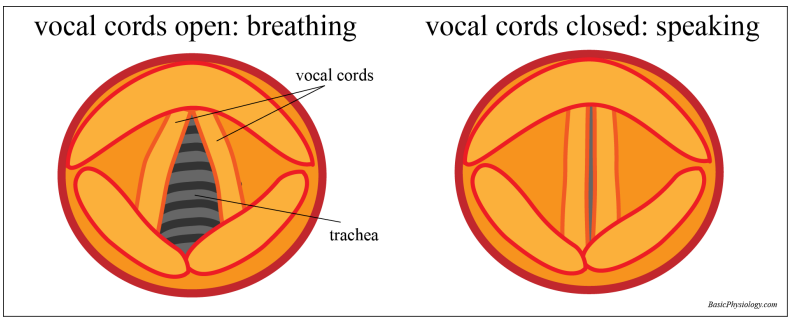
C.3. Lower Respiratory Airways

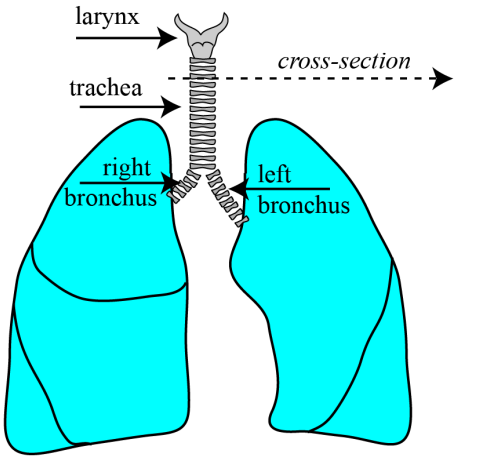
A. The Larynx:

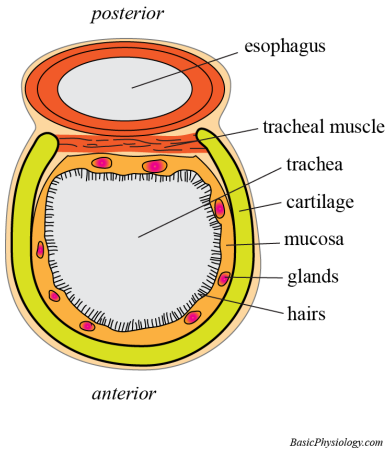
1. The larynx (also called the 'voice box'), starts at the epiglottis and ends at the trachea.	2. It consists of a series of complicated bones (the hyoid bones, or the thyroid cartilage) that surround the airway and contains a very important structure: the vocal cords!
3. The vocal cords are normally folded against the walls. When one wants to talk (or sing!), the vocal cords are extended into the larynx (effectively closing or narrowing the space).	4. The faster the airflow is expired, the higher the vibrations of the vocal cord and vice versa.
	
5. It is important to realize that, although the vocal cords create a vibration, that this sound does not resemble at all the nice words or songs that we hear when someone is speaking or singing.	6. As the air is expired, the turbulence caused by the vocal cords, enters the oral and nasal cavities where the sound is further modulated.
7. You can compare this with a guitar or a violin in which the snares create the vibrations but the box of the violin or the guitar give the vibrations its particular sound, depth and experience.	8. So, it is the surrounding structures such as the palate, the tongue and the lips that transform our (guttural) sound into a beautiful song or intelligent speech (*hopefully*!).

B. The Trachea:

1.
The **trachea** connects the upper airways to the lungs. It is essentially a **stiff** tube (such as a vacuum cleaner tube), which runs in front of the esophagus, for a distance of about 10-15 cm before splitting into the left and right main **bronchus** (plural: bronchi).

2.
Crucial for the function of the trachea are the **rings** of cartilage, shaped like a series of horseshoes, that keeps the airways **open** at all times. These are required or else the trachea would collapse and that would increase the resistance to breathing.





Note the presence of the glands and the hairs sticking out from the mucosa. (See link to paragraph D).

3.
As a side note, the esophagus does not have such horseshoe rings. Therefore, normally, the esophagus is collapsed.

4.
But because of its flexibility, it can easily be distended when a bolus of food is propelled through it.
So; why is it not good for the trachea to be collapsed, like the esophagus? (increased resistance to the airflow)

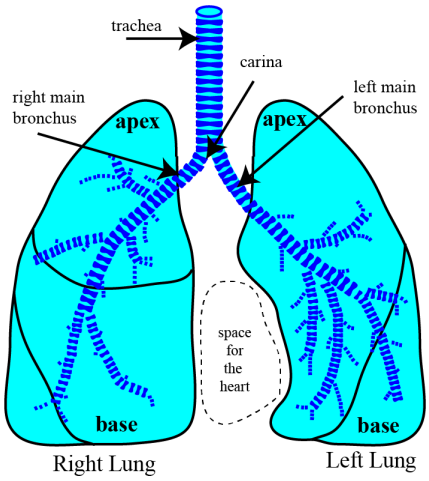
5.
Back to the trachea. At the **carina**, the trachea splits into the two main bronchi. These two main bronchi then split further into many more bronchi, like the branches of a tree. (*Hence the name 'bronchial tree'!*)

6.
Finally, the last branches (= bronchiole) are reached, which are terminated by blind sacs = the **alveoli** (singular: alveolus). *See next page.*

C. The Bronchial tree:

1.
Finally, we are in the lungs where all the action occurs!

2.
As we said before, the main bronchus splits into **many branches**, each branch becoming smaller and thinner than the previous branch.



3.
Note that the **right** lung is divided into **three lobes** while the **left** lung only has **two lobes**.

4.
Furthermore, the left lung is slightly smaller than the right lung thereby creating space for the heart and the big blood vessels.

