

Breathing and ventilation

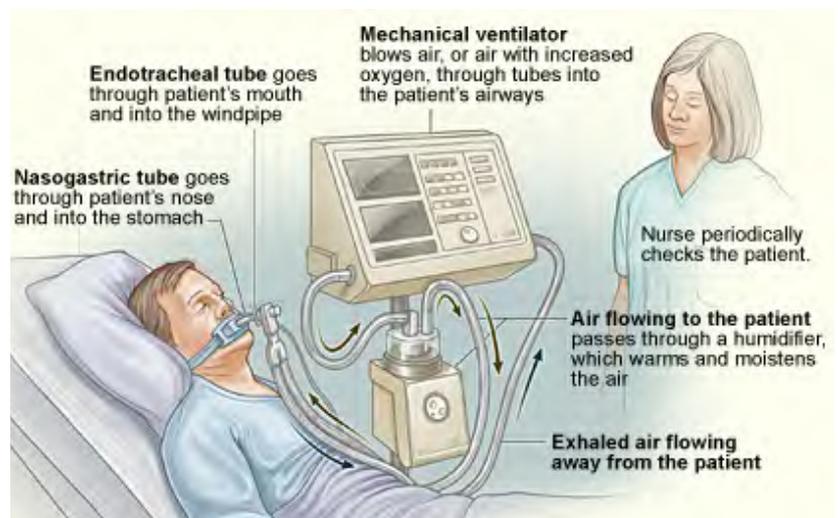
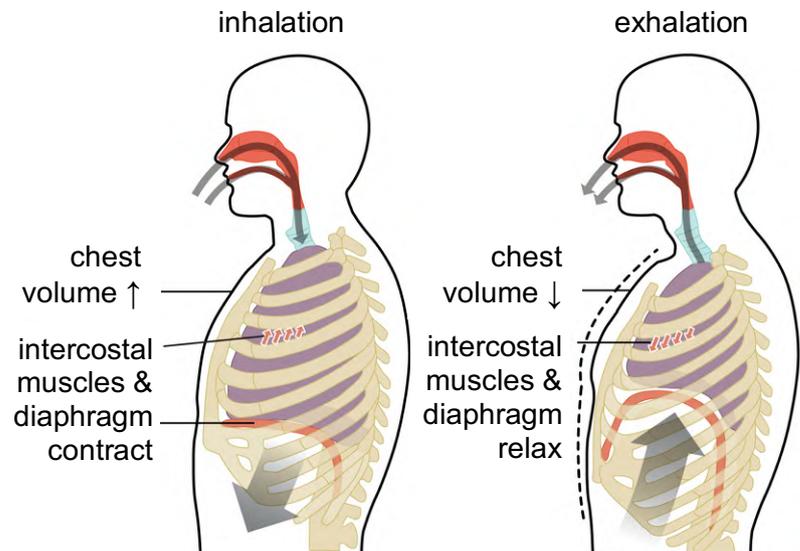
When **intercostal muscles** contract, they shorten and pull up the **ribcage**. When **diaphragm** muscles contract, it flattens. These movements increase the volume of the **chest**.

As volume increases, pressure decreases. Now, air flows from the higher pressure in the surroundings to the lower pressure in the chest, where it fills the lungs (**inhalation**).

Exhalation happens as muscles relax (the rib cage falls, and elastic fibres make the diaphragm rise).

This movement of muscles is **breathing**, and the flow of air is **ventilation**. Lungs are not attached to the ribs or chest. They inflate and deflate due pressure differences moving the air in and out of them.

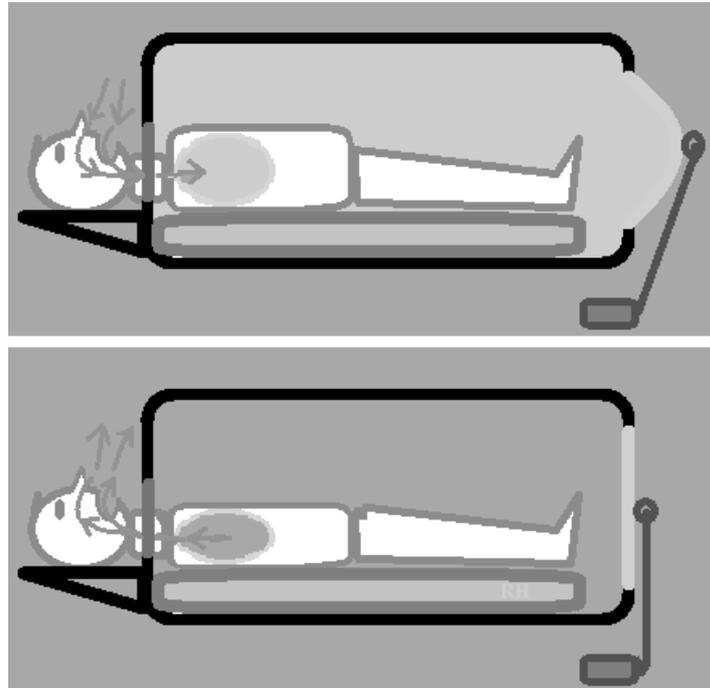
In very serious cases of COVID-19, the lungs fill with fluid. It takes a greater pressure difference to get the heavy lungs to inflate; normal breathing movements are not enough. So, a tube is put into a patient's trachea and a machine generates a large pressure to cause air to flow into the lungs. The machine generates a higher pressure than inside the chest, and so is a 'positive pressure' **ventilator**.



Find out

- a. 'Iron lung' ventilators were used in the 1950s. Use [sciencemuseum.org.uk](https://www.sciencemuseum.org.uk) to find out why.

b. An 'iron lung' is a negative pressure ventilator. Label the diagram to explain how it works.



Test yourself

2. Complete these sentences using *some* words from the box.

When _____ muscles relax, the ribcage _____. When the muscles in the diaphragm relax, it _____. These movements _____ the volume of the chest. Air flows from the _____ pressure in the chest to the _____ pressure in the surroundings. This is _____.

decrease	exhalation
falls	higher
increase	equal
intercostal	inhalation
lower	riser
surroundings	

3. Explain why a patient with the most serious form of COVID-19 finds it difficult to breathe.

Check-up

- I. Check your answers.
- II. Design a way to model how the lungs works. Use two party balloons and a strong, clear, see-through plastic drinks bottle with the bottom cut off.

