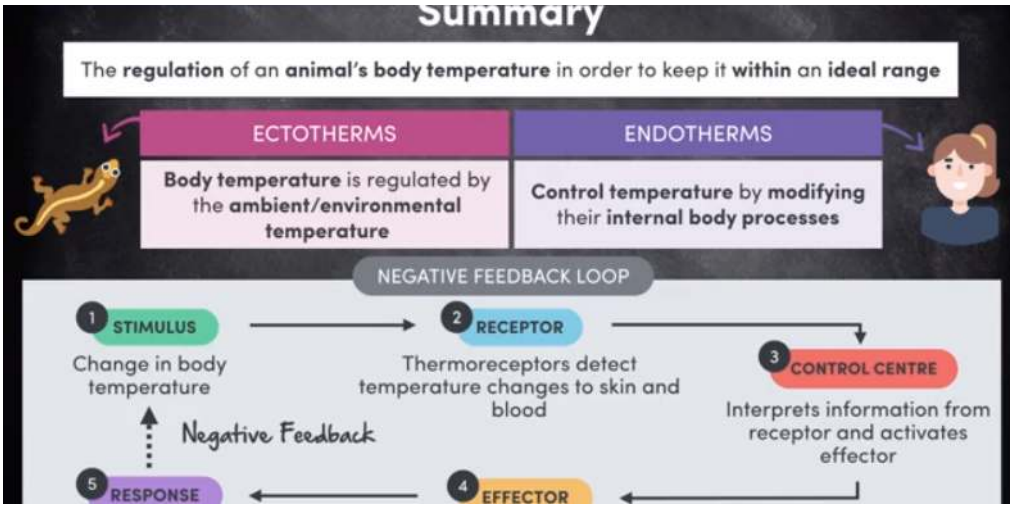
MODULE 8: Non-infectious Disease and Disorders

Content: Homeostasis

1. Inquiry question: How is an organism's internal environment maintained in response to a changing external environment?

<table>
<tr>
<td>1.1 construct and interpret negative feedback loops that show homeostasis by using a range of sources, including but not limited to:

(a) temperature</td>
<td>Thermoregulation: the regulation of an animal's body temp in order to keep it within the ideal range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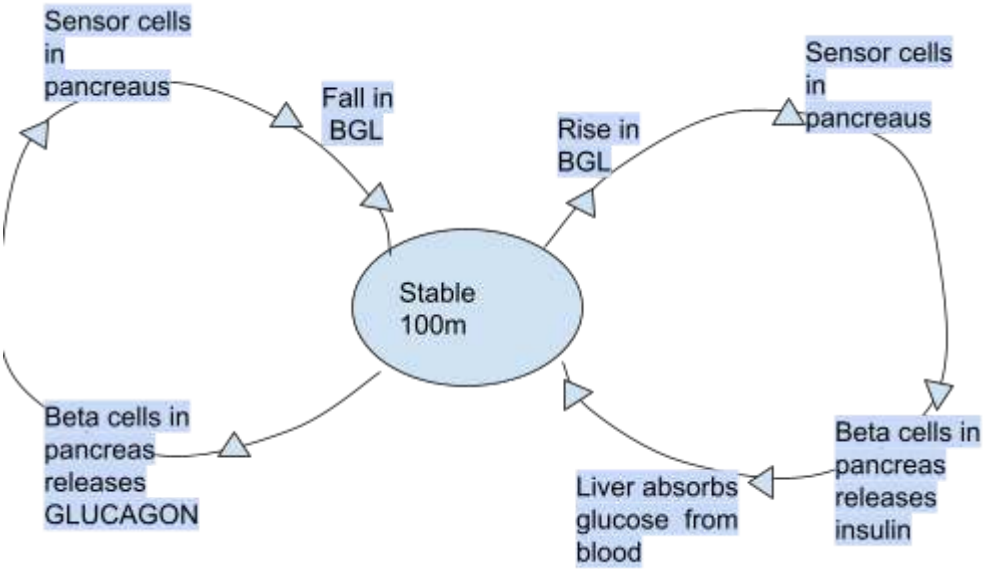
<td>(b) glucose</td>
<td> 
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<tr>
<td>1.2 investigate the various mechanisms used by organisms to maintain their internal environment within tolerance limits, including:

(a) trends and patterns in behavioral, structural and physiological adaptations in endotherms that assist in maintaining homeostasis</td>
<td>Up nextQuiz: Thermoregulation15 min quiz

- Behavioral → relate to organism behavior
- Structural→ relate to size/shape = body part
- Physiological→ ho organism boyd work</td>
</tr>
</table>

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<td></td>
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<table>
<tr><th>Temp</th><th>Behavioral</th><th>structural</th><th>Physiological</th></tr>
<tr><td>Cool down</td><td>-Seek shade
-Cool in water
-Licking for cooling
-Stretch out</td><td>Large ears ↑ SA:V = heat loss

