12 ATAR Biology Revision Seminar Unit 4

Alison Siciliano 2023

Never measure the height of a mountain until you reach the top.

Then you will see how low it was.

Dag Hammerskjold

Unit 4: Surviving in a Changing Environment

Learning Outcomes

By the end of this unit students will

- understand the mechanisms by which plants and animals use homeostasis to control their internal environment in a changing external environment
- understand the ways in which infection, transmission and spread of disease occur in vector-borne diseases
- understand how biological models and theories have developed over time
- use science inquiry skills to design, conduct, evaluate and communicate investigations into organisms' responses to changing environmental conditions and infectious disease
- communicate biological understanding using qualitative and quantitative representations in appropriate modes and genres.

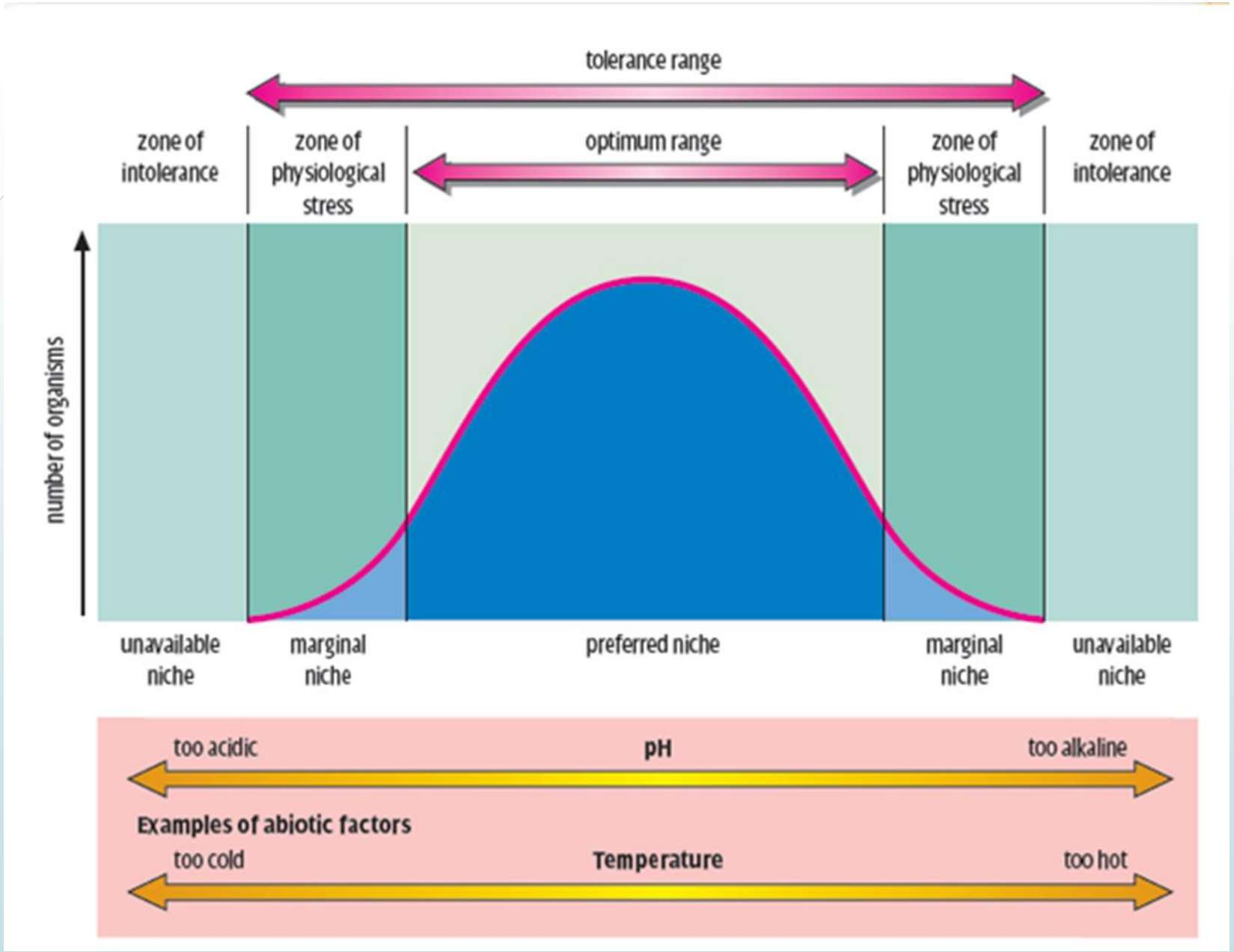
Understand the **mechanisms** by which plants and animals **use homeostasis to control their internal environment** in a **changing external environment.**

PART ONE:

- Homeostasis
  - stimulus-response model
  - negative feed-back loops
- Tolerance limits
- Thermoregulation
- Water and Salt balance
- Nitrogenous waste
- Xerophytes and halophytes

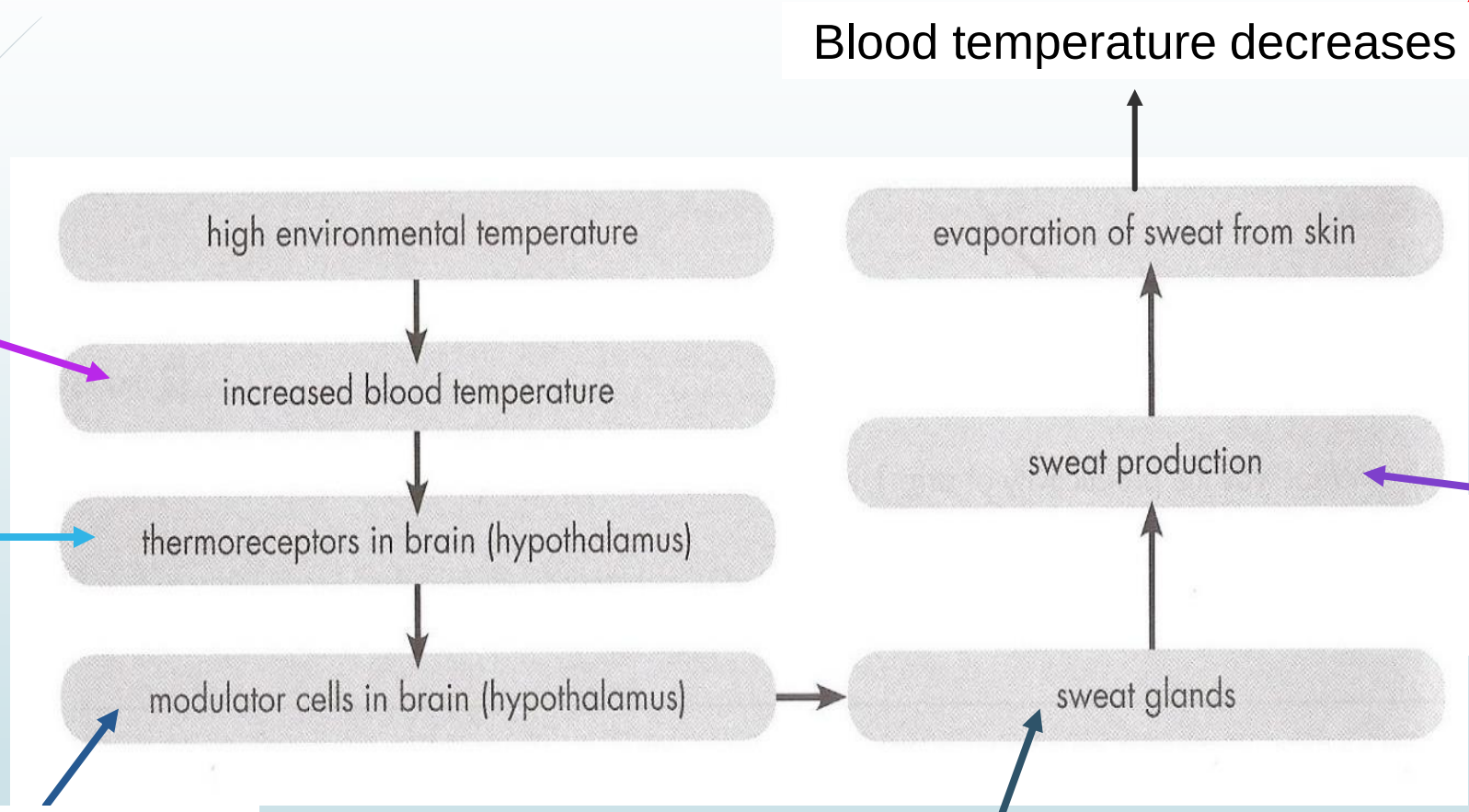
Homeostasis

The process by which the body (organism) maintains a *relatively* constant internal environment.


tolerance range
zone of intolerance
zone of physiological stress
optimum range
zone of physiological stress
zone of intolerance
number of organisms
unavailable niche
marginal niche
preferred niche
marginal niche
unavailable niche
too acidic
pH
too alkaline
Examples of abiotic factors
too cold
Temperature
too hot

Homeostasis Q1

NEGATIVE FEEDBACK



STIMULUS

RECEPTOR

MODULATOR

EFFECTOR

Internal RESPONSE

Positive feedback v's Negative feedback

Positive feedback	Negative feedback
Reinforces (amplifies) the change detected It will continue until a result is achieved.	Reduces the change- it is the reverse of the stimulus. Promotes equilibrium.
Example 1: Labour (child birth): oxytoxin hormone is released when the babies head pushes against the cervix. Oxytoxin causes contraction of the uterus- pushing the babies head against the cervix. This continues until the baby is born. **Example 2**: Blood clotting **Example 3**: Fruit ripening	**Example 1**: temperature regulation- sweating to reduce a rise in body temperature. **Example 2**: osmoregulation **Example 3**: blood sugar regulation

Question 2: Many Australian mammals do not sweat. In order to cool themselves they will pant. Describe, in detail, the homeostatic mechanism of panting.

