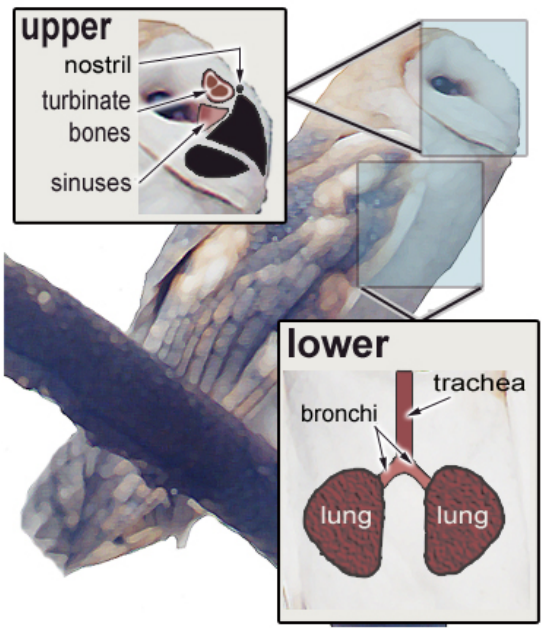
Avian Respiratory System

Respiratory System

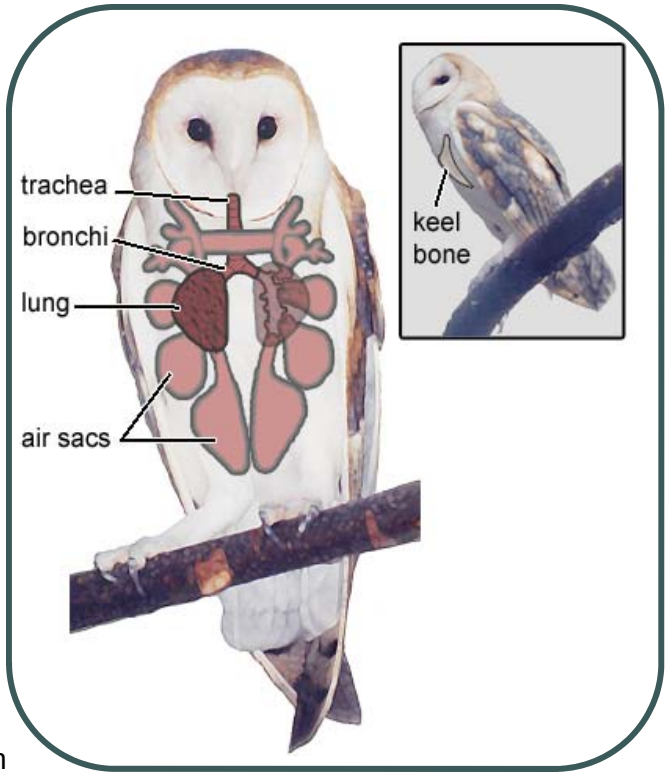
Dr. Bruce Hunter,[1] Ashley Whiteman,[1] Dr. Babak Sanei,[2] and Al Dam[2]

The respiratory tract of the bird has unique adaptations that have evolved to accommodate high metabolic rates and highly energetic activities such as flight. The avian respiratory tract is more efficient than that of mammals. For example, canaries were used for rapid detection of toxic gases in underground mines, and geese and other birds are capable of sustained high performance flight over long distances and at extremely high altitudes. Despite having a smaller total lung volume on a body weight basis than mammals, most bird species have a significantly greater surface area for gas exchange and many species are over 80% more efficient than mammals in oxygen exchange.

The respiratory tract of the bird performs several important functions including: exchange of gases (i.e. intake of oxygen and elimination of carbon dioxide); regulation of acid/base balance; filtration of dust, molds and other particulate material; and temperature regulation of incoming air. The respiratory tract of the bird also plays a highly significant role in the control of body temperature and in the regulation of body water balance. Birds that are hot will mouth breathe and pant which may fool you into thinking the bird is ill.

