PENANG SANGAM HIGH SCHOOL
P.O.BOX 44, RAKIRAKI
LESSON NOTES

Year/Level: 12C/D week 20 **Subject:** Biology

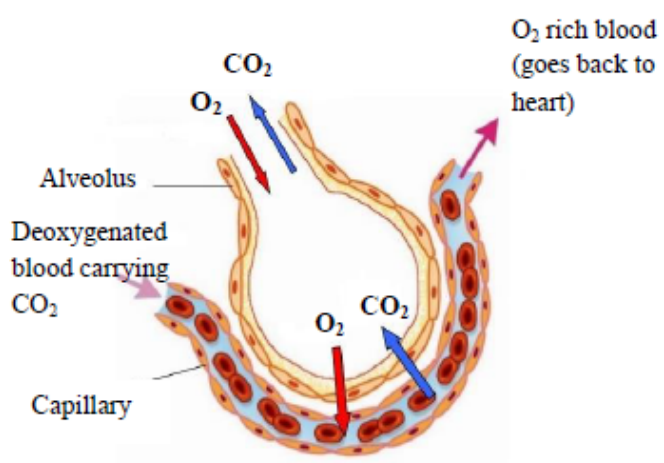
Strand	1 structure & life processes
Sub Strand	1.4 comparative form and function in plants and animals
Content Learning Outcome	Describe the gas exchange in reptiles, mammals and birds

Gas Exchange in Reptiles, Mammals and Birds – lungs

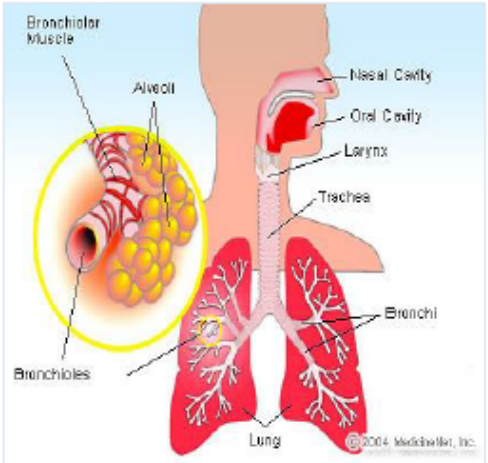
- Reptiles, such as lizards and snakes, were the first vertebrates adapted for living their entire lives on land.
- Evidence suggests that birds and mammals later evolved from reptiles.
- These three vertebrate classes have lungs and muscles specialised to suck air.

Adaptation for Efficient Gas Exchange

1. The alveoli in the lungs have thin, moist surfaces.
2. The alveoli create a large surface area for gas exchange.
3. Their lungs are extremely well supplied with blood capillaries



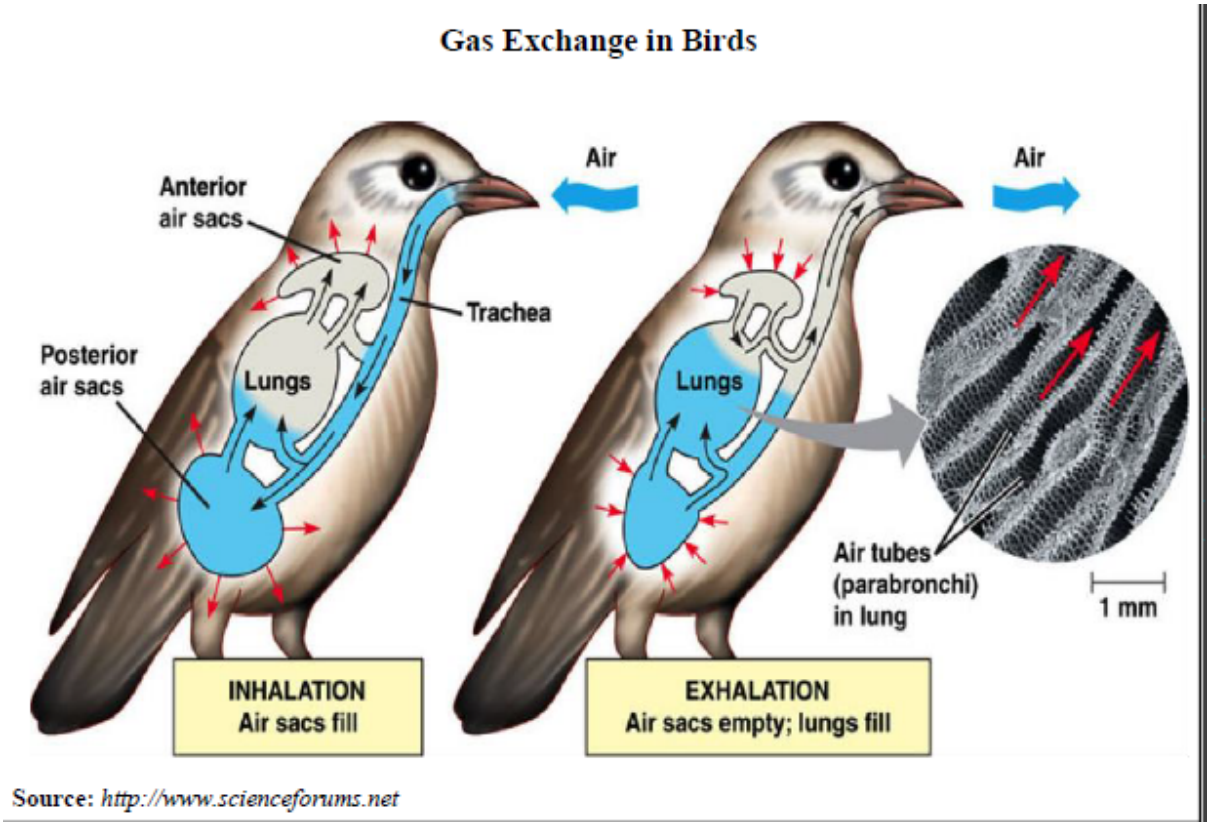
Source: *http://image.slidesharecdn.com/*

