

# Introduction to Physiology

## **Individual Academic Poster**

BSc Health and Social Care

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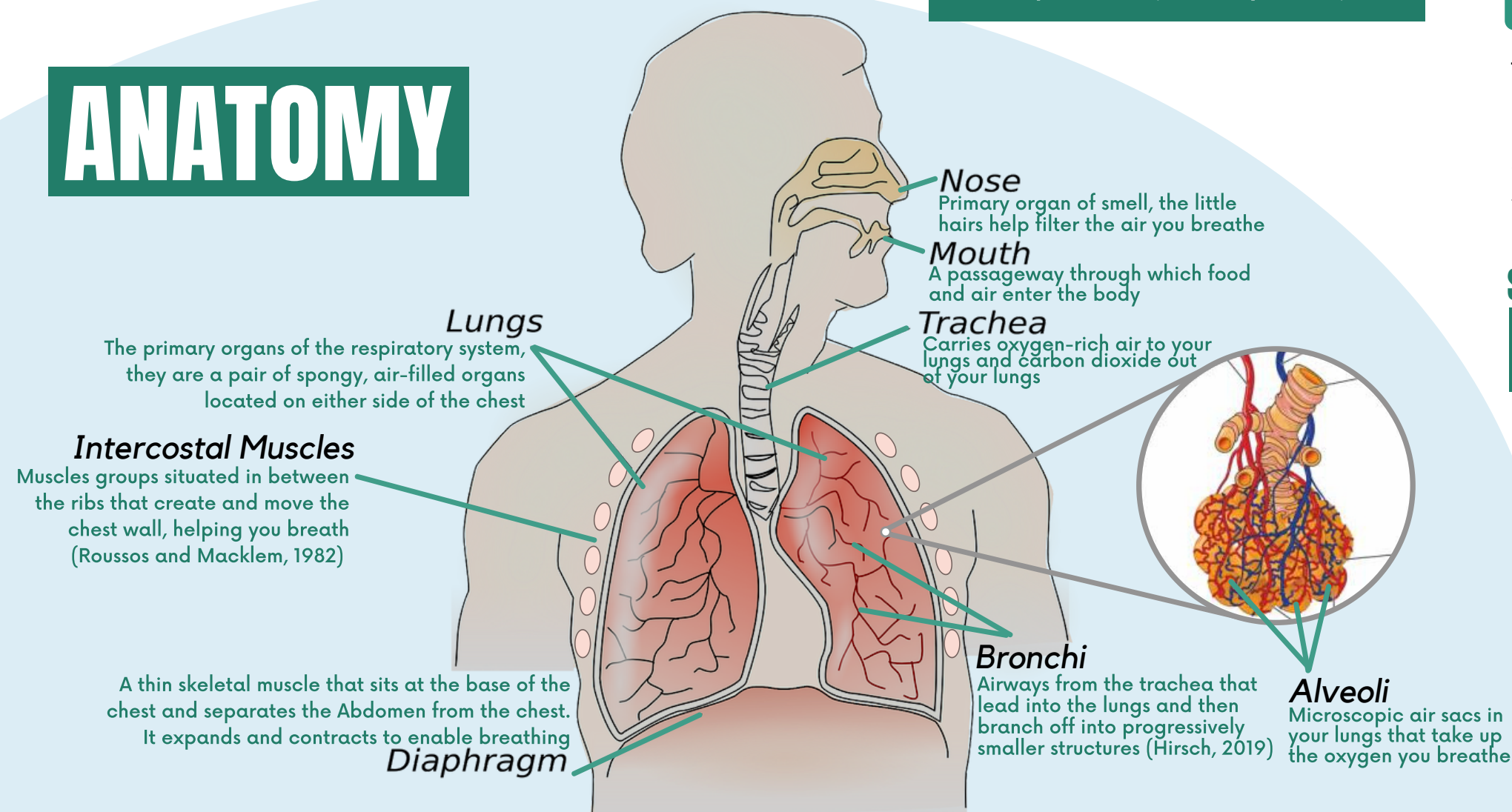
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# THE RESPIRATORY SYSTEM

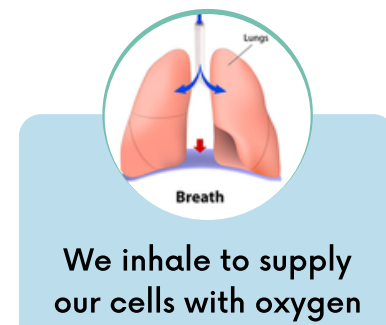
## DEFINITION

The respiratory system consists of the set of organs and tissues involved in the uptake of oxygen from the atmosphere and the release of carbon dioxide generated during aerobic respiration. This gas exchange is also called breathing or external respiration (Buckley, 2021).

## ANATOMY



## PRIMARY FUNCTION

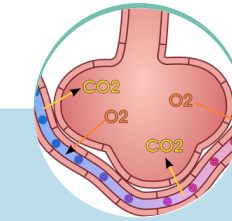


### 1) INHALING

The diaphragm contracts and moves down

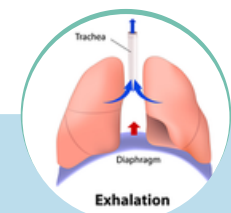
The intercostal muscles contract to expand the rib cage

Chest volume increases as air is sucked into the lungs



In the alveoli oxygen diffuses from the air to the blood and carbon dioxide diffuses from the blood to the air (Davies and Moores, 2010)

### 2) GASEOUS EXCHANGE



### 3) EXHALING

The diaphragm expands and moves up

The intercostal muscles relax to reduce the chest volume

Chest volume decreases as air is forced out of the lungs

The alveoli directly contact tiny capillaries and are able to pass gas molecules and waste products across the cell membranes separating them. When the breath is released, this carbon dioxide is released into the atmosphere. The oxygen will make its way via the circulatory system to the tissues, where it will release its oxygen and pick up more carbon dioxide (Ratini, 2019).