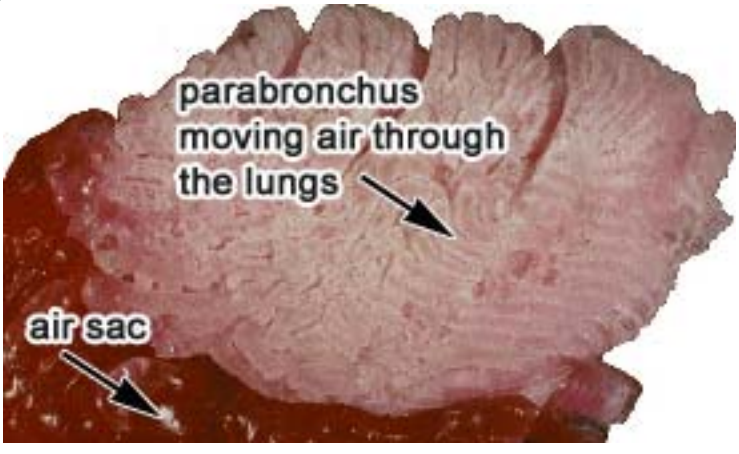


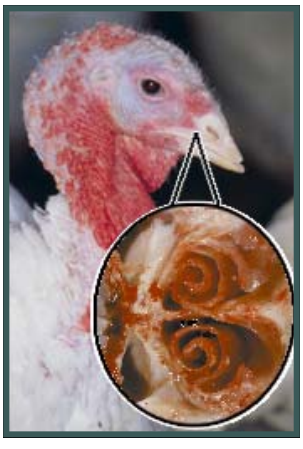
The lung of the bird does not expand and contract during respiration. There is no muscular diaphragm to regulate air movements. Instead birds have a series of thin-walled, transparent air sacs that occupy a large portion of the abdominal cavity. These air sacs serve as air reservoirs and help direct and control the direction of airflow. In most birds the large wing bones (humerus), leg bone (femur) and several other bones are hollow (i.e. do not contain bone marrow) and communicate with local air sacs. A few species like the turkey have an additional air sac, an extension of the sinuses that extends down the back of the neck (called the cervicocephalic air sac).



ABOVE: A schematic of the location of lungs and air sacs in a bird.

Birds breathe more slowly and more deeply than mammals. Respiratory muscles actively move the keel during both inspiration and expiration to create the necessary pressure changes in the air sacs causing air to move through the lungs, an action similar to that of a bellows. When you are handling a bird, holding them too firmly and squeezing the body or restricting free movement of the keel will suffocate them.

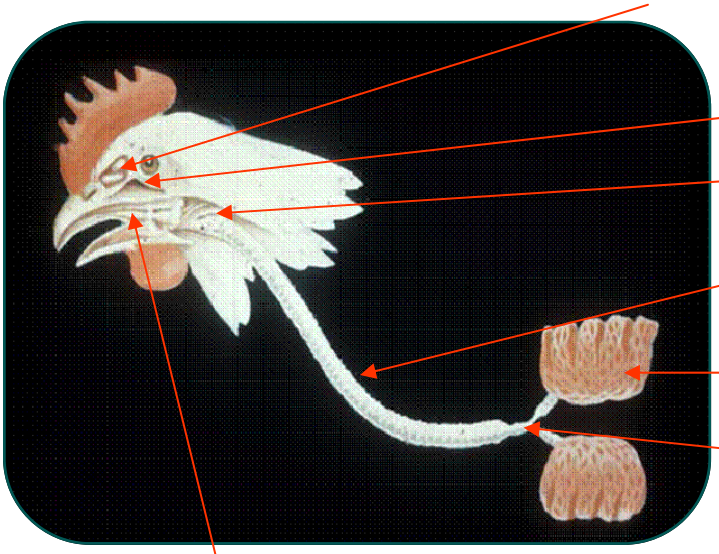


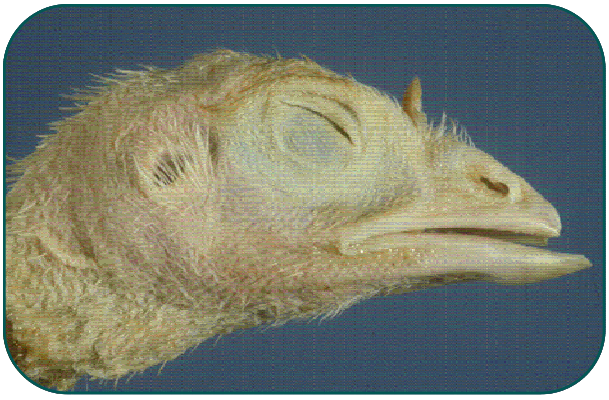


Protective mechanisms in the respiratory system:

Scroll-like structures called the turbinate bones are found just inside the nostrils of a bird. The turbinates are lined by cells that produce mucus that traps dust and bacteria and helps clean the air before it reaches the lungs. Large sinuses communicate with these turbinate structures and extend below the eyes. Sinus infections are common in poultry and infected sinuses swell and fill with mucus or debris.