5.
Note that the most upper part of each lung is called the **apex**, while the bottom of the lungs is called the **base**.

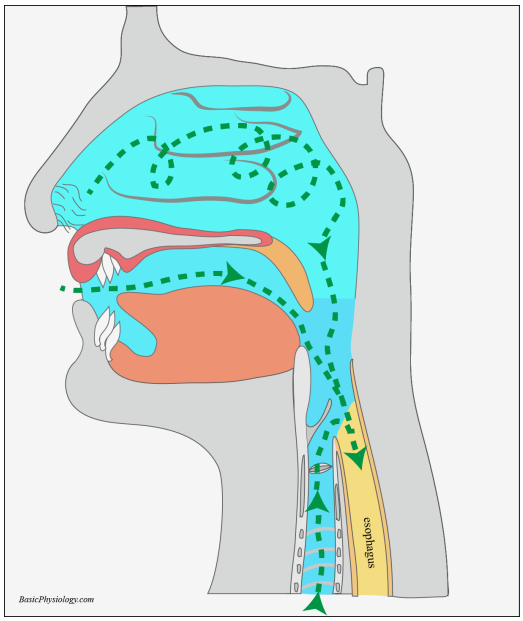
D. The role of the respiratory mucosa:

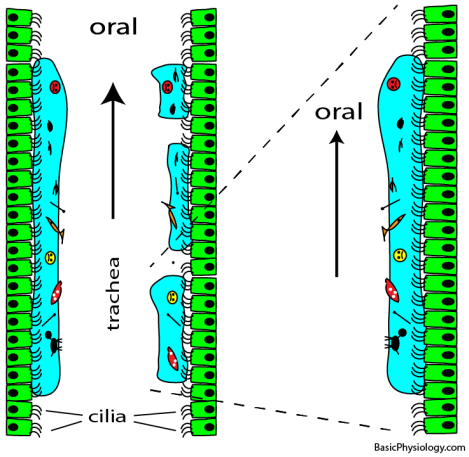
1.
As we said before, the epithelium of the airways (nose, mouth, pharynx, larynx, trachea and bronchi) plays several crucial roles:

a. Moisturizes the air
b. Filters the air

2.
The large particles are trapped in a slimy layer of mucus, which is secreted by the mucosa.

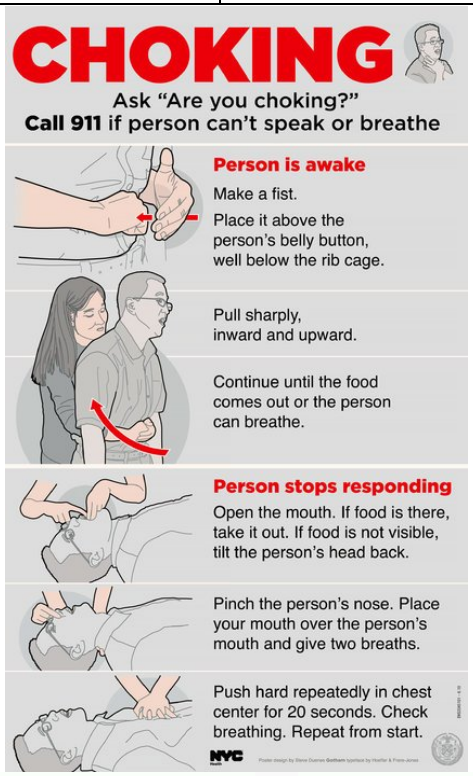
3.
This mucus is created by the glands located in the mucosa all along the whole length of the respiratory pathway; from the nose all the way to the most distal bronchiole.



4. Their function is **extremely** important; to filter and clean the air that is inspired. However, what happens to all the filthy particles when they are caught in this mucus?	5. This is the task of the hairs (=cilia) that is sticking out into the lumen. They beat the mucus down (or up, depending on the location) towards the esophagus where the mucous is then swallowed and digested in the stomach.
6. Sometimes, especially when we have a cold, our body produces too much mucus which we then either sneeze out or blow it out into our handkerchief.	
7. Interestingly, smoking **paralyses** the beating of the cilia. This will lead to accumulation of slime in the airways. *(Not very healthy, is it?)*	
8. That is why smokers always have to cough so much to get rid of their mucus!	

E. The Heimlich maneuver

1. This is such an important and potentially **life-saving** intervention that I have dedicated a special paragraph to it.	2. Sometimes, accidentally, people swallow something that gets **stuck** in their throat. This is immediately noticeable, as one will try to **cough** the object as vigorously as possible out of their pharynx/larynx. This is very often successful.
3. But sometimes, it is not possible to cough the object out such as when it is wedged to firmly in the throat or when it is too big. If this problem is not solved **immediately**, such a person will **die** in a few minutes due to lack of air!	4. The **Heimlich** maneuver consists of a second person 1) Standing behind the victim 2) Turn his two hands into a big fist 3) Place the fist on the belly, just below the ribs of the patient and 4) Push the fist forcefully in- and upward.
5. The point of this maneuver is to push the air from the lungs into the trachea and thereby unplug the plug from the larynx back into the mouth and out to the outside world.	6. There are some excellent websites that demonstrate clearly how to perform this maneuver (Google: *Heimlich maneuver*).


CHOKING
Ask "Are you choking?"
Call 911 if person can't speak or breathe
Person is awake
Make a fist.
Place it above the person's belly button, well below the rib cage.
Pull sharply, inward and upward.
Continue until the food comes out or the person can breathe.
Person stops responding
Open the mouth. If food is there, take it out. If food is not visible, tilt the person's head back.
Pinch the person's nose. Place your mouth over the person's mouth and give two breaths.
Push hard repeatedly in chest center for 20 seconds. Check breathing. Repeat from start.
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