Thin forearm skin</td><td>-sweating+blood vessel dilation

↑ blood flow to extremities</td></tr>
<tr><td>Retain heat</td><td>-hibernation
-migration
-huddling</td><td>-insulation(fat/ fur)
-smaller SA:V= minimize loss</td><td>↓ blood flow to extremities
-Shivering
- ↑ metabolisms</td></tr>
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<tr>
<td>(b) internal coordination systems that allow homeostasis to be maintained, including hormones and neural pathways</td>
<td></td>
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<tr>
<td>(c) mechanisms in plants that allow water balance to be maintained</td>
<td>
ALREADY DONE FOR TRIALS
Plant Mechanisms for Water Balance
* For optimum osmotic levels for metabolism and water regulation (transpiration)
Structural Adaptations:
° thin leaves, waxy cuticle, sunken stomata on only one side, deep/ extensive root systems → aus. sclerophyll plants minimise water loss.
° decrease photosynthesis + close stomata reduce transpiration
° hairs on leaves and roots
° fleshy leaves that store water → succulents.
</td>
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Content: Causes and Effects

*2. **Inquiry question:** Do non-infectious diseases cause more deaths than infectious diseases?*

2.1 investigate the causes and effects of non-infectious diseases in humans, including but not limited to: (a) genetic diseases	**Genetic disorders** - inherited diseases **ALTERED or incorrect expression of a gene that causes disease is passed on** - **The production of the protein coded for by that gene is altered** - **- either to much or too little** **(**  **DISEASES INC** - **huntington's disease** - **Cystic fibrosis** - **Trisomy 21** → **CAUSE** **3 chromosomes 21"s. Which is caused by abnormal cell division(no disjunction of chromosomes)** **→ EFFECT** - **Heart defect** - **Learning problems** - **hearing/vision problems**
(b) diseases caused by environmental exposure	**Environmental diseases** - caused by exposure to harmful substances Environment factor can trigger disease wihtin an organism lifetime

	EG SKIN CANCER - CAUSE Caused by excessive and unprotected exposure to UV light from the sun. - EFFECT UV creates changes in the skin cell DNA, creating continuous abnormal cell division
(c) nutritional diseases	**Nutritional diseases** - caused by poor nutrition **A disease or disorder caused by undereating,overeating or an** imbalance of nutrients → UNDERNUTRITION - Stunting (height) - Wasting (low weight) - Underweight(low for ages - Micronutrient deficiencies → overnutrition - Obesity - Diet related EG **SCURVY** **→ cause** - Lack of vitamin C

	→ **effect** - Impaired immunity - Wound don't heal and old wound open -
(d) cancer	**Cancer** - uncontrolled cell division in a part of the body, with these cells failing to coordinate with surrounding cells and not differentiating to become specialized cell A group of non infectious disease which have unregulated and abnormal cell growth Caused by genetic mutation a which can be triggered by environmental carcinogens 1. Mutations **damage the proto oncogenes/tumor suppressors genes** 2. **↑ cell division** 3. **Suppression of programmed cell death(apoptosis)** **carcinogen=cancer causing agent(eg uv or tobacco** ○ **Carcinoma: cancer of the epithelial tissue, e.g.**

	skin **o Sarcoma: cancer of the connective tissue, e.g. bone, fat, muscle, blood vessel** **o Leukaemia: cancer of the bone marrow and thus blood cells** **o Lymphoma: cancer of the immune system or lymphatic system** **→ BENIGn** **Clell ramin in boundary of tumor= no spread.** **Can become cancerous if not treated** **→ MALIGNANT** **No convinced by boundary- spread in disorganized manner than normal cells** **+** redirect nutrients to themselves rather than to souring normal cells. **metastasis.** The process of spreading to other parts of the body
2.2 collect and represent data to show the incidence, prevalence and mortality rates of non-infectious diseases, for example: (a) nutritional diseases	TYPE 2 DIABETES - Body becomes resistant to insulin→ gradually unable to produce it - = build up of glucose in blood= damage INCIDENCE - No. quadruples over past 30 yrs - Predicted ↑ adults between 2010-2030

	PREVALENCE - Males = higher prevalence than females - Highest prevalence %75+ ⇒ 19.2% MORALITY - Currently 5 mil deaths per year→ CVD(cardiovascular disease) - Type 2 expected to be 7th most prevalent cause of death globally →2030 -
(b) diseases caused by environmental exposure	**- Most lethal type of skin cancer, developing from mutations of Melanocytes** **INCIDENCE** **21.5 per 100,000 new case/year** **PREVALENCE** - **53.5 per 100,000 have melanoma** - **1 in 13 in males or 1.23 females diagnosed by 85** - **MORTALITY** - **4.0and Deaths per 100,000**

Content: Epidemiology

3. ***Inquiry question:*** *Why are epidemiological studies used?*

3.1 analyze patterns of non-infectious diseases in populations, including their incidence and prevalence, including but not limited to: (a) nutritional diseases	***Epidemiological studies*** - ***Epidemiological studies can identify the causes of disease and the ways in which the disease can be cured or managed.*** - ***All epidemiological studies require long time periods, large sample sizes (ideally thousands), data collection both on the participants and on the disease, randomized participant selection, control measures, statistical analysis, and ethical management.***

EPIDEMIOLOGY:

Epidemiology: the study of patterns of the distribution of disease in populations

An epidemiological study can:

- Determine the cause of a disease and which populations are affected by the disease
- Help to develop strategies to control the disease and improve public health
- Evaluate the effectiveness of strategies in place to treat and control disease

➔ information can then be used to identify areas and ways in which the overall health of the population can be improved.