STIMULUS: increase in core body temperature.

RECEPTOR: thermoreceptors. [electrical/nerve message sent to modulator]

MODULATOR: hypothalamus [electrical/nerve messages sent].

EFFECTORS:

- **Respiratory muscles (diaphragm, intercostal muscles)- increase breathing rate.**
- **Blood vessels/arterioles in tongue & mouth- vasodilation.**
- **Salivary glands- increase saliva production.**

Question 2 continued…

RESPONSE:

- **Panting- short rapid breathing- heat loss through evaporation.**
- **Vasodilation (of arterioles NOT capillaries), heat loss through conduction/convection.**
- **Saliva production- heat loss through evaporation (uses energy).**

FEEDBACK: decrease in core body temperature. [negative feedback because it opposite of the stimulus.]

Most active at dawn and dusk when it is cooler

<u>Sweating</u>: during periods of activity

<u>Rests</u> in the shade during the heat of the day

<u>Panting</u>: reduces body temperature

<u>Crouch</u> with tail under body to reduce amount of surface exposed to sun

<u>Licks forearms</u>: evaporation of moisture reduces body temp.

<u>Shiver</u> during cold weather

Can redirect blood flow away from extremities to reduce heat loss

Michael Seebeck photography

Large ears to increase SA for heat loss

In heat individuals lay flat to increase SA:Vol ratio = ↑ heat loss

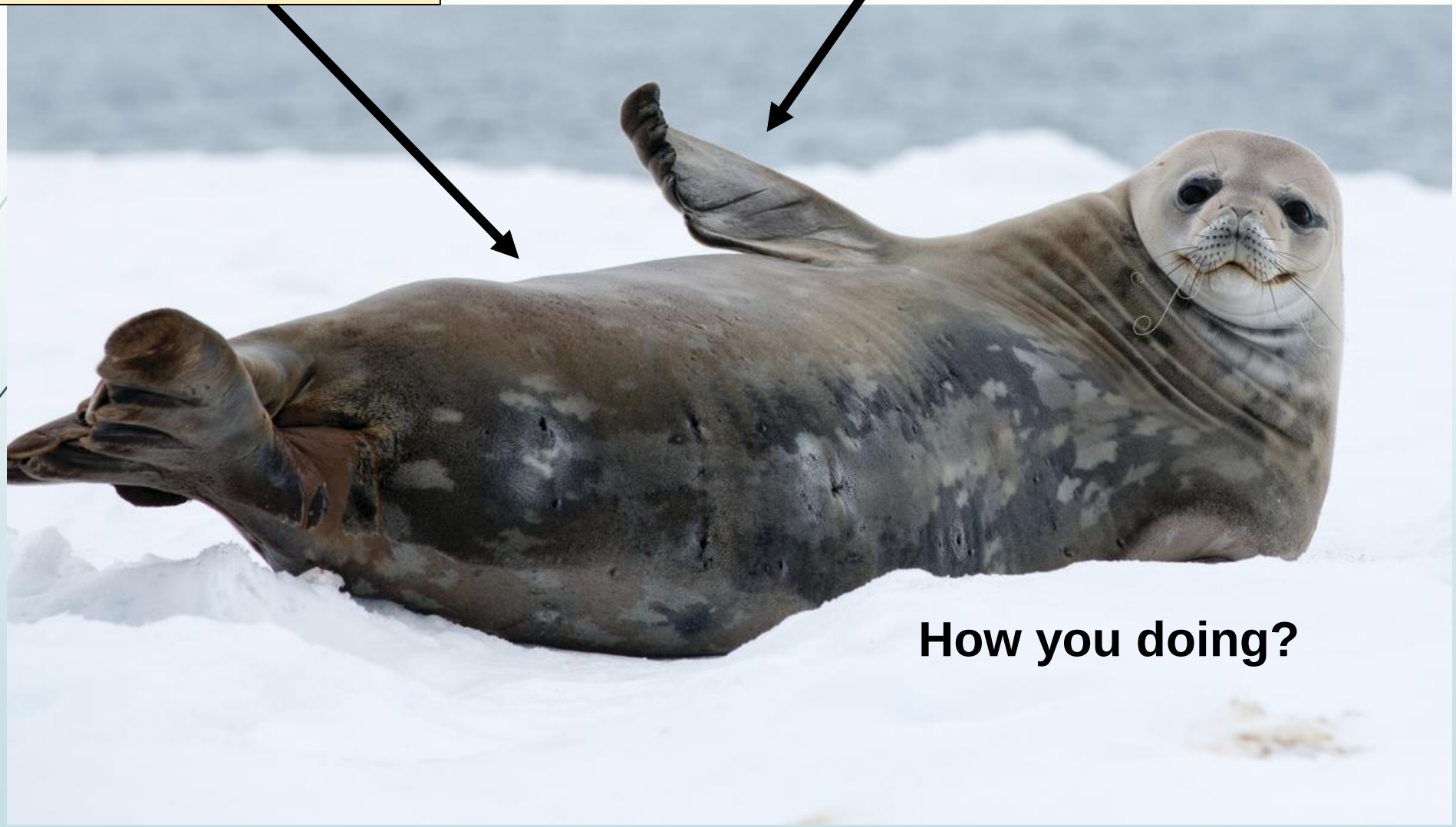
Nocturnal

Burrows: provides cool environment.

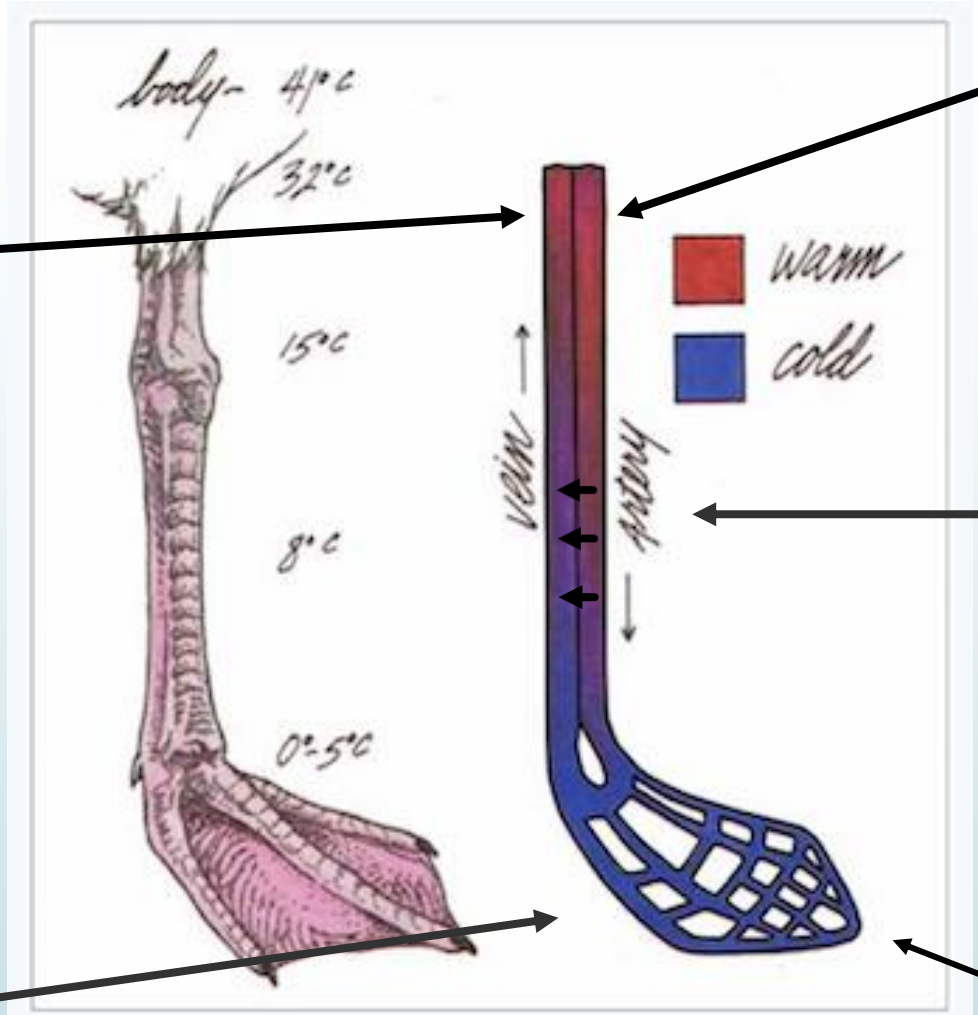
Huddling behaviour increases warmth- reduces SA:Vol ratio = ↓ heat loss

Counter-current blood flow

Blubber- insulation



1. Warm arterial blood from the body moves towards extremities



FROM COLD TO WARM: Two views of a gull's leg show how heat is exchanged between blood vessels. Art by Michael McNelly (after Ricklefs. 1990. Ecology. W.H. Freeman, New York).