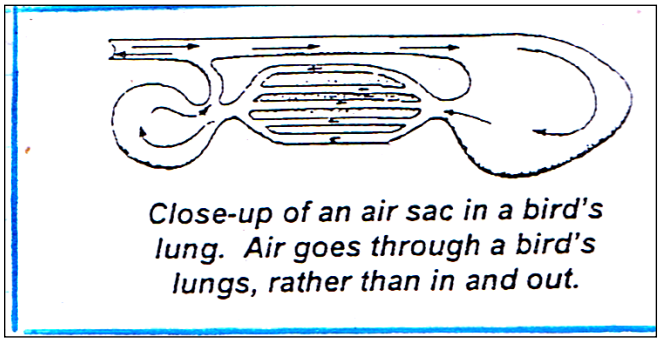


Source: *http://www.emedicinehealth.com*

- Birds are the most active of the mentioned three vertebrate groups.
- Birds have evolved the most efficient gas exchange system of all animals on Earth.
- Other land vertebrates suck air into dead- end sacs and then force it back out the same path.
- Birds instead have one way air flow through small tubes in their lungs.
- This way, birds do not just draw air into their lungs, but through them.

- Birds need this efficient air- supply system in order to provide their muscles with oxygen to get the energy needed for flying.





Adaptations for Gas Exchange		
Gas Exchange Method	**Organisms Group**	**Adaptive Value**
Direct Diffusion – no respiratory organs or connection with a transport system.	Plants, bacteria, protist, fungi, cnidarians	Supplies sufficient oxygen to the cells of small or sessile organisms.
Diffusion through the skin into blood.	Worms, adult amphibians	Supplies blood with oxygen in organisms that are able to keep their skin moist at all times.

Gas Exchange Method	Organism group	Adaptive Value
Diffusion through tube network – air diffuses to body cells through tubes, no connection to transport system.	Insects and spiders	Supplies sufficient oxygen to the cells of small organisms conserves water since tubes are inside the body.
Gills – gas exchange between water and the blood capillaries inside gills, gills hang outside of the body	Crustaceans, bivalves, immature amphibians	Adapted for exchanging gases with water (gill filaments, water pumped over gills, counter-current blood flow in gills)
Lungs – gas exchange between inhaled air and the blood capillaries supplying the lungs; lungs are inside the body	Adult amphibians, reptiles , mammals, birds	Adapted for very efficient exchange of gases with air in order to supply cells of large active land animals; conserves water

Evolutionary Trends in Gas Exchange

- The more an organism moves the more energy it uses energy.
- For example, a jellyfish drifts around in the ocean and occasionally pumps water to push itself forward and due to its inactive lifestyle, the jellyfish suffices its gas exchange needs by diffusion only.
- A fish on the other hand, darts around quickly looking for food and evading predators and hence, it needs a more active form of gas exchange system compared to the jelly fish.
- The more energy it uses, the more oxygen it needs and the more carbon dioxide waste it produces.
- As speedier organisms evolved, they needed more efficient gas exchange systems which actively pumped air or water and linked with a transport system.
- Additionally, terrestrial organisms evolved adaptations for reducing water loss from their respiratory surfaces.

1. Choose three organisms you have studied and explain the adaptations of each for increasing their surface area for gas exchange

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2. Choose three organisms you have studied and explain the adaptations of each for reducing water loss from their respiratory surface

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3. Why does a vertebrate's breathing rate vary with its activity level?

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4. What is the primary differences between lungs and the gills? How is this difference adaptive?

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5. Dolphins and whales have small breathing hole in the middle of their backs. Explain how the location of this hole might be adaptive?

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6. In what way are the lungs of a bird more efficient than those of a mammal or reptile?

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