



ANATOMY OF THE AVIAN RESPIRATORY TRACT: Tracing the Flow of Inspired Air

Cere – feathered or unfeathered area around the top most aspect of the rhamphotheca or upper beak.

Nares or nostrils – allow entry of air.

Operculum – flap of tissue visible through nostril, acts as a “baffle”.

Nasal cavity – divided by the nasal septum, contains nasal conchae or scrolls of tissue, whose function is to clean and warm and humidify the air moving into the respiratory tract. These are highly vascularised and also contain the olfactory tubercles (used for smell).

Infraorbital sinus – bird skull bones are porous. Sinuses within the bones extend around the eye, into the skull, around the ears and into the rhamphotheca (upper beak) and rhinotheca (lower beak). It also connects with the cervicocephalic air sac (see below). The sinus drains from opening on its roof into the nasal conchae. Air filled sinuses are an adaptation for flight, among other things. The right and left infraorbital sinuses of psittacine birds are connected.

Choanal slit – in the roof of the oral cavity; air moves through the internal nares, located on the palate.

Larynx – no sound is produced here, a cartilaginous structure whose function is to open and close the trachea.

Rima glottis – the opening to the trachea is wider than it is in a mammal, and there is no epiglottis to prevent aspiration or breathing in of foreign material.

Trachea – longer and greater in diameter than in a mammal of comparable size, to allow the greatest volume of air to move through, with the least resistance, complete tracheal rings for increased strength and flexibility.

Syrinx – at the bifurcation or division of the trachea, where sound is produced, comprised of muscle, membranes and bony cartilage.

Main stem bronchi – the first division of the trachea, one goes to each lung. The bronchi divide twice more into smaller tubes, and then into minute air capillaries which interconnect and are parallel to blood capillaries. This is where exchange of carbon dioxide for oxygen takes place.

Lungs – attached to the spine and ribs, they are firm spongy structures. They do not expand.

Air sacs – most birds have nine. They are 1-2 cell layers thick and fill the body cavity, extending into the upper wing and leg bones, the clavicles, the skull and the sternum (keel).



DIFFERENCES BETWEEN THE AVIAN AND THE MAMMALIAN RESPIRATORY TRACT

BIRDS

Air sacs – minimal inflammatory response
Syrinx
Continuous, one-way flow of air
No epiglottis
Limited lung expansion
No diaphragm – cannot cough
Much less able to clear particulate matter from air

MAMMALS

No air sacs
Larynx with vocal chords
Residual air in lungs
Epiglottis to protect trachea
Highly expandable lungs
Diaphragm
Cells remove material from lungs

AIR MOVEMENT THROUGH THE AVIAN RESPIRATORY TRACT

Two full inspiration/expiration cycles are required for any given “piece” of air to undergo one complete passage through the respiratory tract of a bird. Inspiration begins when the sternum or keel is lifted out from the body and slightly forward, inflating the air sacs, through the creation of negative pressure, in the manner of a bellows. The pivot point is the coracoid sternal junction. Each breath replaces 50% of the air in the respiratory tract, so fresh air is always available to the lungs.

- a) In the first phase of inspiration, new (oxygen rich) air moves into the trachea. Note that the air sacs are deflated.
- b) As inspiration continues, half of the new air moves into the caudal air sacs and half moves to the lungs, as old (oxygen poor) air moves from the lungs to the cranial air sacs.
- c) During expiration, air in the caudal air sacs moves the lungs, while air already in the lungs and air from the cranial air sacs moves out through the trachea.
- d) The second inspiration begins with new air coming in through the trachea, half going to the caudal air sacs and half to the lungs. Air already in the lungs moves to the caudal air sacs.

The remainder of the air from the first inspiration (a) will now move from the cranial air sac, through the trachea and will be exhaled.



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SIGNS ASSOCIATED WITH RESPIRATORY DISEASE

Eyes or nose discharge, matted feathers or a loss of feathers around the nostrils cere or eyes
Sneezing or plugged nostrils
Swollen, sunken or protruding eye or eyes; swelling or puffiness around the eye or eyes
Noisy or audible breathing; repeated yawning, stretching of the neck or mouth; head shaking and open mouthed breathing
Labored breathing-increased rate or effort, extending wings, panting, abdominal effort
Abnormal posture
Tail bobbing
Wide based, two legged stance Change in voice or loss of voice

PREVENTION OF RESPIRATORY DISEASE

Optimal ventilation and air quality Hygiene
Humidity
Exercise
Nutrition
Regular veterinary attention