2. Heat passes from the arteries to the vein warming the cold blood returning from the foot. *Blood vessels in close proximity.*

The **temperature gradient** between the foot & the environment is **much less**, therefore **less heat is lost**.

3. The arterial blood is cooler so it loses less heat at the extremities.

4. Venous blood has been warmed by the time it returns to the body.

Often WACE questions will ask you to **apply** biology concepts to a context. An example below:

Q4.Marine iguanas (*Amblyrhynchus cristatus*) are endemic to the Galapagos Islands, situated in the Pacific Ocean off the coast of Ecuador. The marine Iguana is classified as a ***marine reptile*** as it is the only species of iguana to forage within the ocean. Even though the islands are located close to the equator, the ***waters are extremely cold*** due to the influence of ocean currents.

Marine iguanas are usually ***grey to black in colour*** and can grow up to 75 centimetres in length. They live in colonies located near shallow reefs that lie within an extensive intertidal zone. The volcanic rocks bordering these reefs are covered with hundreds of iguanas ***basking in the morning sun***. *During the heat of the day*, individuals forage *for green algae (seaweed) in the ocean.*

Iguana ***activity slows down in the late afternoon*** and they retire for the day by ***sheltering in rock crevices or under large boulders.***

Question 4a answers

Conduction (heat transfer through contact with SOLID objects or LIQUID):

- **Heat gain by basking on hot rocks**
- **Heat loss when in contact with water.**

Convection (heat transfer through the movement of AIR)

- **Heat loss through cool wind off the ocean**
- **Heat gain from air being heated by rocks**

Evaporation

- **Heat loss via evaporation water from skin (requires heat energy)**

Radiation (heat transfer by sun)

- **Heat gain through absorption via dark skin**
- **Heat loss from warm body to cool atmosphere (eg at night)**

Osmoregulation

The terrestrial environment is very dry (in comparison to an aquatic one). Terrestrial animals are under continual water stress, therefore they are always regulating water losses and gains.

Maintaining water balance is called OSMOREGULATION.

Question 5

The Spinifex hopping mouse is a small Australian mammal. It can survive long periods in a hot desert without drinking water. These animals have a number of adaptations which enable them to avoid dehydration.

a. List FOUR ways in which a desert mammal such as the spinifex hopping mouse, would lose water.

Answer:

- Evaporation from respiratory surfaces
- Sweating and panting
- Faeces
- Urine

Question 5 continued

b. To reduce water loss, many desert mammals are nocturnal. Give ONE other behavioural adaptation that would help a mammal such as this reduce water loss and explain how it would help.

Answer:

- ✓ Living in burrows with other mammals- increases humidity, reducing water loss.

Question 5 continued

c. When comparing the kidney of a spinifex hopping mouse with that of a similar sized mammal which is not adapted to an arid environment, state **ONE** difference you would expect to find.

Answer: long Loop of Henle

d. Explain how the difference in kidney structure you have given above would help the spinifex hopping mouse survive in a dry environment.

Answer: increases salt gradient, allows for greater water absorption

Osmoregulation in aquatic animals

Q6 Explain the **problems** that a **bony fish** experiences in **maintaining water and salt balance in seawater** and *explain* how the fish **solves** these problems.

(10 marks) [WACE 2017 Ext Response Q39b]

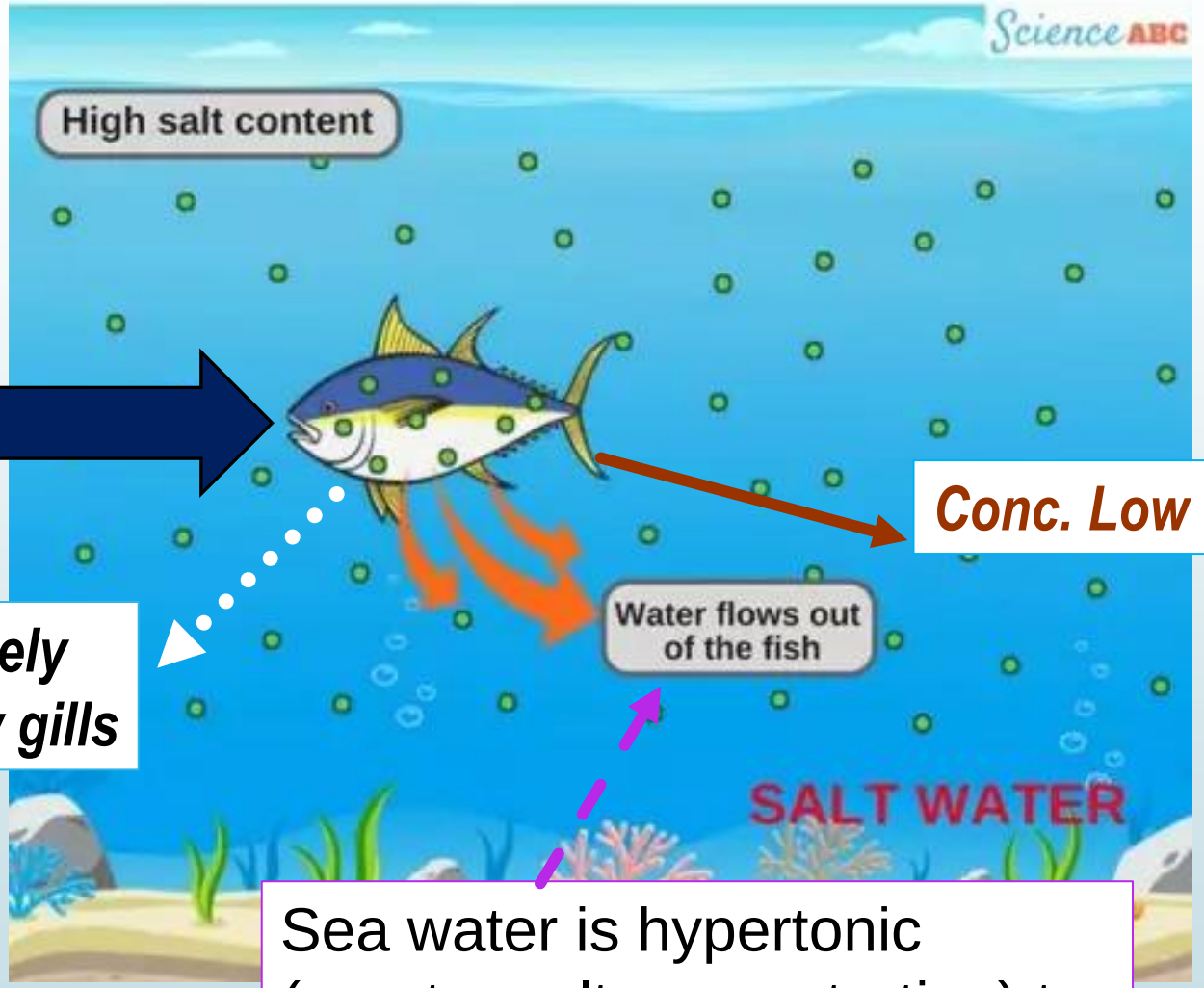
Answer in 2 parts: *problems* experienced , then *solutions.*

Problems up to 4 marks, any of the five points:

- **The salt concentration of body/body fluids is lower than in seawater OR the salt concentration in seawater is higher than in body fluids/blood.**
- **Fish blood/body fluids are hypotonic OR seawater is hypertonic.**
- **Therefore fish loses water to seawater**
- **Because the water flows from low salt concentration to high salt concentration,**
- **By osmosis**

Solutions up to 6 marks, any of the following points:

- **Osmoregulation**
- **The fish drinks seawater (to replace lost water)**
- **But takes in salt as well (with the seawater)**
- **Excess salt is removed**
- **Actively excretes/removes salts**
- **Salt is secreted in gills**
- **Small volume of urine (conserves water)**
- **Urine is concentrated**
- **Kidneys have few/small glomeruli (produces smaller volume of urine)**



