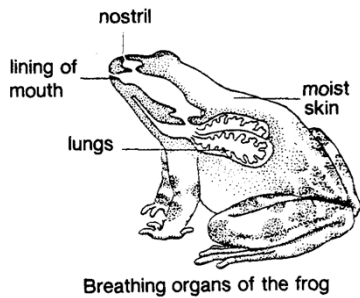


## Gaseous exchange in amphibians

Tadpoles use gills. Adults have three different respiratory surfaces i.e.

1. The skin
2. Buccal cavity
3. **Lungs**



### The skin (cutaneous) gaseous exchange

The skin is adapted for gaseous exchange in the following ways

1. It is thin, thus reducing the distance across which diffusion of gases occurs, so increasing the rate of diffusion.
2. It is kept moist always by secretion of watery mucus from simple sacular glands in the dermis. This quickens th
3. e dissolution of air into the skin and therefore diffusion of carbondioxide out of blood and oxygen into.
4. It has a dense network of blood vessels supplied by blood from the cutaneous artery. This ensures more gases are absorbed and immediately carried which create and maintains a diffusion gradient between the air and blood and this favours diffusion of gases.

NB. (i) cutaneous gaseous exchange is operational in toads when in water and when they are hibernating but frogs use it mostly because the toads skin is less moist than a frogs skin.

(ii) cutaneous gas exchange system is more efficient at removing carbondioxide than the lungs because CO<sub>2</sub> dissolves more easily in water.

### **Buccal gaseous exchange**

There is a thin epithelium lining the buccal cavity and is kept moist so the exchange of CO<sub>2</sub> and O<sub>2</sub> occurs here. A ventilation mechanism operates by which the air content of the buccal cavity is changed frequently.

### **Inspiration**

**There** is lowering of the floor of the buccal cavity brought about by the contraction of sternohyoid muscles which stretch from the hyoid body to the pectoral girdle. This happens when the nares (nostrils) are open and mouth and glottis closed. This forces air through nasal passages from out into the buccal cavity. The inhaled air dissolves in the lining of the buccal cavity which is thin and moist allowing oxygen into and CO<sub>2</sub> out of the blood.

### **Expiration**

There is raising of the floor of the buccal cavity brought about by the contraction of the petrohyoid muscles which extend from the hyoid body to the auditory capsule. This happens when the nares are open, mouth and glottis closed. This results in increase in pressure in buccal cavity and decrease in volume. Air is then forced out through the nostrils.

Buccal cavity gaseous exchange is only important on land.

### **Pulmonary gaseous exchange**

It involves the buccal cavity and the lungs. It is used less frequently but can be used during and activity. It is only used when the amphibian is on land.

### **Inspiration**

This involves the buccal cavity being filled with air as described under buccal respiration.

Nostrils are closed as the clottis open

Contraction of the pterohyoid muscles raises the floor of the mouth. This results in air increase in the pressure of the buccal cavity. It also forces air into the lungs because the mouth and nostrils are closed. When the lungs are full, glottis closes and air is trapped.

Gaseous exchange occurs across the epithelial lining of the lungs when O<sub>2</sub> diffuses in and CO<sub>2</sub> diffuses out of the blood. The lungs are highly vascularised and this ensures

that oxygen is carried away and CO<sub>2</sub> is brought in maintaining a steep concentration gradient for both gases.

### **Expiration**

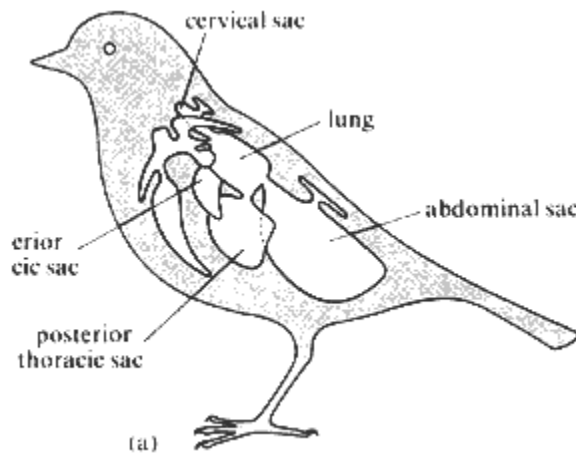
The nostrils are closed, the glottis opened and the floor of the mouth lowered by the contraction of the sternohyoid muscles. When the pressure is lowered in the buccal cavity the air is sucked in from the lungs. The lungs tend to recoil and partially aid expiration.

The nostrils then open, the glottis closes and the floor of buccal cavity is raised. This forces the air out.

### **Birds**

Birds lungs do not have alveoli and are extensible. They have air sacs some of which extend into the bones. There is no gaseous exchange in the air sacs but their presence improves greatly the rate of ventilation, they also offer lightness to the bird.

### **Respiratory system of a bird**



### **Inspiration**

There is lowering of the sternum, expansion of the chest and lungs. The lungs diminish in volume and air is expelled from the lungs into the air sacs.

### **Expiration**

There is raising of the sternum, contraction of abdominal air sacs and then the air is sent into the bronchi and then the capillary bronchioles in the lungs and then outside the body.