Estimated total number of adults (20 – 79) living with diabetes in 2015

ieneral trends:

- Affects older age groups at a higher rate
- Affects lower socioeconomic groups at a higher rate

Incidence	- Incidence has quadrupled over past 3 decades - 1.4 million new cases per year in the U.S.
Prevalence	- 1 in 11 adults age 2ff – 79 had diabetes in 2ff15 - Epicentre of epidemic = China and India
Mortality	- 5 million deaths per year - Expected to become 7th most prevalent cause of globally by 2ff3ff

(b) diseases caused by environmental exposure

3.2 investigate the treatment/management, and possible future directions for further research, of a non-infectious disease using an example from one of the non-infectious diseases categories listed above

Treatment:

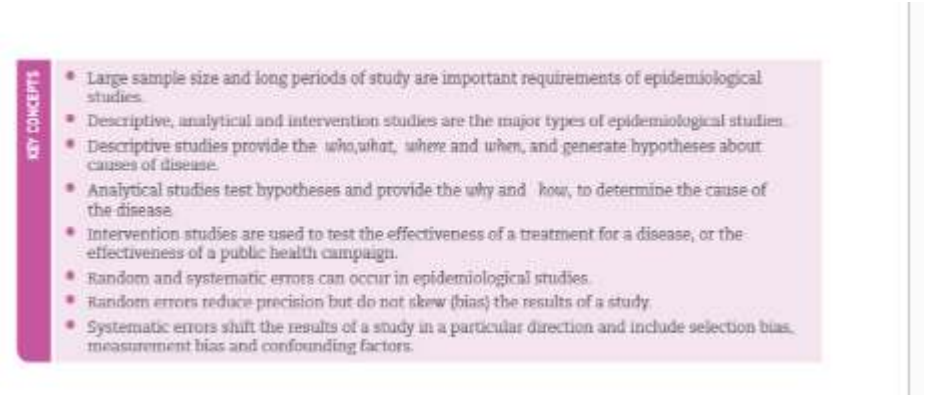
- ***Medical care given to patient for illness or injury***

MANAGEMENT:

- ***Healthcare interventions***
- ***Aim to reduce symptom and prevent complication***

TYPE 2 DIABETES

→ Prevention

	Identification of at risk group (genetic testing) - maintaining normal weight.eating ehealth and varied diet *Treatment and management* - *Gradual responses upon severity* - *Lifestyle change* - *Medication* - *Insulin injection* - *→ future directions* - *Synthetic insulin* *→GENETIC ENGINEERING* - *Whole organ transplant* *→ create pancreatic tissues*
3.3 evaluate the method used in an example of an epidemiological study	 *METHODS* *Descriptive studies: study patterns across population* - *Cross sectional study* ***hypotheos*** *Analytical - study testing hypothesis* - *Cohort→ disease vs heath* **involve studying 2 groups of people who are free of disease but differ in 1 factor (the potential cause of the disease). A long time later (years, decades) the incidence of disease in the 2 groups is compared.** - *Case-control study* compare people with the disease (case) with people who do not have the disease (control) case control - starts with group WITH disease and group WITHOUT the disease. cohort - starts WITHOUT the disease *Intervention studies*

	RCT ***study to measure effectiveness of an intervention*** ***- Controlled:*** ***- Quasi-experimental: researcher chooses the subjects who receive the drug/treatment*** ***PROVE HYPOTHESIS*** *data collection methods vary for each epidemiological study, depending on its purpose.* **EVALUATION** *Lulu the large red country queen smells* - *L: long period of time* - *L:large sample size* - *R:range of date(if case/control study* - *C:control groups used(cohort study)* - *Q:quantitative date on I,P,M* - *S:tatiscal analysis* *→ ERRORS* - *Random errors: random inconsistencies* - *Systematic errors: bias either selection bias for ino bias*
3.4 evaluate, using examples, the benefits of engaging in an epidemiological study	**KEY BENEFIT IS SAVING LIVES** epidemiological studies help to identify risk factors, determine the resources needed for health care, education and research, and develop targeted public health interventions that are cost and resource effective. **Example: The link between sun exposure and skin cancer** **Example: The link between exposure to thalidomide during pregnancy and birth defects** In the late 1950's more than 10 000 cases of birth defects were reported in over 46 countries. Babies were born with missing or abnormal legs, arms, feet and

	hands; spinal cord defects, absent or missing ears. By the early 1960's epidemiological studies had found the link between severe birth defects and the drug thalidomide. Thalidomide was first marketed in 1957 for morning sickness and was widely used. **Example: The link between exposure to asbestos and mesothelioma.**