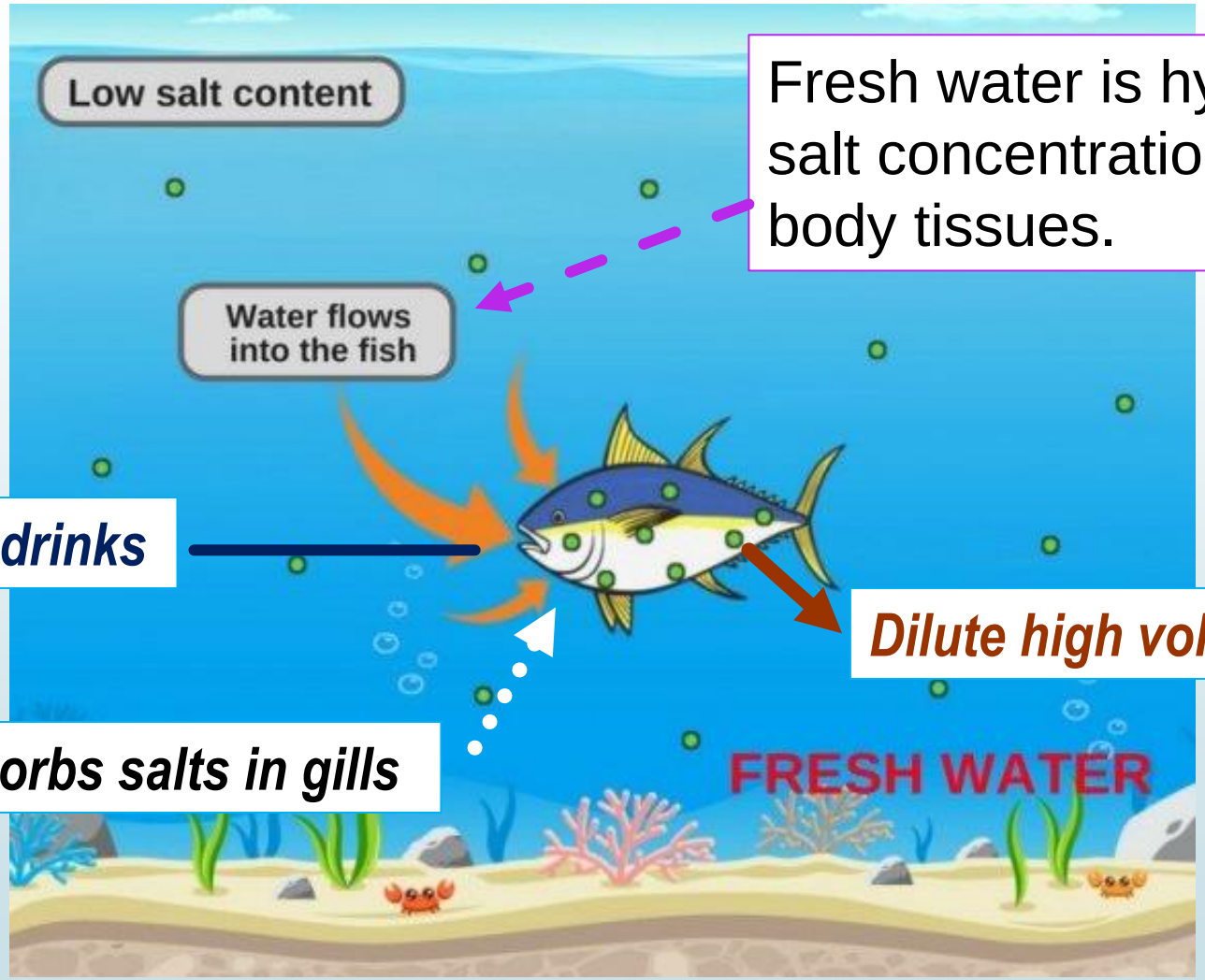
Drinks water

Salt actively secreted by gills

Conc. Low volume urine [urea]

Sea water is hypertonic (greater salt concentration) to the fishes body tissues.

Fresh water is hypotonic (lower salt concentrations) to the Fish body tissues.

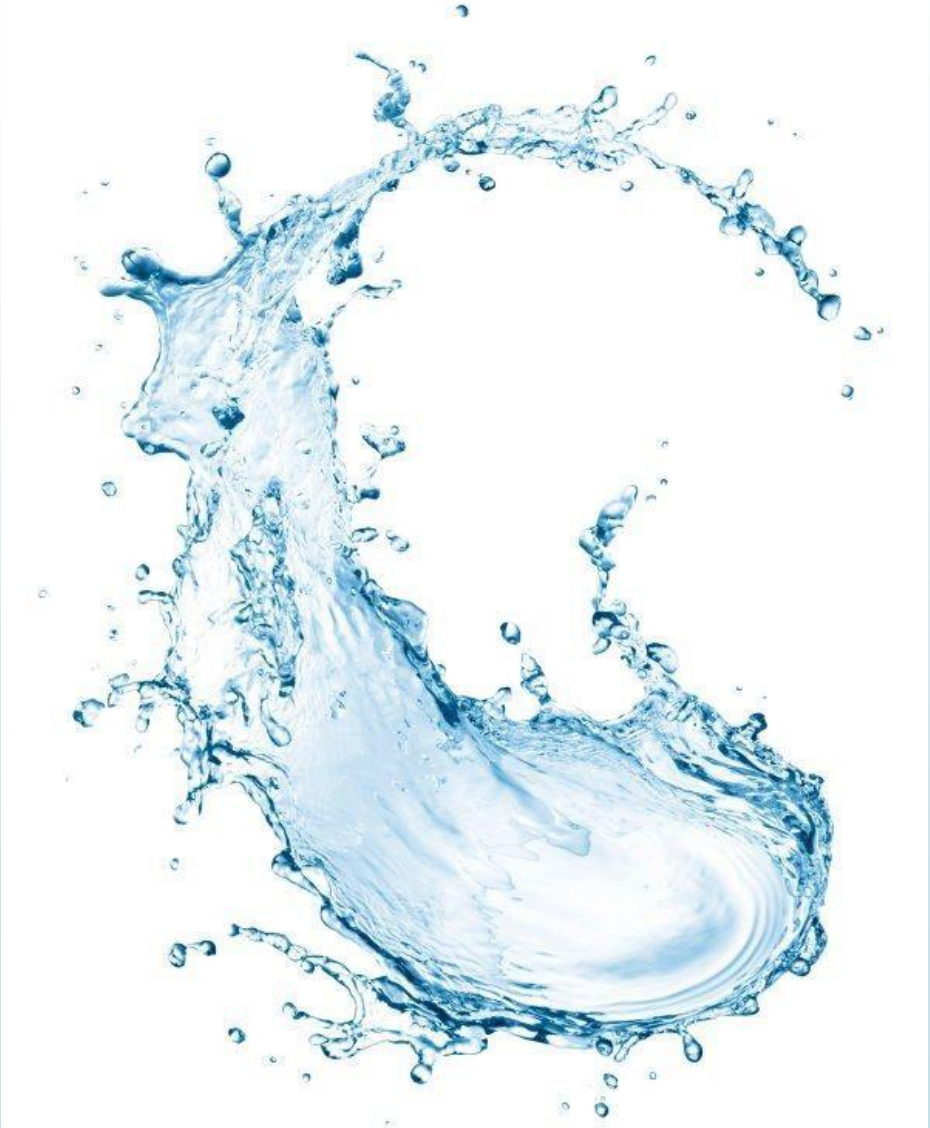


Rarely drinks

Dilute high volume urine [ammonia]

Actively absorbs salts in gills

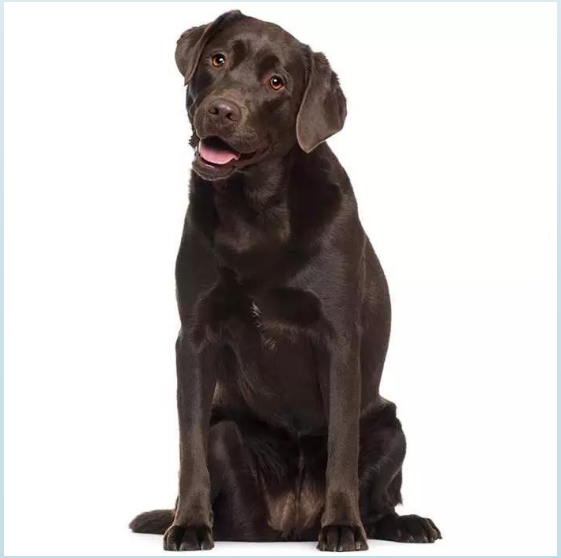
Nitrogenous waste- it's all about water availability!



Nitrogenous Waste Question 7:

Q39 a 2016 WACE Extended Response

"**Name** the type of *nitrogenous waste* produced by *fresh water fish, a dog and a desert lizard*. **Explain** how these *relate to the availability of water* in each animals environment and the *benefits & costs* of each type of waste to each animal."



Animal	N-waste	Availability of water	Benefits	Costs
Fresh-water fish	**AMMONIA**	**HIGH**	**LOW ENERGY REQUIREMENT**	**AMMONIA IS HIGHLY TOXIC**
Dog	**UREA**	**MODERATE**	**MODERATE TOXICITY SO CAN BE STORE FOR SHORT PERIODS OF TIME**	**MODERATE ENERGY COST TO PRODUCE, REQUIRES WATER**
Desert lizard	**URIC ACID**	**LOW**	**NON-TOXIC, CAN BE STORED FOR LONG PERIODS OF TIME. LOW WATER REQUIREMENT.**	**VERY HIGH ENERGY COST**

Homeostasis and Plants

Plant growth hormones regulate plant activities in response to environmental stimuli.

