Investigation

3.8B: Lung Anatomy

Tuberculosis is a contagious disease that affects mainly the lungs, the key organ of the **respiratory system**. Our lungs exchange the waste product of metabolism (burning food for energy) **carbon dioxide** for life-sustaining **oxygen** that we also need for deriving energy from the food we eat.

Humans, indeed all primates, have two lungs. Your lungs are located in your chest, or **thorax**. They are connected to the atmosphere by way of the **trachea**, which ends at the **epiglottis**. Your epiglottis is a protective cover designed to keep food from entering your trachea. The trachea receives air from the mouth and nose. Go ahead, cover your nostrils and breathe in through your mouth. Now close your mouth and breathe in through only your nose. You should still be conscious and feeling well; breathing through either you nose or mouth results in air passing to your lungs.

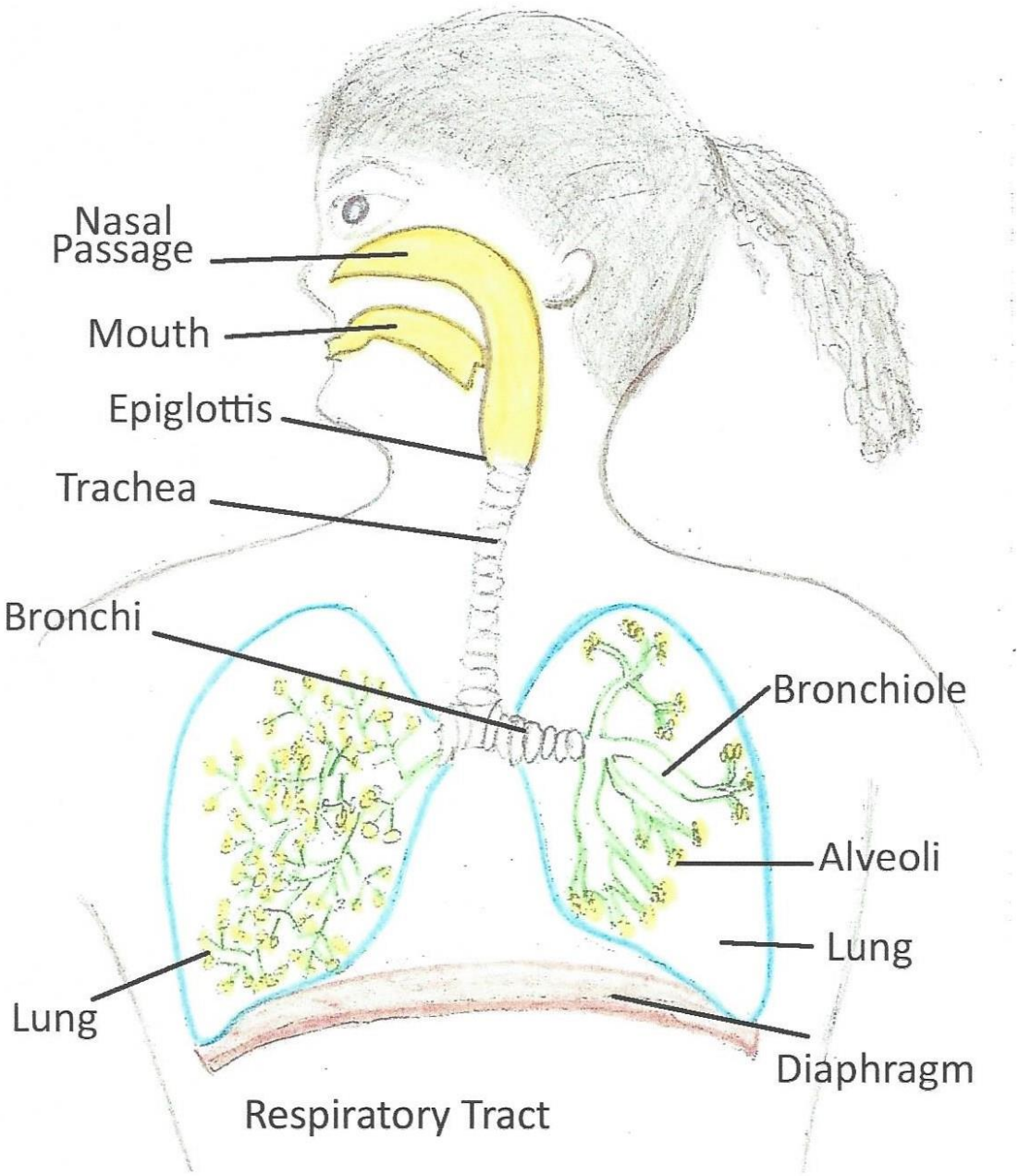
Sometimes we can only breathe through our mouth; think about the last time you had a stuffy nose and could barely breathe at all through your nose. You definitely did some mouth breathing then. What happens when you are eating a meal and your parent reminds you to keep your mouth closed while chewing? In that case you would probably need to do your breathing through your nose.