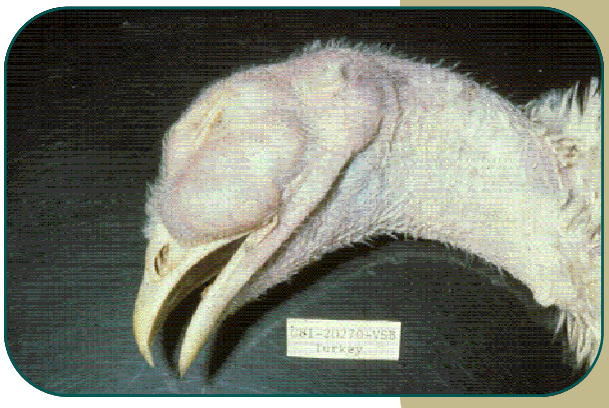
BELOW: Respiratory system of a chicken.





ABOVE: Normal turkey.

BELOW: Turkey with swollen infraorbital sinus.



FACTSHEET 5.4

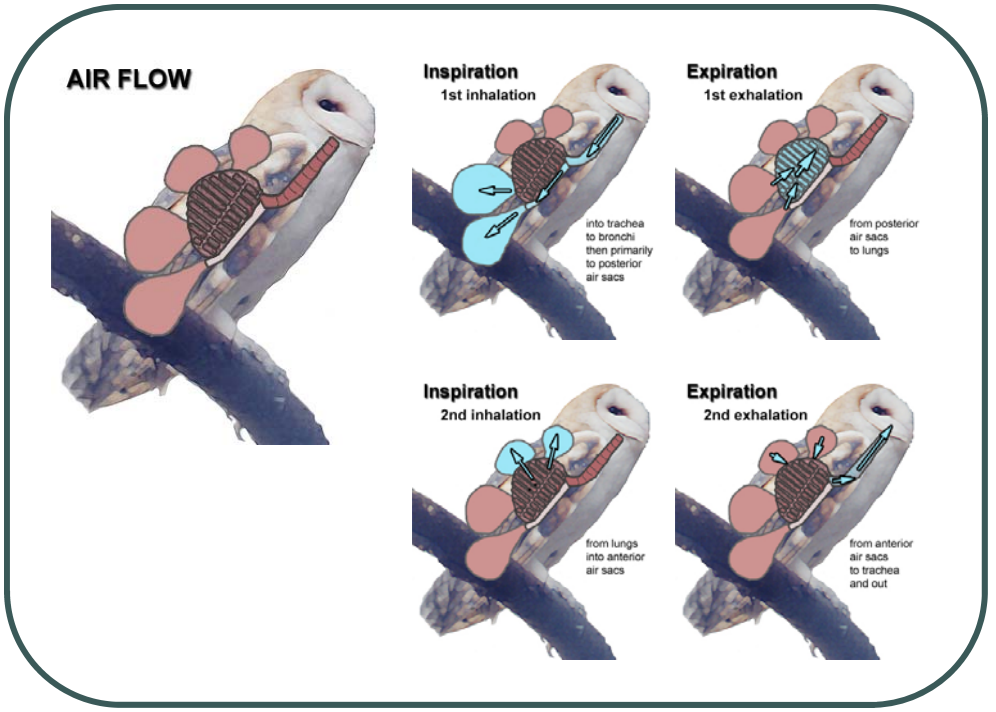
Respiratory System

Biosecurity Education Initiative

FACTSHEET 5.4
March 2008

Air moves from the sinuses to the lungs via the windpipe (trachea). The trachea is made up of many rings of cartilage and is lined with special ciliated cells. These ciliated cells help move dust and debris that might have been inhaled into the lungs up into the throat area where it can be swallowed. Air sacs do not have many protective mechanisms and are easily infected if dust-laden bacteria and viruses reach deep into the respiratory system.

These special mechanisms that help prevent respiratory disease are easily damaged by high ammonia levels in the air from improperly cleaned pens and wet bedding. In addition to ammonia, fungi like *Aspergillus* will grow in wet bedding. If you can smell ammonia or feel it irritate your eyes as you enter the pen area, it is too high. Birds are also very susceptible to dusty environments, so proper pen ventilation and good air-flow is critical. The most effective method for preventing respiratory disease in your birds is by practicing good litter management (i.e. not wet and not too dry and keeping ammonia levels low).



University of Guelph [1]

Ontario [2]

CONTACT

OMAFRA's Agricultural Information Contact Centre:

1-877-424-1300