Content: Prevention

1. *4. Inquiry question: How can non-infectious diseases be prevented?*

4.1 use secondary sources to evaluate the effectiveness of current disease-prevention methods and develop strategies for the prevention of a non-infectious disease, including but not limited to:

(a) educational programs and campaigns

Campaign and non Infectious disease and type	Quit campaign - NATIONAL TOBACCO CAMPAIGN (from late 1990's) environmental exposure - lung cancer	Slip, slap, slop, seek, slide campaign. Skin Cancer - environmental exposure
Non-infectious Disease (and type)	LUNG CANCER	SKIN CANCER
Identify and outline the current education and prevention campaign you have been assigned	QUIT CAMPAIGN -	
What are some advantages of this education and prevention campaign?	- Slogans - Graphic image in media and on cigarette packages- highlight danger - National helpline - Showing people with life cancer in their own life situations Helping people to quit smoking or never start - Better health for australians - Reduced financial cost for out health system Supported by government legislation. Increase taxed on cigarettes, ban on smoking .	It was a comprehensive , integrated community awareness campaign. Health promo campaigning has been implemented by specific government policy decisions - Simplicity -
What are some limitations/disadvantages of this education and prevention campaign?	To be effective , campaigns need to be repetitive. Smoking is very addictive so not east to Qouit on the 1st try	Somwtimes get's old , needs refreshing. Melanomas in the 60+ age bracket continue to climb

(b) genetic engineering

Example 1: preimplantation genetic testing

Analyzing offspring DNA and removing the faulty genes that code for genetic disorders, thus Preventing non infectious disease from occuring in offspring

PGT involve testing 3 day old embryos for a specific gene mutations associated with a known disease b4 transplantations

Near 1oo% effective

Example 2: transgenic foods, eg. golden rice

Transgenic crops are being developed to prevent nutritional disease

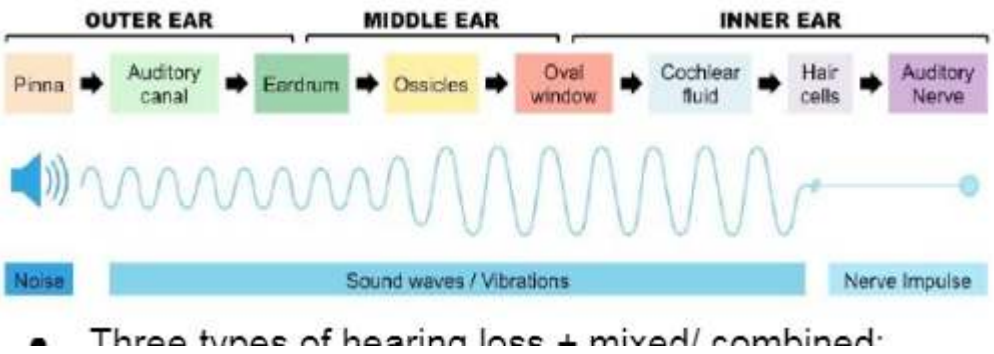
Over comes vitamin a deficiency

(preventing blindness and compromised

	immune system

Content : Technologies and Disorders

1. **Inquiry question**: How can technologies be used to assist people who experience disorders?

5.1 explain a range of causes of disorders by investigating the structures and functions of the relevant organs, for example: AND	
a. hearing loss	STRUCTURE AND FUNCTION  • Three types of hearing loss + mixed/ combined: **OUTER EAR** -

STRUCTURE	**FUNCTION**
Pinna (fleshy external part)	Collect and funnel sound waves
Ear canal (passage=bone and skin)	Leads sound wave to ear drum
Ear drum (membrane between outer or middle)	Vibrates →response to sound in same frequency

- **MIDDLE EAR**

STRUCTURE	**FUNCTION**

Ossicles (3 bones :malleus, incus and stapes)	amplify/transmit vibrations Eardrum→ oval window
Oval window(thin flexible membrane)	Transmits vibration Staples→ fluid in cochlea

- **INNER EAR**

STRUCTURE	**FUNCTION**
Cochlea (snail shaped tube filled with fluid Inside **Organ of corti (** hair cells within cochlea)	Hair cells= sound receptors **WHEN BENT THEY GENERATE NERVE IMPULSES**
Auditory Nerve	Transmits nerve impulse to brain for interpretation

WHEN OVAL WINDOW VIBRATES→ FLUID IN COCHLEA VIBRATE

BASILAR ,MEMBRANE FLEXES ⇒ BENDING THE HAIR CELLS

Types of hearing loss

- **C**onductive hearing loss

When vibrations cannot be transferred effectively through the outer and middle ear