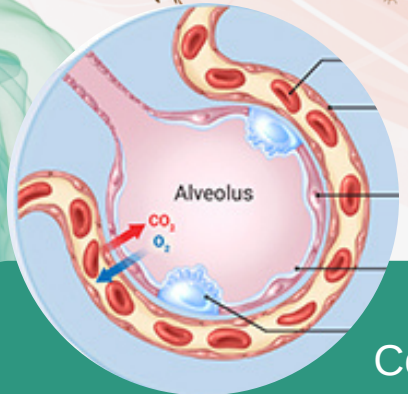
## SECONDARY FUNCTIONS

- **Phonation:** The respiratory system is integral for creating sounds such as those used for speech. The larynx is the main component in the production of sound and can modulate pitch, volume, and clarity (LeVert, 2002).
- **Smell:** The olfactory nerves and their associated structures within the respiratory system are also involved in sensing smell as noted by Askanazi et al (1982) . This ranges from digestion to mating.
- **Immunity:** The cells of the respiratory tract protect the body from the invasion of pathogens through the nasal passages. They have an important role since the respiratory tract has intensive and repeated interaction with the environment. Cells in the airway secrete antibodies and various enzymes that hamper pathogen growth (Cotes, Chinn, and Miller, 2009).

# DISEASES & ILLNESSES

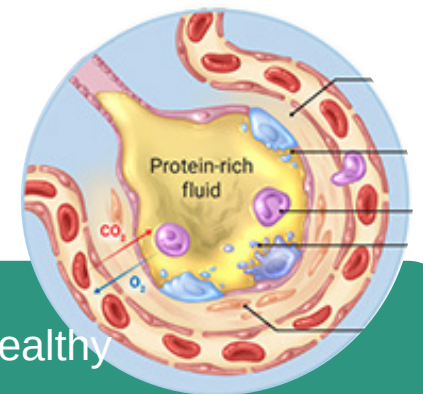
Diseases of the respiratory tract can arise due to obstruction to the airway, constriction of the passages, or the loss of the extensive surface area of alveoli for gas exchange (Lekeux and Art, 1994). There could also be difficulties with the capillaries surrounding these alveoli, either due to clots or due to altered cardiac function (Empey, 1978). These illnesses could be chronic conditions or temporary infections.

## COVID-19



HEALTHY  
alveolus

Covid-19 is a pandemic caused by severe Accute Respiratory Syndrome Coronavirus 2 (SARS CoV-2). It starts in the nose, mouth, or eyes and travels down to the alveoli in the lungs where gas exchange occurs (Aguiar et al, 2020). Each alveolus is wrapped with capillaries where red blood cells release carbon dioxide and pick up oxygen .



INFECTED  
alveolus

When the immune system attacks the area of infection it also kills healthy alveolar cells resulting in three things:

1. Alveolar collapse due to loss of surfactant from Type II cells
  2. Less oxygen enters the bloodstream due to lack of Type I cells
  3. More fluid enters the alveolus
- (Aguiar et al, 2020)

### Immune Response

After infection, cells release inflammatory signals that trigger immune cells. Fluid accumulates inside the alveolus diluting the surfactant which triggers alveolar collapse. This means gas exchange decreases and breathing becomes difficult. As more cells are destroyed, the alveolus collapses. If inflammation becomes severe, the protein-rich fluid can enter the blood stream and travel elsewhere. This may lead to septic shock and multi-organ failure which can be fatal (Waugh and Grant, 2014).

### RNA Vaccine Explained

Scientists have taken genes for the spike protein on the surface of coronavirus and put them into a harmless vaccine to make a virus. This is injected into the patient. The vaccine enters cells which then start to produce the coronavirus spike protein. This prompts the immune system to produce antibodies and activate killer cells to destroy infected cells. Patel et al (2020) state, if the patient encounters coronavirus again, the antibodies and T-cells are triggered to fight the virus.

### Vaccine Administration

Intramuscular administration is the chosen method of delivering all form of the vaccine as it has the benefit of a better immune response, as the appropriate cells are present in the muscle tissue to initiate the immune response. It is vital not to inject too high up the arm into the shoulder capsule, which could result in inflammation and pain, such as frozen shoulder, or too low into the axillary or radial nerve, resulting in pain during the administration and possible nerve damage.

### Vaccine Side-effects

Very common side effects shown in trials for the Pfizer vaccine include: headache, injection site pain, fatigue, chills, arthralgia, myalgia. Common side effects include: redness and swelling at the injection site and nausea. Uncommon side effects include: malaise and lymphadenopathy. Although rare, anaphylaxis is a known side effect of any vaccine. Vaccine recipients should be monitored for 15 minutes after vaccination, with a longer observation period when indicated after clinical assessment (Pardi et al, 2018).

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