Normal structures: The respiratory tract consists of the upper and lower airways. The upper airway includes the nose, nasal cavity, pharynx, and larynx, **which filter, warm, and humidify the air**. The lower airway consists of the trachea, bronchi, bronchioles, and alveoli. The trachea divides into two bronchi, leading to each lung, where they branch into smaller bronchioles, ending in alveoli—**tiny sacs where gas exchange occurs**. Oxygen diffuses into the bloodstream, and carbon dioxide is expelled. In patients with COPD (Chronic Obstructive Pulmonary Disease), the most critical aspects include the airway's ability to remain open and the efficiency of gas exchange. COPD patients experience **inflammation and obstruction of the airways, making it harder for them to exhale, trapping air in the lungs**, and leading to poor oxygenation and CO2 retention. **Inspiration**: the diaphragm contracts and moves downward, while the intercostal muscles contract and lift the rib cage expanding the chest cavity**. Oxygen transport**: oxygen binds to hemoglobin in RBCs and is carried throughout the body**. Carbon dioxide removal**: Waste product from cells diffuse from the capillaries into the alveoli to be expelled during exhalation. **Expiration**: Diaphragm relaxes and moves upward, while the intercostal muscles relax, causing chest cavity to decrease in size.

Complications:

Complications:

Cor Pulmonale: This is right-sided heart failure resulting from pulmonary hypertension. The heart has to work harder to pump blood through narrowed, stiffened pulmonary arteries, leading to heart failure.

Acute Exacerbations: Episodes of worsening symptoms, such as increased breathlessness, cough, and sputum production, often triggered by infections or environmental factors. Exacerbations can lead to hospitalization and accelerated decline in lung function.

Hypoxemia and Hypercapnia: Poor gas exchange in advanced COPD can cause chronic low blood oxygen levels (hypoxemia) and elevated carbon dioxide levels (hypercapnia), leading to complications such as confusion, headaches, and cyanosis.

Pneumothorax: a collapsed lung (pneumothorax), which occurs when air leaks into the space between the lung and chest wall, causing sudden chest pain and difficulty breathing.

Weight Loss and Muscle Wasting: Advanced COPD can cause unintentional weight loss and muscle atrophy due to increased energy expenditure from breathing, poor appetite, and difficulty

Chronic Respiratory Failure: In advanced stages, the lungs may no longer be able to maintain adequate oxygen levels or remove enough carbon dioxide, leading

to respiratory failure and the need for long-term oxygen therapy or ventilatory support.