Deafness caused by damage to the **outer or middle ear**

- **Auditory** processing disorder

Due to **defects** in the **Auditory** areas of the brain

- **T**innitus

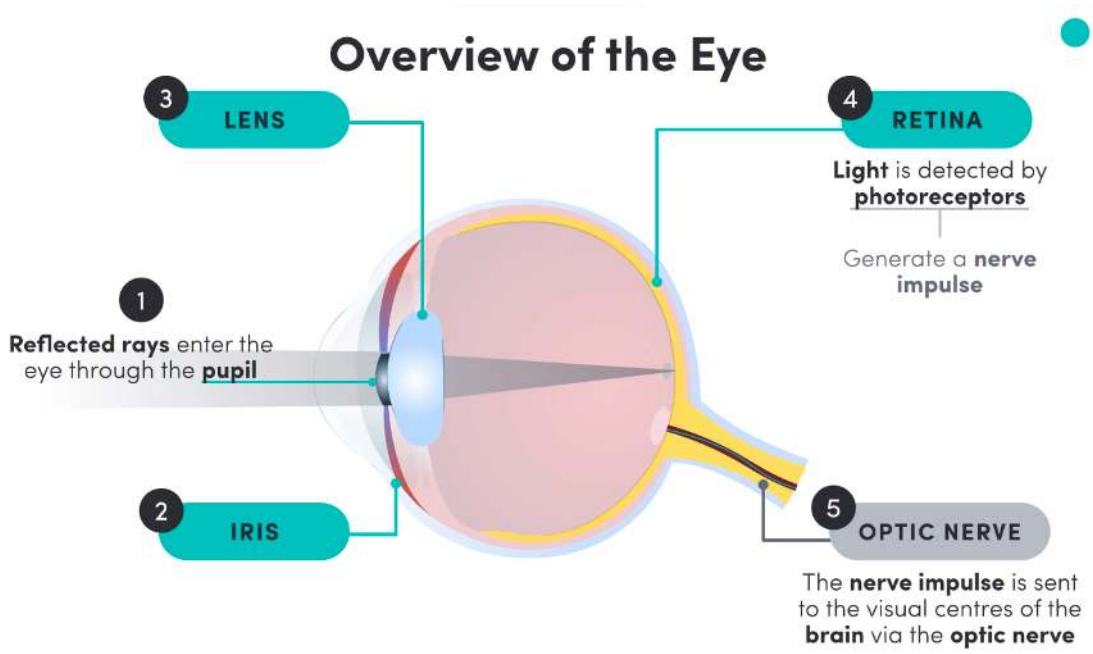
Broad term for hearing a ringing in the ears

- **S**ensorineural hearing loss
-

Deafness cause any damage to the inner ear or nerve pathway from the inner ear to the brain- eg excessive noise exposure / aging

-

b. visual disorders



Structure and function of key parts of the eye

STRUCTURE	**FUNCTION**
Iris(ring of pigmented muscle tissue)	- Controls pupil sizes and the amount of light entering the eye **Help us deal with light at different intensities** - bright=constricted - Dim light= dilated
Lens - Transparent - Biconvex protein disc - Bulging shape	- - - Adjusting it's thickness to bend light → focus directly on retina - DISTANT objects= littles bending→ parallel light rays CLOSE objects: light rays diverge = more demanding to be focused **THIS IS CALLED ACCOMMODATION** (lens job= helps us see object at different distances away from us()
Vitreous humor Jelly like fluid	Fluid that allows light to be transmitted
Retina - Thin layer of photoreceptor cells- inner back of eye - Specialise neuron -- light sensitive pigment	After light has passed all components of the eye⇒ hits rods aNd cones → when episode to light→ change shape ⇒ generate electrochemical signal ↓

	1. **RODS** Don't detect color- best a night/low levels of lo=ight 2. **CONES** Detect color and work best in bright light	Sent to brain for interpretation

VISUAL DISORDERS-

→ Myopia (short sighted)

- Blurry vision of object **far away**
- Light gets focused **in front of the retina**
- Either shape of **eye is too long** or curve of **cornea is to steep**

→ Hyperopia (far sighted)

