

air moves by pressure, gases move by diffusion, two different jobs done back to back

Breathing vs respiration, the distinction the chapter rests on

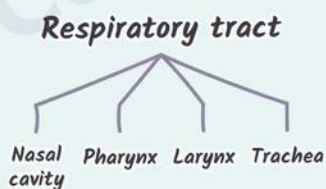
- breathing is purely mechanical: air moves in and out of the lungs down a pressure gradient
- respiration is the biochemical oxidation of food inside a cell, releasing energy
- breathing only supplies the O_2 that step needs
- breathing never produces energy on its own, it only ventilates the exchange surface

breathing ventilates, respiration extracts energy: the lungs never touch the second half of that sentence

Mechanism of breathing, pressure does the work

- air always moves high to low pressure; the lungs never pull air in any other way
- inspiration: diaphragm contracts and flattens, external intercostals contract and lift the ribs
- thoracic volume increases, pulmonary pressure falls below atmospheric, air rushes in
- expiration: diaphragm and external intercostals relax, thoracic volume decreases
- pulmonary pressure rises above atmospheric, air is pushed out
- quiet breathing is mostly passive on expiration; forced expiration recruits internal intercostals and abdominal muscles

The respiratory tract, in order



air's first four stops. The trachea then splits into bronchi, then bronchioles, then alveoli, the actual exchange surface

Alveoli, the exchange surface itself

- each lung packs millions of alveoli, a huge surface area in very little chest space
- the alveolar wall and the capillary wall together form a very thin, moist membrane
- ideal for a gas to diffuse across
- surrounded by a dense capillary network: blood and air sit separated by the smallest barrier

Inspiration vs expiration, one flip

Inspiration

- diaphragm contracts, domes flatten downward
- thoracic volume **increases**, pulmonary pressure drops below atmospheric

Expiration

- diaphragm relaxes, domes rise back up
- thoracic volume **decreases**, pulmonary pressure rises above atmospheric

the diaphragm's own state, contracted or relaxed, is the fastest tell between the two