Air (21% oxygen, 78% nitrogen, and the rest water vapor, carbon dioxide, and rare gases) enters the trachea from either your mouth or nose and is sucked pushed down into the lung bronchi by atmospheric pressure as your muscles expand the volume of your chest cavity. Are you asking yourself what happens to the other stuff in the air that is not oxygen? That's an excellent question. We think mainly of oxygen passing through the lung tissue into our blood stream and carbon dioxide coming out. Nitrogen and other gases also pass through but because they do not participate in the body's chemical processes they are said to come to equilibrium, which means as many molecules wander in as wander out. So under normal conditions it appears as if nitrogen does not pass through the lungs at all. If you should read about deep sea diving you will learn that nitrogen has in fact passed into the body and can become quite important to divers who come to the surface too quickly after diving to great depths.

Dust and other pollutants that might float about in the air we breathe we hope get filtered from the air on its way down the trachea and bronchi by hair-like villi covered in sticky mucus lining the surface. If you have ever blown your nose on a white tissue after being in a very dust place, you may have seen the evidence of this filtering process.

Cigarette smokers over time destroy the protective villi and disrupt their amazing ability to move that sticky mucus up and out of the trachea. Continued smoking can keep the trachea and bronchi irritated resulting in the cough characteristic of chronic bronchitis (a word meaning inflammation of the bronchi).

The bronchi break into smaller units called bronchioles until the air finally reaches the microscopic air sacs called alveoli. Air is passed from the alveoli into the capillaries and carbon dioxide, a waste product of your body metabolism, passes from the capillaries to the alveoli, where it passes from the alveoli to bronchioles to bronchi, then up the trachea and is exhaled by the mouth or nose.



The lungs are covered on the outside by a thin lining called the pleura. The pleura also lines the inside of the chest cavity. The pleural membranes excrete a lubricant. If they weren't lubricated the pleural membranes would not slide smoothly to allow the lung to expand when you take a breath by tightening muscles that expand the chest cavity. Your right lung has three lobes while the left has two. Perhaps the left lung has one less lobe to make room for your heart.

The process of air inhalation followed by exhalation we call breathing or **respiration**. Respiration is an active, not passive process. Inspiration (drawing in air) is an active process resulting from contraction of your intercostal muscles and diaphragm. The **diaphragm** is a very strong muscle separating your chest from your abdomen. Exhalation can be a passive powered by the elasticity of our lung pushing the air out so it can relax to its relaxed volume. You don't have to use any muscles at all for exhalation. You probably also recognize that you can switch exhalation into an active process when you want to blow out the candles on a birthday cake.

Because our lungs are processing air from our external environment, toxins and infectious microbes, both living and non-living can find their way into our lungs. When that happens we rely on our immune system to fight back and keep us healthy - The plan has been known to fail from time to time.

Toxic chemicals in the air can enter our lungs and cause damage. Many people suffer from chronic diseases caused by long term exposure to chemicals found in urban communities or perhaps at their work site. Governments and private organizations work to identify and remove these health threats and it makes sense for us all to support these efforts.

Almost everyone who smokes for many years will end up with some degree of **emphysema**. This disease results in damage to the alveoli and a loss of elasticity in the lung tissue itself. These changes make it difficult to move air in and out, and also to get oxygen into the blood stream. Emphysema patients are sometimes called "pink puffers" or "blue blotters" depending upon which problem in breathing dominates. If the parents coming to your medical office smoke in your presence, please ask them refrain, for your health can be affected as well. Smokers also have an increased risk of lung cancer because of a **carcinogenic** chemical found in cigarette smoke.

In addition to the toxic chemicals attacking our lungs from our environment, our lungs are exposed to disease-causing microbes, viruses and bacteria. There are hundreds of such infectious diseases capable of airborne spread.

Tuberculosis, as we learned in this case history, is a bacterial infection contracted by breathing in organisms from the air from infected people. How can you avoid breathing? Obviously, you can't. It is particularly disturbing when you realize that airborne pathogens can stay in the air after the infected person has left the room. You may have no knowledge of your exposure to these pathogens whatsoever. The best defense is a healthy immune system. Just because you are exposed to an airborne pathogen does not mean you will definitely get sick. More often than we probably realize our immune system recognizes the bad guys you inhale and attacks and conquers them before they can establish themselves within our respiratory system.

We rely constantly on our respiratory system to provide us breathable air and filter out dirt, pollen, and pollutants. Our respiratory system works very well most of the time with our immune system working to keep us healthy. It’s important to keep our lungs healthy by not smoking and avoiding smog, dust, and toxic vapors as best we can.