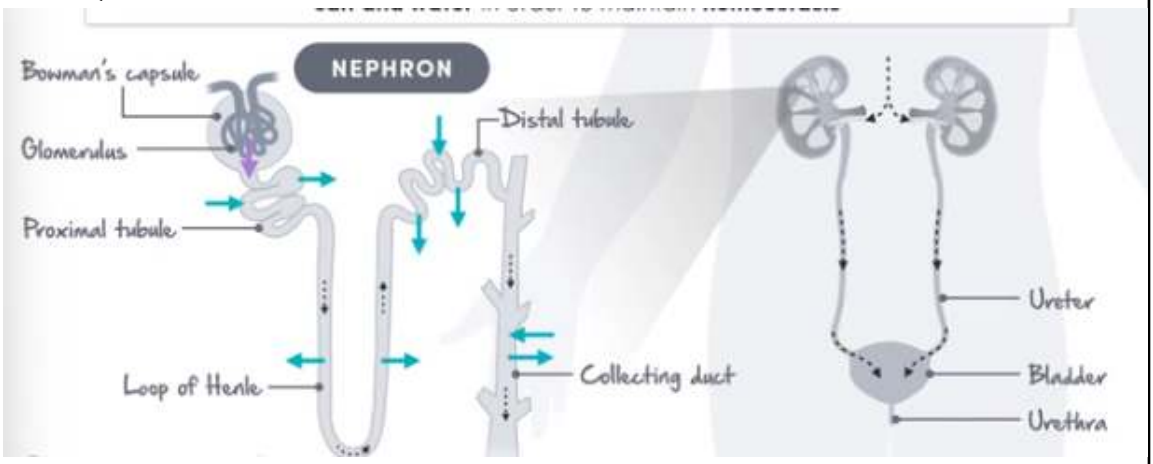
- Blurry vision of object **close up**
- Light gets focused **behind the retina**
- Either shape of **eye is too short** or curve of **cornea is to flat**

→ Astigmatism (vision is blurred at all distances)

- Light focus in 2 places
- Can be caused by curve of cornea or lens
  - **Corneal:** curve of cornea is asymmetrical
  - **-Lenticular:** curve of lens is asymmetrical

c. loss of kidney function

The kidney is responsible for the filtering the blood and excreting excess wastes, salt and water in order to maintain homeostasis

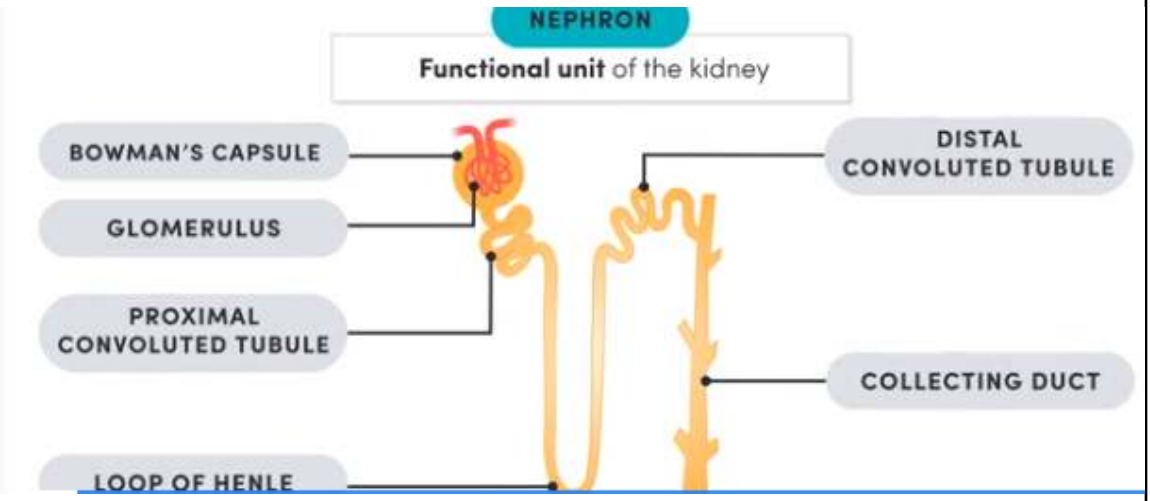


Structure and function

- Inside each nephron; glomerulus (special blood vessel) keeps blood cells and needed substances whilst filtering out extra fluid and wastes
- Each kidney contains a million nephrons
- Blood enters through renal artery where it is then filtered and cleaned
- Urine is produced from urea in blood, travels through

ureters to the bladder

- **STRUCTURE**



FUNCTION

- **Filtration**

Blood enters glomerulus → large blood cells/proteins are not filtered into the bowman's capsule)

The glomerular filtrate that enters the semi permeable tubule

- **Reabsorption and secretion**

Useful substances are passively reabsorbed into the blood as the fluid travels along the tuble

- **excretion**

Substances that aren't reabsorbs exit nephron via collection ducts
This is transported as urine. This is taken via the ureter to be stored in the bladder