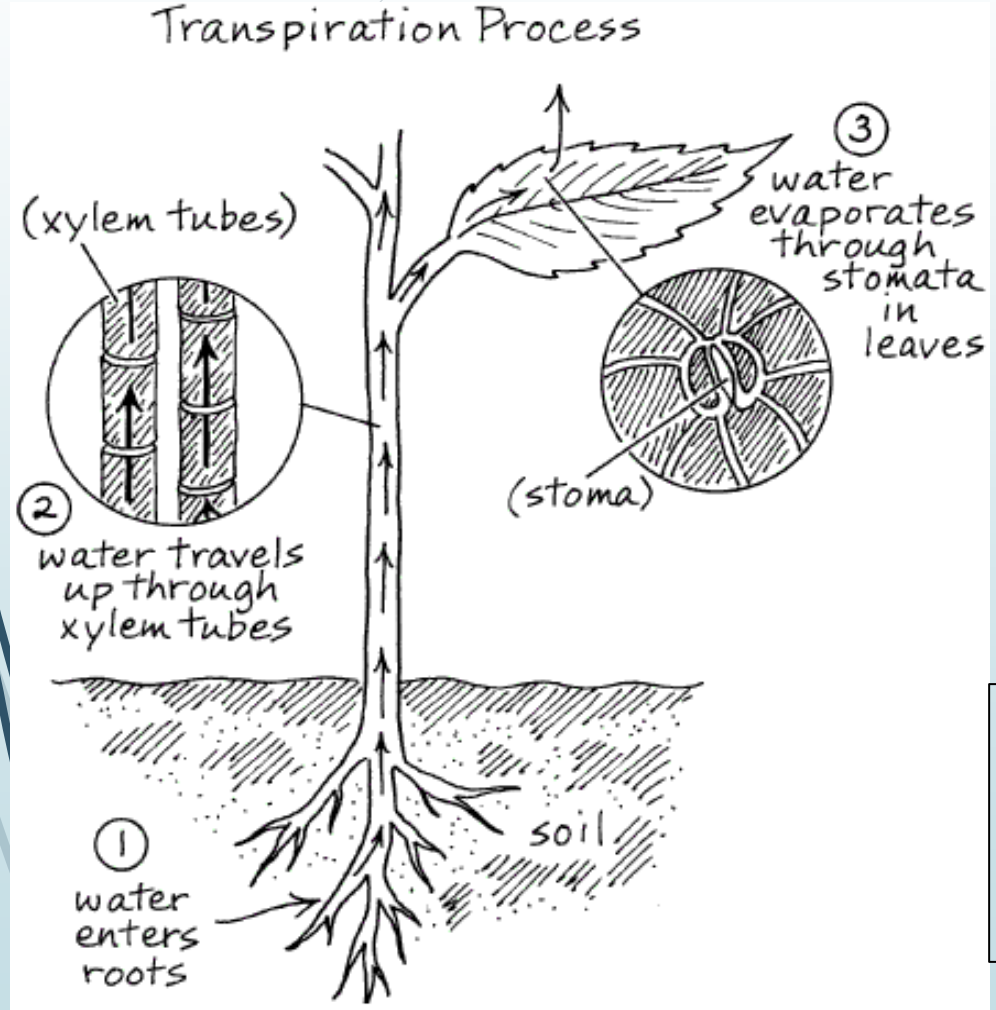
Temperature changes are also a major factor, for:

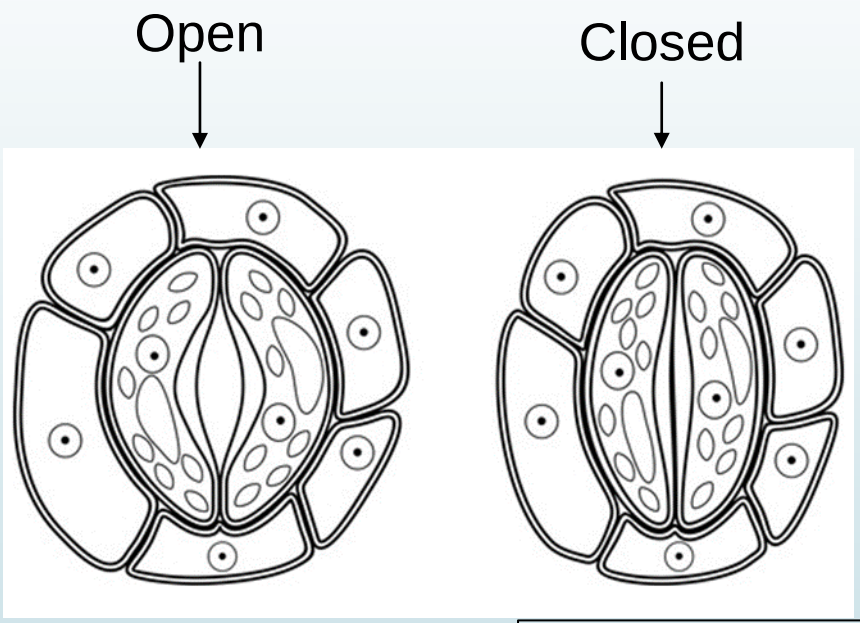
- Seed germination
- Growing seasons
- Flowering and seed dispersal

However, we are not concerned with this for Unit 4. What you need to know are the adaptation of XEROPHYTES and HALOPHYTES.

Firstly- lets review stomatal function.

- Stomates allow gases to enter and leave the leaf.



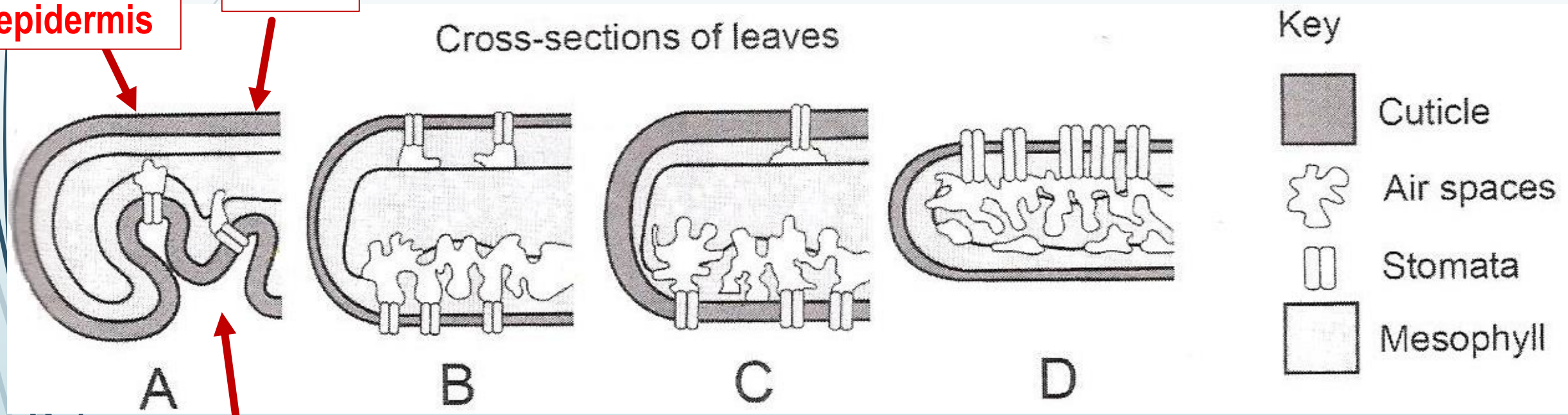


Guard cells are turgid: 'bean' shape.
Allows gases in and out of leaf

Guard cells are flaccid, inner membrane close against each other.
No gas exchange.

