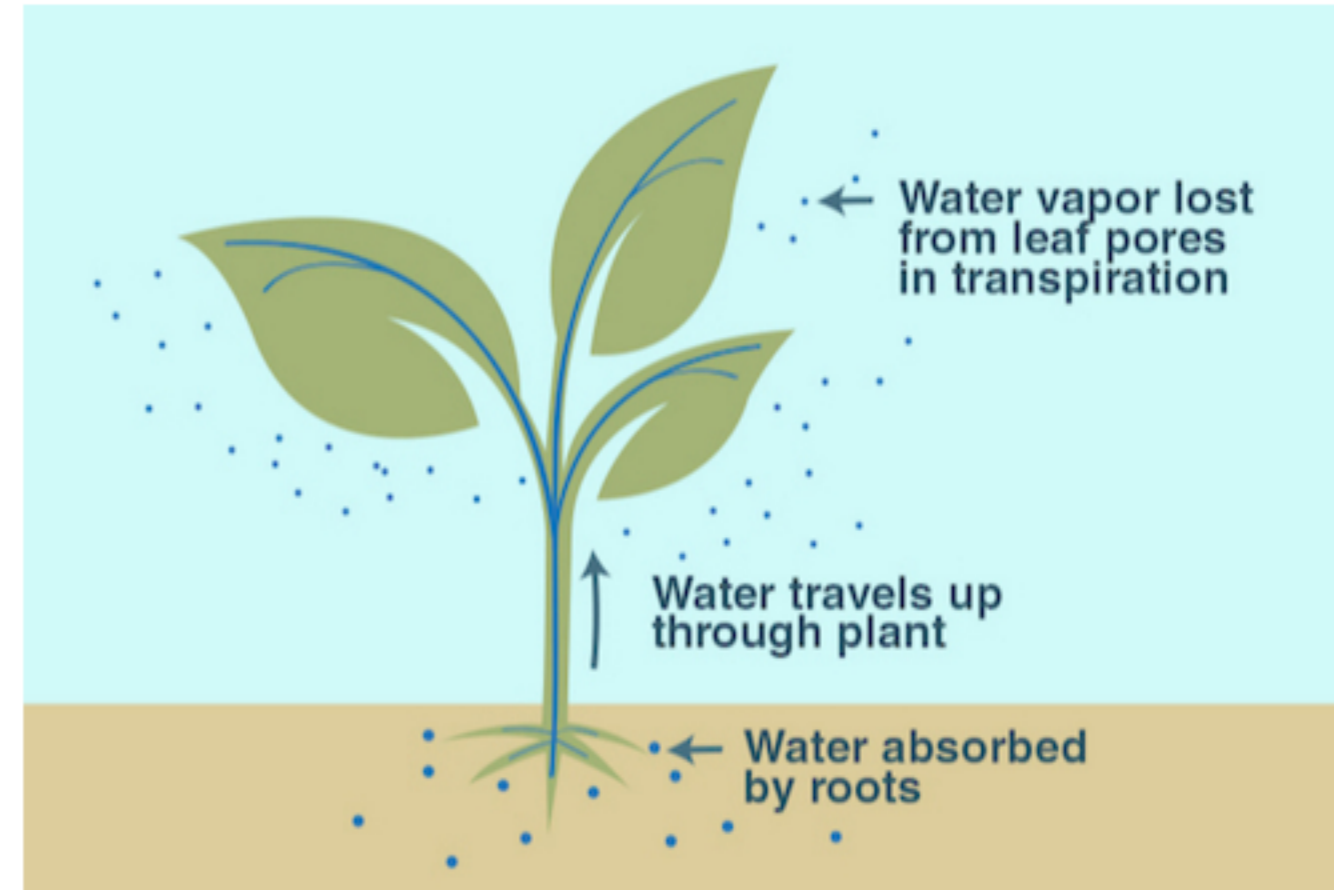
TRANSPIRATION

Transpiration is the loss of water from the surface of the leaves in the forms of water vapours.

In plants it takes place through the stomata.



