Active fish have high metabolic rate and there is a small amount of oxygen in the water. Need to maximise rate of diffusion of oxygen from the water.

Parallel (concurrent) flow – Water and blood flow in the same direction. Only half the available oxygen enters the blood.

Counter current flow – Water and blood flow in opposite directions. Maintains a steep concentration gradient. Always more oxygen in the water than the blood.

Insects:

Insects can open and close their spiracles to alter level of ventilation/ prevent water loss.

Some insects with a high metabolic rate are able to increase ventilation by muscular contraction of the abdomen.

Trachea supported by rings of chitilin whereas trachioles have thin permeable walls for gas exchange.

Diffusion through air is rapid.

No very large insects as the tracheal system doesn't work above a certain size.

They prevent water loss by closing spiracles. Spiracles are also sunken or have hair to trap hair. The exoskeleton and trachea are waterproof.

Cellulose – made from B-glucose and has strong straight chained linkages held together by hydrogen bonds which form parallel fibres which have great strength.

Leaves:

Flat – large surface area for catching sunlight.

Thin – Short diffusion pathway.

Waxy cuticle impermeable to water – prevents water loss.

Upper epidermis transparent – allows light to penetrate the pallaside layer.

Pallaside cells are located at the top of the leaf packed with chloroplasts – rapid photosynthesis.

Spongy mesophyll cells have large air spaces between them and contain chloroplasts – allows gas exchange between atmosphere and cells.

Vascular bundle contains xylem and phloem tissues – transports of water in tissues.

Stomata – allow gas to enter and leave air spaces to and from the atmosphere.

Guard cells – have thicker cellulose and stomatal pores – allows plant to close stomata at night to minimise water loss.

Absorption of water:

Soil water has higher water potential than root hair cells. As water enters the water potential is raised inside the cells so water moves to the xylem along a water potential gradient.

Apoplast pathway – water moves through gaps in and around the cell walls – takes place through living tissue.

Symplast pathway – Takes water through the cytoplasm of root cells. Takes place through living tissue.

Some individuals have a selective advantage making it more likely to survive than the normal strain. Competition for limited resources means only the fittest survive the fittest are those resistant to the antibiotic. The fittest individuals are more likely to reproduce and pass on its alleles to the next generation. The frequency of these alleles increases so the whole population may become resistant.

Selective breeding –

Inbreeding – mating between relatives. Occurs when gametes of close relatives join, promotes homozygosity, and increases chance of harmful double recessive individuals being produced, loss of vigour, size and fertility.

Outbreeding – Mating between non-related individuals. Promotes heterozygosity. Decreases the chance of harmful double recessive genes being produced, hybrid vigour.

Selective breeding programme – take individuals with desired trait and mate them. Select offspring with the trait you desire and mate them with others who are also desirable. Continue for generations until variation is no longer shown in the offspring.

Artificial selection produces high yielding as the plant with the largest seed is selected and used to parent the next generation. This continues for many years.

Ethical issues with selective breeding:

- Larger animals bred for their meat often suffer joint pain as bone size does not increase as fast a muscle. They may also have back pain and be too big to be born naturally. Chickens laying eggs everyday have a reduced lifespan.
- Dairy cows may suffer from mastitis (mammary gland infection)
- Genetic variation is reduced so they may be susceptible to diseases.
- Pets may suffer from inbreeding depression.

<u>Classification and Biodiversity:</u>

Hierarchy – group within groups with no overlap.

Elucidate – make clear

Composite – made up of several parts.

Tentative – uncertain/not fixed.

Classification is known as taxonomy.

Binomial name is a made up of genus and species. When written they have to be in italics.

Phylogenetic – the evolution of a particular group of organisms.