Arid Environments

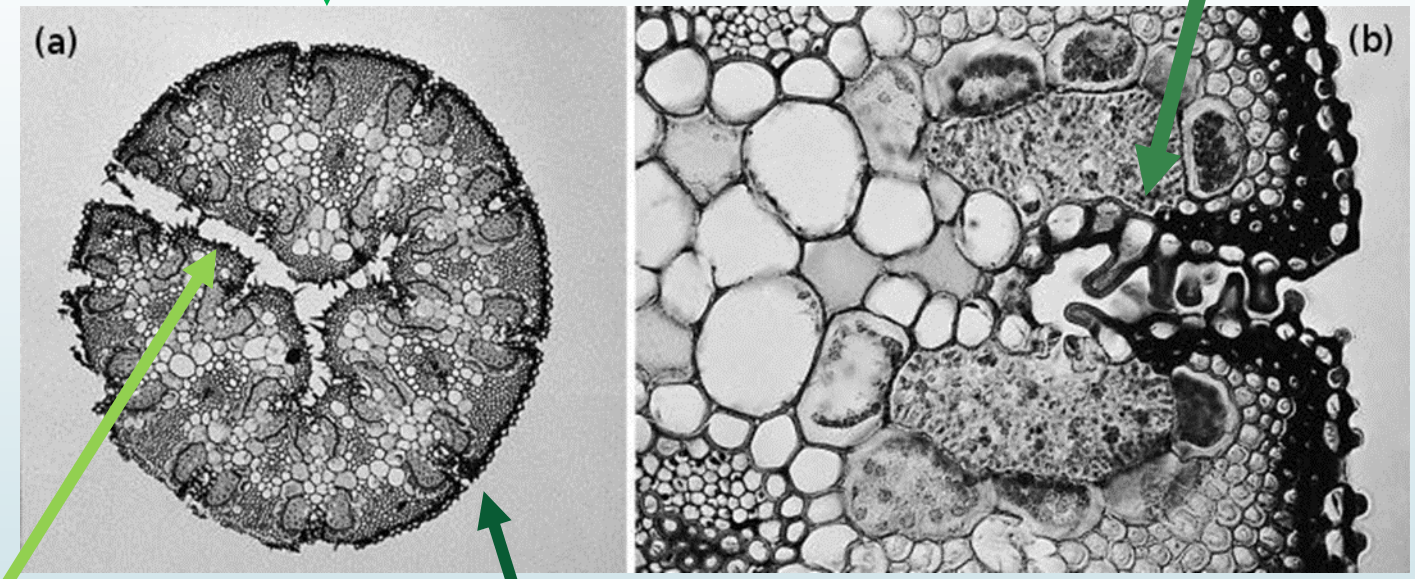
Question 8. Which of these leaves represents a xerophyte? Give reasons for your answer.



Q9: Spinifex Grass What adaptations can you see that help to prevent water loss?

Curled leaf

Hairs trap moisture increasing humidity around stomata



Air trapped inside the leaf is humid, reducing water loss

Stomata on upper epidermis are sunken

Question 10: WACE 2018 Extended Response

Discuss how a xerophyte *minimises water loss* while still *allowing for gas exchange*. (10 marks)

Firstly define the topic:
How do plants lose water? Where does gas exchange occur? [4 marks]

Secondly **discuss** how a xerophyte minimises water loss while still allowing for gas exchange. [6 marks]

TIP: don't just list things. Give an example and then say WHY it minimises water loss.

6 marks= 3 examples worth 2 marks each.

How gas exchange and water loss occurs: 4 marks

- **gas exchange occurs through stomata**
- **stomata need to be open (for gas exchange to occur)**
- **(a lot of) water is lost through open stomata**
- **water is lost through transpiration/evaporation**

Minimisation of water loss by a xerophyte while still allowing for gas exchange: 6 marks= 3 examples explained [2 marks each]

1. Stomatal activity:

- **stomata only open at night/close during the day**
- **temperature is usually cooler at night/no solar radiation**
- **open when water loss is least/closed when water loss is greater**

Continued from previous slide

2. Stomatal adaptations

- stomata are sunken
- surrounded by moist/humid air
- hair in stomatal pits/hair on leaves
- helps to trap moist air which reduces evaporation **OR**
- stomata are on underside of leaf
- reduced light/energy absorption reduces evaporation **OR**
- reduced number of stomata
- decrease points of water loss when open

Previous slide continued

3. Leaf adaptations/changes

- roll leaves to trap moisture
- reduce number/size of leaves/dropping of leaves (deciduous)
- reduce number of stomata/reduced size of stomata
- (these) reduce unnecessary water loss/the number of open stomata **OR**
- adjust position of leaves (vertical leaves)
- reduce light intensity/absorption (which would increase transpiration)
- reduces transpiration (and therefore water loss)
- keeps leaf cooler (reduces evaporation) **OR**
- thick leaf cuticle
- ensures that water is only lost through open stomata

BRAIN BREAK

Infectious Disease

Understand the ways in which infection, transmission and spread of disease occur in vector-borne diseases

Part Two:

- Infectious Disease
- Zoonoses
- Bacteria
- Fungi
- Protists
- Viruses
- Spread of disease
- Management Strategies

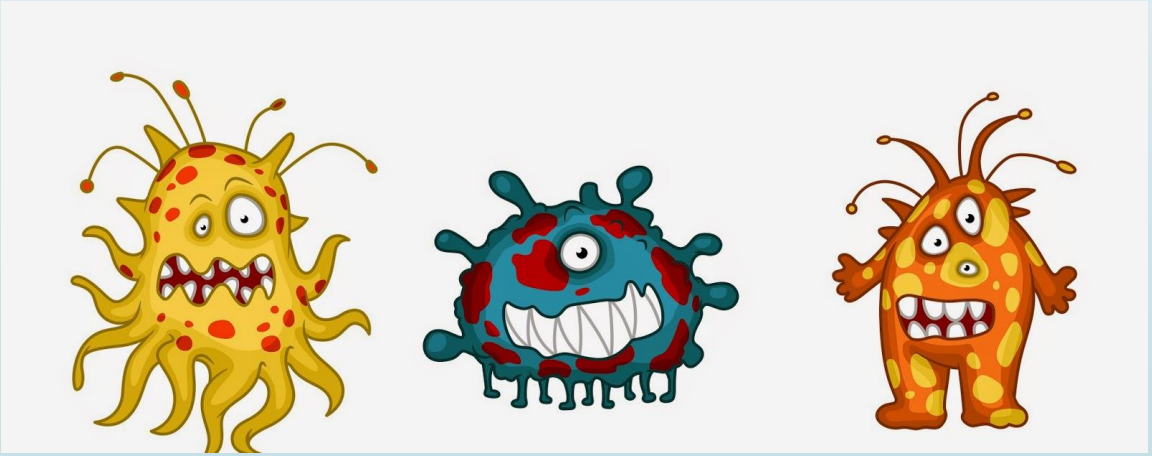
What do you know?

Question 11:

State how infectious diseases differ from other types of diseases. (2 marks)

Communicable- can be passed on to other people

Caused by pathogens



Disease	Organism causing the disease	Organism affected by the disease
Tuberculosis	**BACTERIA**	**HUMAN**
Crown Gall	**BACTERIA**	**PLANTS**
Chytridiomycosis	**FUNGUS**	**FROG**
Phytophthora dieback	**PROTIST**	**PLANTS**
Influenza	**VIRUS**	**HUMAN**
Malaria	**PROTIST**	**HUMAN**

Q 13. Malaria *is common* among people living at *low altitudes in tropical regions* but is much *rarer at higher altitudes,* where the *temperature is cooler*. Global climate change is predicted to *increase the risk of malaria transmission at higher altitudes* in tropical regions. Explain why.
(4 marks)

- (Malaria is) Transferred by mosquito/Mosquito vector/Anopheles
- Mosquito thrives in a warm environment/Is restricted to warm environment OR/IS rare in cooler environments/at higher altitudes
- (Global climate change will) increase temperature at higher altitudes
- Mosquito will spread to higher altitudes or will increase in abundance at higher altitudes OR will be more active at higher altitudes
- Mosquito will take the disease with it when it spreads OR people are more likely to be bitten if mosquitoes are more abundant/more active
- (Higher temperature) Will speed up the life-cycle of the pathogen/ Plasmodium/ protozoan
- This will increase the abundance of the pathogen
- Greater abundance of pathogen, means the risk of transmission is higher

Q14. Exam Extended Response

<u>Malaria</u> is a disease caused by infection with a *parasite*. Malaria is widespread in many tropical and developing nations. It is the major cause of death in the Asia-Pacific region, infecting around 500 million people per year.

<u>Describe</u> the *lifecycle of the Malaria parasite*. <u>Include</u> the *symptoms and treatments* for Malaria in your discussion.

(10 marks)

Describe the *lifecycle of the Malaria parasite*.

- Malaria is caused by a **protist (Plasmodium**) which is transmitted through the bite of a female mosquito.
- ***Zygote***s of Plasmodium develop into ***sporozoites* in *gut of a female mosquito*** and then ***migrate to salivary glands***.
- Mosquito bites and feeds on human blood (intermediate host*), injecting saliva with sporozoites* into *bloodstream*. Sporozoites move to the ***liver.***
- Sporozoites reproduce ***asexually in the liver cells*** and produce ***merozoites***. These *merozoites enter the bloodstream*.
- ***Merozoites infect blood cells*** and multiply, infecting more blood cells.
- Some ***merozoites can form male and female gametocytes*** (for sexual reproduction) that are also released into the bloodstream
- The infected human host is bitten by another mosquito. *Gametocytes enter the mosquitoes gut*, ***mature into gametes and fuse to form zygotes.***

<u>Include</u> the *symptoms* *and treatments* for Malaria in your discussion.

Malaria causes severe illness including (*must list at least 2*);

- **flu-like symptoms**
- **sweating**
- **fever**
- **shaking**
- **chills**
- **pain in muscles and joints**
- **headache**
- **diarrhoea**
- **nausea**
- **Haemolytic anaemia (anaemia due to red blood cell death/loss)**

Include the *symptoms and treatments* for Malaria in your discussion.