Loss of kidney function

When kidney cannot remove waste from blood+control fluid level

Nephrosis : body excretes too much protein in urine

→ CAUSES

- Diabetes
- High blood pressure
- Polycystic kidney disease

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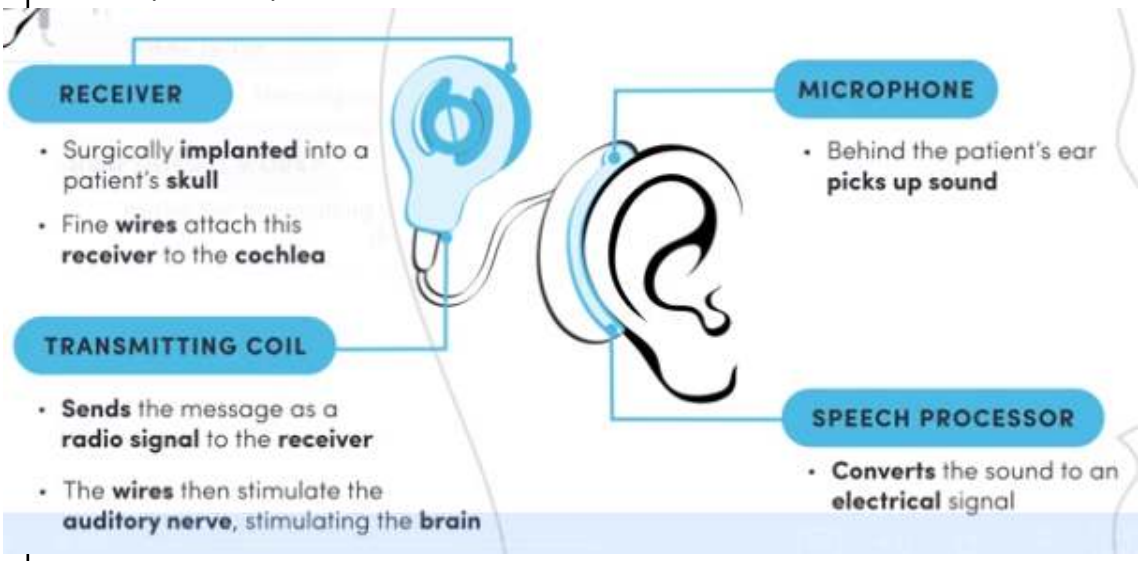
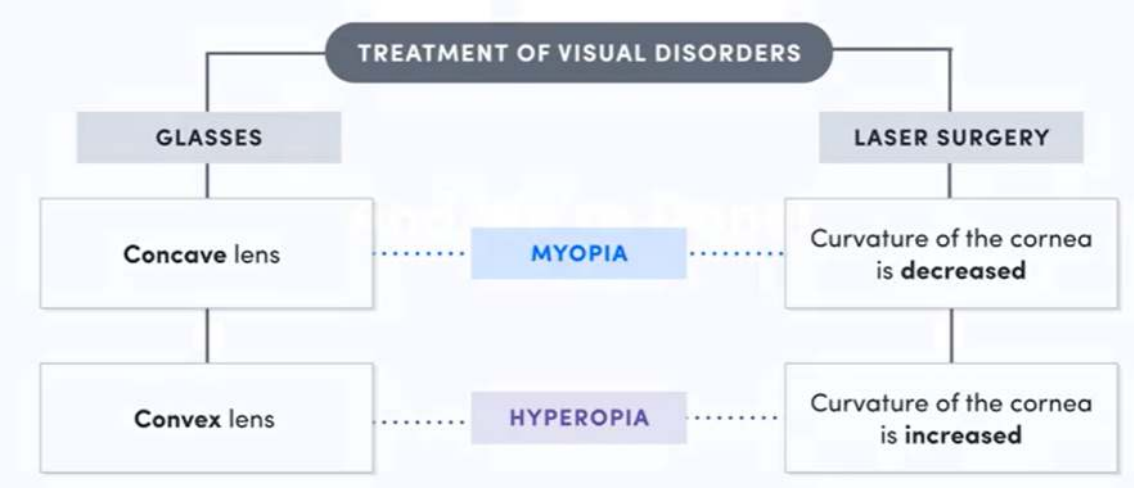
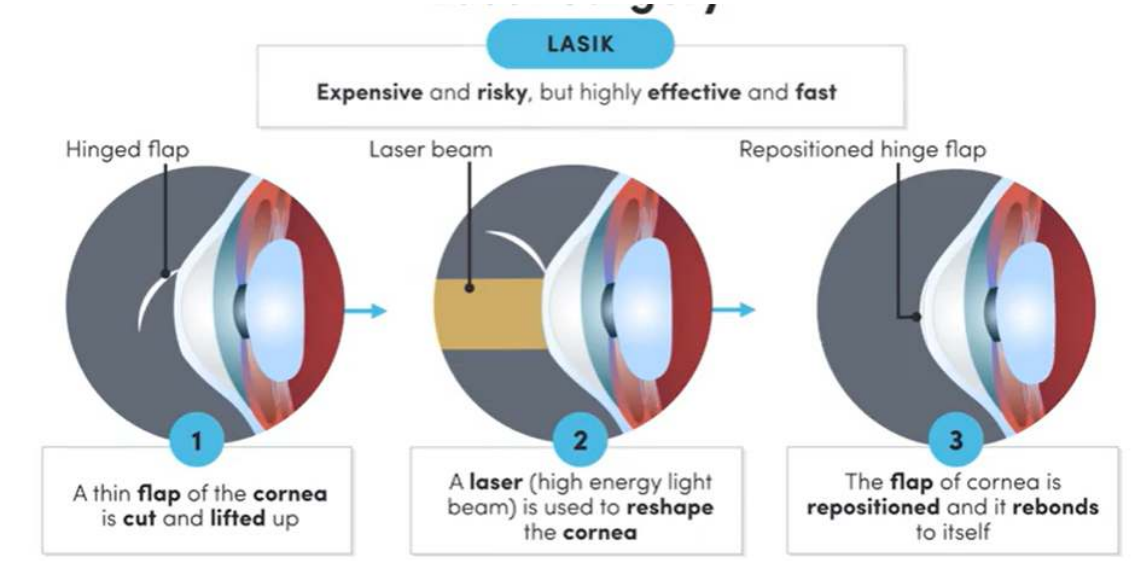
5.2 investigate technologies that are used to assist with the effects of a disorder, including but not limited to: (ACSBL100) a. hearing loss: cochlear implants, bone conduction implants, hearing aids	**HEARING AIDS** Amplifies sounds way that enter the external ear - Microphone (receives soundwave and turn them into electrical energy - Amplifier(makes signal stronger_ - Receiver (changes energy into sound energy) - speaker(direct sound energy into ear canal For people with mild- severe hearing loss - Sensorineural and conductive **HOW DOES IT WORK?** It **amplifies** sound waves within the **ear canal**, by making them louder **ADVANTAGES** • Relatively **cheap** • Easy to **install** (since there's no surgery required) **DISADVANTAGES** • They **amplify all sounds** in an environment (including background noise) and can cause pain • It does **not help** people with severe **damage** to the **inner ear/auditory nerve** **BONE CONDUCTION IMPLANT** Sends sounds as vibration through bone directly to the inner ear, bypassing the external and middle ear **COCHLEAR IMPLANT** Send sounds as electrical impulses directly to the cochlear (auditory) nerve to be interpreted by the brain  **HOW DOES IT WORK** Instead of transmitting sound waves, it convert sound into electrical signals and directly stimulate auditory nerve -