Source: Wikimedia Commons



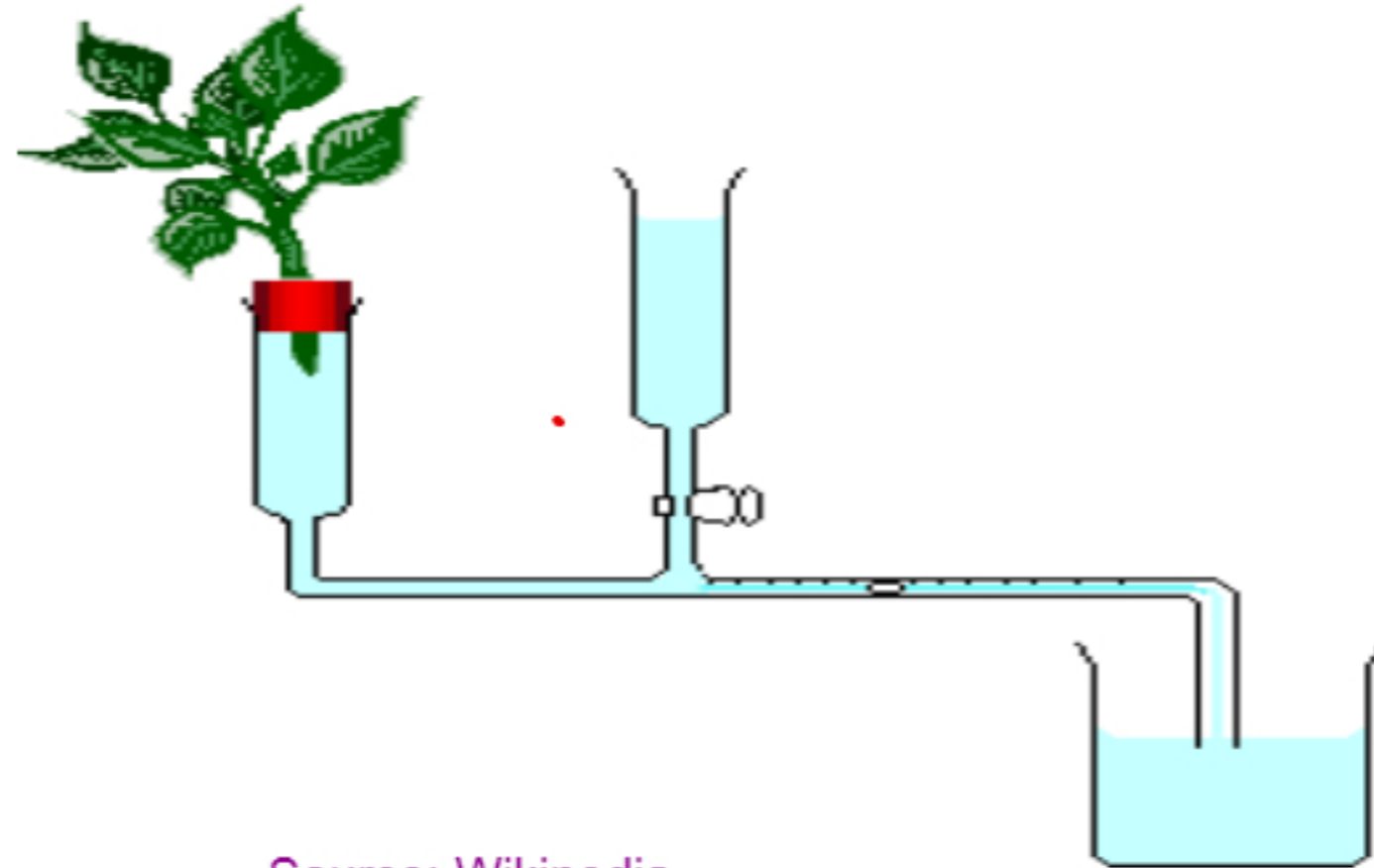
Source: NASA Climate Kids

FACTORS AFFECTING TRANSPIRATION

| FACTORS | DESCRIPTION | EXPLANATION |
|-------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Temperature | Rate of transpiration increases with temperature | Particles gain more kinetic energy. Evaporate faster |
| Light | Rate of transpiration increases with light | Photosynthesis increases. Stomata opens to get more carbon dioxide Rate of transpiration increases. |
| Wind | Rate of transpiration increases with wind speed | Wind removes saturated air. |
| Humidity | Rate of transpiration decreases with humidity | Humid air is already saturated with water vapour so diffusion rate is slow. |

MEASURING RATE OF TRANSPIRATION

Potometer is the device which is used to measure the rate of water uptake or the rate of transpiration.



The movement of bubble is an indicator of water movement which in turn shows the rate of transpiration

Source: Wikipedia

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ADAPTATIONS TO LIMIT TRANSPIRATION

Cuticle layer on the leaf which is waterproof prevent rate of transpiration

Stomata are present on the lower surface to reduce rate of transpiration.

Some plants stomata open is night and closes in day.

In plants like cactus the leaves are reduced to spines to decreases the surface area for water loss.

Some plants have sunken stomata.



Source: Pixabay

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Cells

Tissues

Organs

Organ System

Digestive System

Oesophagus

Stomach

Liver

Pancreas

Small Intestine

Large Intestine

Substrate

Active Site

Carbohydrates

Proteins

Fats

Enzymes

Catalyst

Denaturation

Amylase

Protease

Lipase

Bile

Emulsification

Plasma

Red Blood Cells

White blood Cells

Plasma

KEY TERMS !!!!!

TEST YOURSELF

Ateries

Veins

Capillaries

Double Circulatory System

Coronary Arteries

Stents

Statins

Pacemaker

Xylem

Phloem

Transpiration

Translocation

Potometer

Stomata

Guard Cells

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NEXT STEP !!!!

★ CHECK SPECIFICATION

★ EXAM QUESTIONS

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