- **There is no vaccine for malaria. Anti-malarial medication prior to visiting affected regions should be taken. Preventing mosquito bites by keeping covered and using repellent.**

OR

- **Malarial drugs must be taken as soon as symptoms are diagnosed. Combination of antibiotics and quinine-based medications. Medication based on type of Plasmodium species (five cause malaria).**

WACE 2018 Short answer question

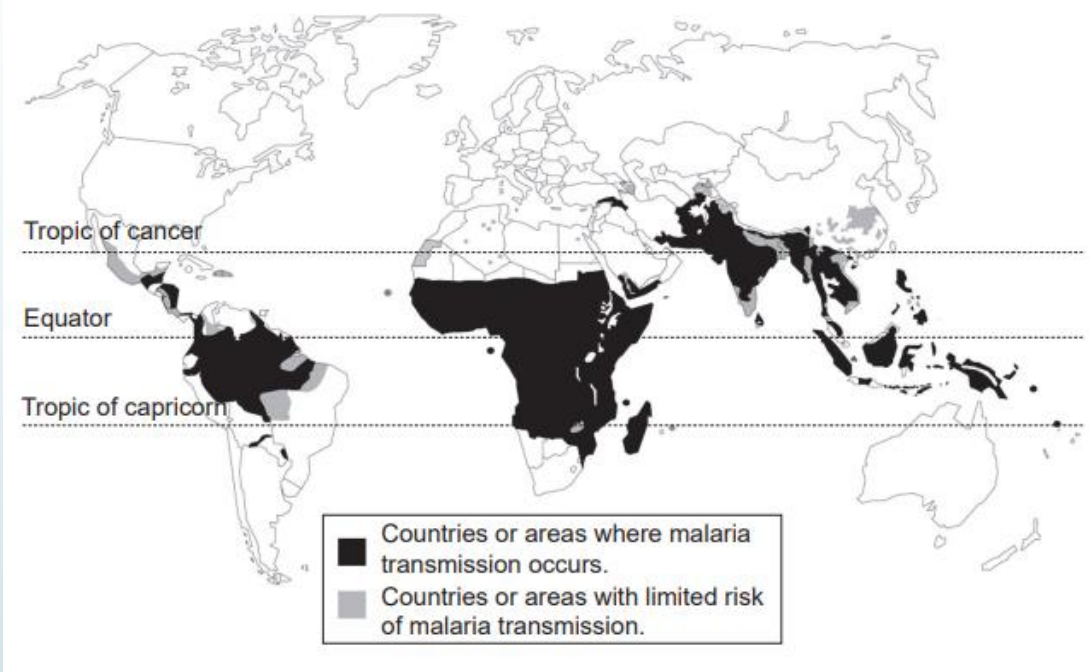
- 15a.Malaria and tuberculosis are infectious diseases of humans. (a) Malaria is caused by a protist. Describe the main structural features of protists. (4 marks)
- Eukaryote
- Membrane bound organelles
- Nucleus OR Nuclei (may be more than 1)
- Microscope/small
- Cilia/flagella/psueodopodia
- May have cell wall OR protective outer layer
- We'll leave the next 2 as we've covered them earlier or in the summary book.
- 15b.Describe how malaria is transmitted from an infected person to an uninfected person. (4 marks)
- 15c.Outline two distinctly different methods of controlling the spread of malaria. (4 marks)

Question 15 continued

- The map below shows the worldwide distribution of malaria. Malaria is present in those areas that are shaded.

- 15d.Describe the distribution of malaria. (3 marks)

- rarely occurs above or below the tropic of cancer or the tropic of capricorn respectively
- centered on the equator/occurs mainly between the tropic of cancer and the tropic of capricorn
- most countries either have malaria transmission or not
- very few areas are at limited risk of malaria transmission
- refers to any specific country or area where malaria transmission does occur
- states any environmental or economic factor regarding temperature and rainfall and malaria transmission

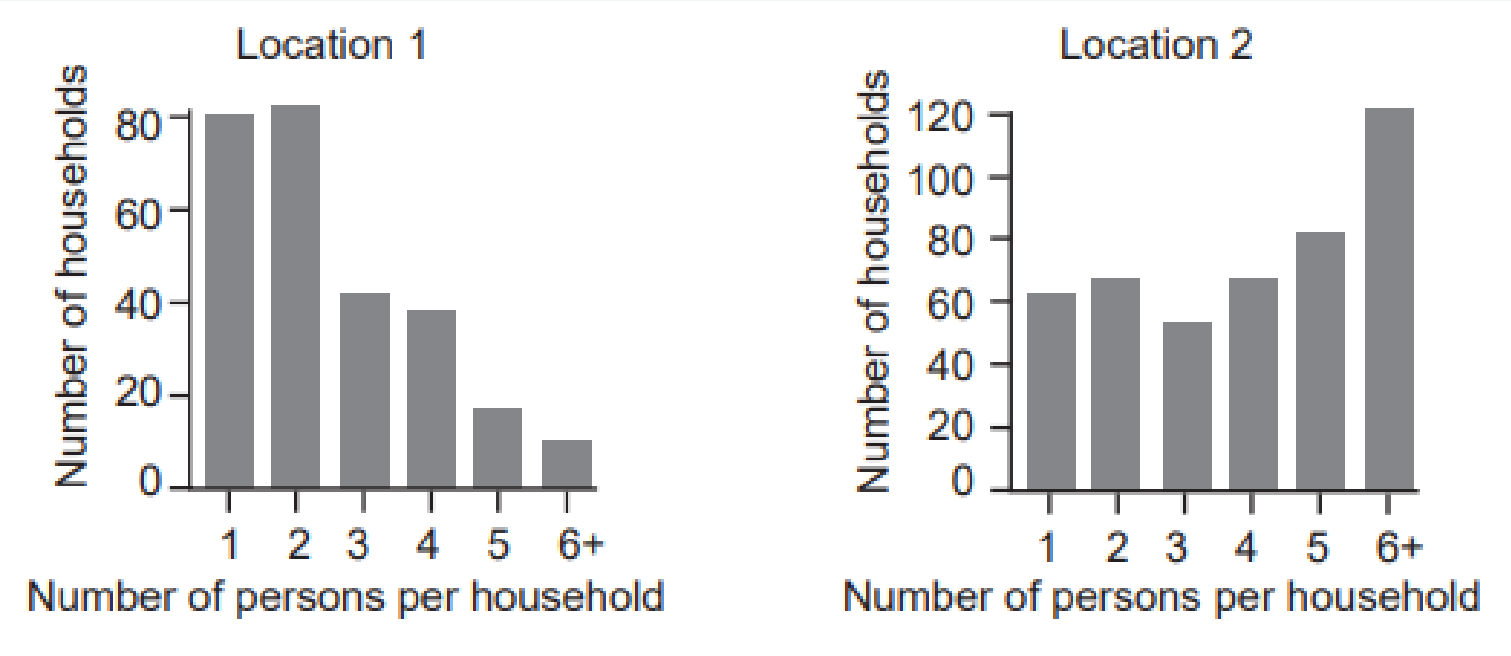


- 15e. Unlike malaria, tuberculosis occurs throughout the world. Explain why tuberculosis is much more widely distributed than malaria. (5 marks)

- different types of transmission
- tuberculosis is caused by bacteria
- transmitted from person to person/no vector involved
- (tuberculosis) transmitted by close contact/droplets/sneezing
- therefore (potentially) spreads (readily) to wherever there are people
- modern transport/movements of people helps spread/tuberculosis asymptomatic
- malaria is transmitted through vector/mosquitoes/transmitted indirectly
- distribution of vector influences distribution of disease or distribution of malaria reflects distribution of (Anopheles) mosquito that transmits it/vector

Q16. Influenza

A group of biologists developed a model for predicting the spread of influenza in human populations. As a part of this, they collected data on the number of individuals per household in two locations, which are shown in the figure below.