b. visual disorders: spectacles, laser surgery	 

c. loss of kidney function: dialysis

The process of **removing waste products** and **excess fluid from blood** by an external machine called a **dialyser**

DIALYSIS

The process of **removing waste products** and **excess fluid from blood** by an external machine called a **dialyser**

ADVANTAGES

- Patients can continue living with a decent quality of life

DISADVANTAGES

- Time consuming

KIDNEY TRANSPLANTS

The **replacement of a damaged kidney** with a healthy one from a matching donor

ADVANTAGES

- Longer and more 'normal' life for patient

DISADVANTAGES

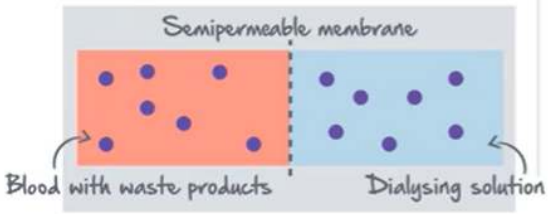
- Possible kidney failure
- Risks using immunosuppressive drugs

2 Blood flows through **tubing**, that is immersed in **dialysing solution**

SEMIPERMEABLE

Pores:

1. **Allow small** molecules to move **out** of the blood
2. **Prevents** any **large** molecules from **leaving** the blood



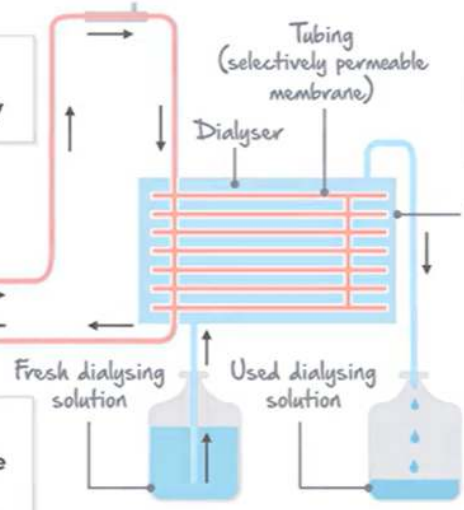
DIALYSING SOLUTION

Promotes the diffusion of **appropriate substances into and out** of the blood

1. Has a **higher concentration of glucose and ions** to limit their diffusion from the blood
2. Has a **low concentration of wastes** to promote their diffusion out of the blood

Dialysis

1 **Blood** is fed into the **dialyser** from an **artery**



2 Blood flows through **tubing**, that is immersed in **dialysing solution**

3

- **Dialysing solution** is continuously **replenished** with fresh solution
- **Used** solution is **removed**

4 **Filtered blood** is **circulated back into the body** through a **vein**

5.3 evaluate the effectiveness of a technology that is used to manage and assist with the effects of a disorder (ACSBL100)	