WACE 2017

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(a) **Compare** the number of people per household in the two locations. **Use data** from the figure to support your answer. (4 marks)

- (On average) location 2 had more people per household or location 1 had fewer people per household.
- In location 1 most households had 2 people or 1 or 2 people or there were more households with 1 or 2 people than in location 2.
- In location 1 very few households had 6 people or households with 6 people were the least common.
- In location 1 there was a (sharp) decline in numbers after 2 people per household.
- In location 2 most households had 6 people or had 5 or 6 people.
- In location 2 households with 3 people were the least common.
- In location 2 there more households with 3, 5 or 6 people than in location 1.
- For location 1, any accurate quote of data which gives both the number of dwellings and the number of persons per household.
- For location 2, any accurate quote of data which gives both the number of dwellings and the number of persons per household.
- The range in the number of people per household was the same for both locations

b. **Explain why** data on the number of people per household are relevant to the development of a model for predicting the spread of influenza in human populations. (4 marks)

- Influenza is spread through close contact
- If one member of the household has the disease, there is a (high) risk that it will be transmitted to other people in the household
- In location 2/locations with large households more people are likely to be infected or in location 1/locations with small households fewer people are likely to be infected
- Infected individuals can spread the disease to individuals from other households
- The more infected people there are, the greater the chances that an uninfected person from another household will come into contact with them or the fewer infected people there are, the lower the chances an uninfected person from another household will come into contact with (if all else is equal)
- The rate of transmission/spread (outside of the household) will also depend on the population size/density/vaccination or other factors.

c. Can influenza be treated with antibiotics? Explain why or why not. (4 marks)

- No (influenza cannot be treated with antibiotics) – 1 mark

Any 3 for 3 marks

- *Influenza is caused by a virus*
- *Antibiotics only work on bacteria*
- *Antibiotics work by targeting structures that are present in bacterial cells* or *antibiotics work by targeting structures that are not present in a virus*
- Specific details – e.g. antibiotics target cell wall of bacteria or ribosomes of bacteria (protein synthesis)
- Antiviral drugs are used to treat viral diseases
- Antiviral drugs disrupt the life cycle of the virus

Q17. Viral Reproduction: LYTIC Phase

1. **Virus particle binds to the wall of the host**

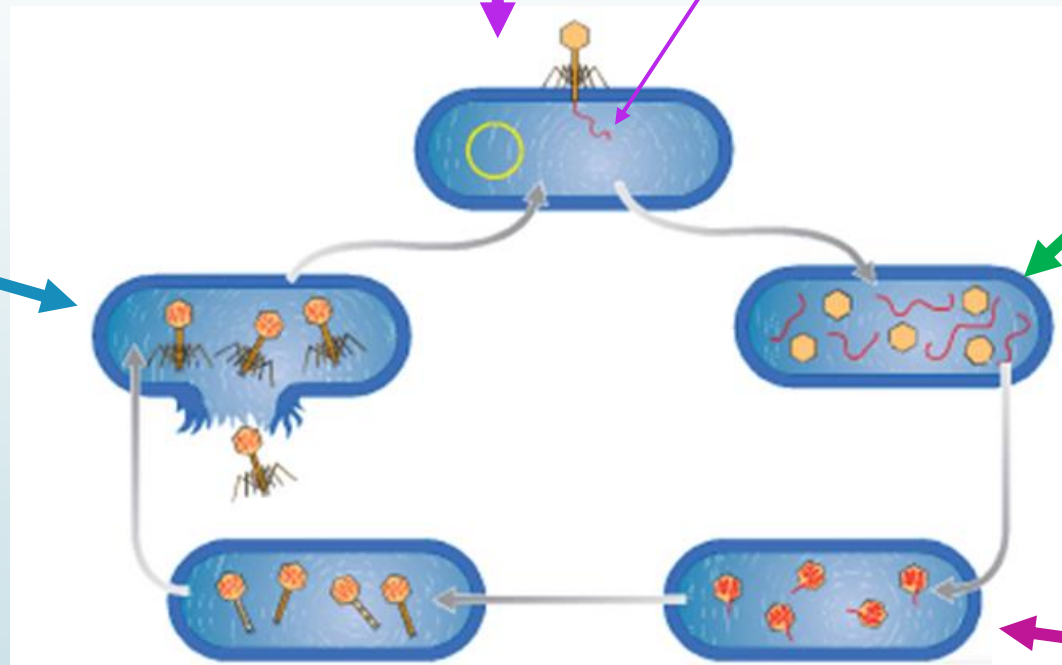
Viral DNA enters cell's cytoplasm

2. **Viral DNA directs cell machinery to produce viral proteins & copies of viral DNA**

3. **Viral proteins are assembled into 'coats' → DNA packaged inside**

4. **Tail fibres & other components are added to coats**

5. **Host cell undergoes LYSIS & dies. Infectious viral particles are released.**



Viruses can remain dormant, this is called the LYSOGENIC Phase.

WACE 2017 Extended Response Question

3 parts to this question!

Q 18. Describe the life cycle of ***the pathogen that causes chytridiomycosis*** (amphibian chytrid fungus disease) and **discuss** the ***impact that the pathogen has on the host*** and the ***mode of transmission*** of the pathogen.

(10 marks)

Describe the life cycle of ***the pathogen that causes chytridiomycosis*** (amphibian chytrid fungus disease) up to 5 marks

- **Fungus/Thallus produces (zoo)spores**
- **Spores are produced by asexual reproduction**
- **(Zoo)spores are released into water (or reinfect host)**
- **(Zoo)spores swim**
- **Encounter/invade host Invade skin cell/surface layer of skin**
- **Zoospores develop into a thallus**
- **Thallus matures (into sporangium)**

Discuss the ***impact that the pathogen has on the host.*** *Any three for* 3 marks

Nervous system:

- **affects frog's behaviour/sit out in sun**
- **sluggish, no appetite**
- **has its legs spread slightly away from itself**

Part of frog's skin that has keratin:

- **Causes skin cells to shed/thicken/harden**
- **Disrupts function of skin cells**
- **Frogs use skin to exchange gases and water and salts**
- **Leads to osmotic problems**

- **Frogs die**

discuss …the ***mode of transmission*** of the pathogen. Any two for 2 marks

- **Contact with contaminated water/water containing zoospores**
- **Direct contact between frogs**
- **Humans or other animals (e.g. ducks) (may spread over land)**
- **Transmission outside of water is not well known**

The Spread of Disease and Management Strategies

These questions are nearly always **application** questions.

This means you will be asked to **apply your knowledge** of disease to a **context** (a particular disease outbreak situation eg a cholera outbreak).

Therefore you must be familiar with:

- Various diseases (see syllabus)
- How diseases spread
- Ways to prevent transmission
- Ways to minimise an outbreak

2020 WACE short answer question 31

Q20. The pathogen that causes jarrah dieback is a type of protist.

(a) (i) **List** two structural features of protists that are not found in bacteria. (2 marks)

- protists are eukaryotes/have a nucleus
- protists have membrane-bound organelles/mitochondria
- cell walls of protists are made of cellulose (not peptidoglycan)

(ii) **List** two structural features of protists that are not found in fungi. (2 marks)

- protists are (usually) unicellular
- protists (often) have flagella (except in Chytrid zoospores)/cilia
- cell walls of protists (when present) are made of cellulose (not chitin)

2020 WACE short answer question 31 continued

In order to prevent the spread of jarrah dieback, vehicles are banned from driving on some tracks when the soil is wet.

(b) Explain how this can prevent the spread of jarrah dieback. (4 marks)

- disease is spread (from plant to plant) by spores/zoospores
- spores/zoospores are more active when it is wet
- vehicles pick up more (contaminated) soil when it is wet; (therefore) risk of transmission/spread is greater when the soil is wet
- vehicles can spread disease/spores/zoospores over a large area

2020 WACE short answer question 31 continued

(c) Describe how the tuberculosis pathogen is transmitted to a new host. (2 marks)

- pathogen is in air/airborne or affected individuals breathe out pathogen/droplet
- new host breathes in/inhales pathogen

(d) Describe the impact that the tuberculosis pathogen has on the host. (2 marks)

- infects lungs/respiratory system
- causes coughing/lung irritation/breathing problems/tuberculosis
- sometimes does not cause symptoms or takes time for symptoms to develop or can infect brain/nervous system/tissue other than the lungs

(e) Explain how vaccination helps to control the spread of tuberculosis. (4 marks)

- vaccination introduces weakened/harmless version of a pathogen into body
- this stimulates production of antibodies/stimulates an immune response
- vaccinated individuals become immune or do not catch the disease
- higher the proportion of the population that is immune, the greater the protection (or the converse)
- because infected individuals do not/rarely come into contact with susceptible individuals (or the converse)
- herd immunity/high immunity protects susceptible individuals

Q21. The development of vaccines has enabled highly contagious diseases to be eradicated from the global population.

(a) Describe how immunisation programs have been successful in stopping the spread of virulent pathogens. (2 marks)

- **Reducing the rate of infection of virulent pathogens.**
- **Eradicating some diseases by completely stopping spread through mass immunisation programs**

(b) Explain why immunisation programs have been compromised in some communities around Australia. (2 marks)

- **More people are choosing NOT to have their infants/children immunised due to fear of serious illness from side effects and misinformation.**
- **The growing number of non-immunised individuals weakens the 'herd immunity' and certain diseases can be reintroduced into a population.**

Q22. *White spot disease is a highly-contagious viral disease in prawns. It is found in parts of Asia, America, Africa and the Middle East, but generally not in Australia*. A recent outbreak has, however, occurred in several prawn farms on a river in Queensland. **Explain** two measures that could be taken to reduce the risk of white spot spreading from *the affected farms to other parts* of Australia.

(4 marks)

- **Kill all the prawns in affected farms**
- **Chlorinate/clean water at affected farms (killing the virus)**
- **Quarantine all effected prawns and equipment**
- **Physical barriers to prevent virus moving into environment**
- **Vaccinate prawns**
- **Delay restocking affected farms- allow virus to die off**
- **Kill prawns at nearby unaffected farms- no hosts for any escaped viral particles to enter.**


and they lived happily ever after.
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