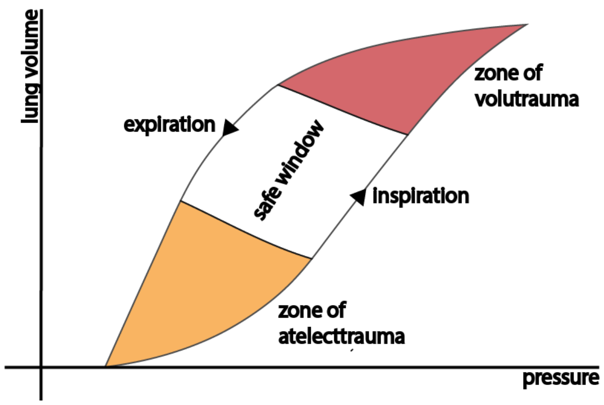
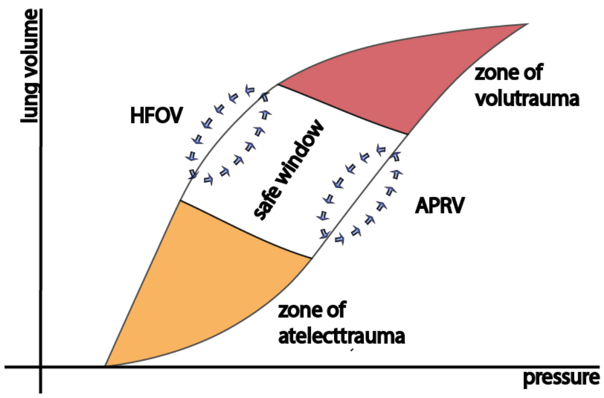
# HIGH FREQUENCY OSCILLATORY VENTILATION (HFOV)

- The theory behind HFOV includes the following aspects:
  - Use of supra-physiologic ventilation frequencies and low tidal volumes (less than dead space)
  - Instead of bulk flow (as in conventional mechanical ventilation), gas flow ad therefore ventilation occurs due to
    - Axial dispersion
    - Collateral flow through pores of Kohn
    - Pendelluft phenomenon
    - Taylor dispersion
    - Asymmetric gas profiles,
    - Gas mixing due to  pressure-diameter relationship of the bronchi
  - Delivery of a constant mean airway pressure (MAP) without the high peak pressures of conventional mechanical ventilation that is directly related to oxygenation
  - Uncoupling of oxygenation and ventilation allowing separate adjustment of either variable



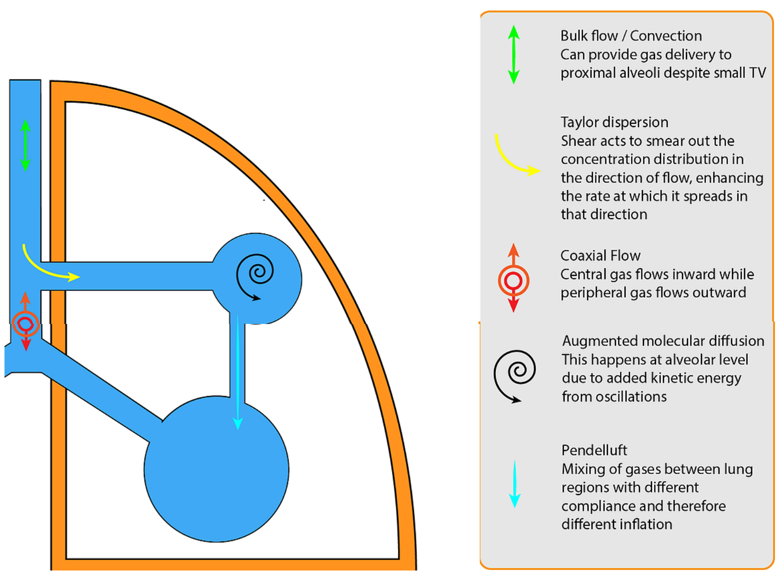

- As pressure increases, lung volume increases depending on the tissues' compliance
- Low pressure go along with atelectasis / collapse, while high pressure cause over distension / volutrauma
- In order to minimise ventilator-induced lung injury (VILI), HFOV operates in the "safe zone"
- Note the hysteresis effect between in- and expiration




- Given the very small tidal volumes during HFOV this mode undulates around a small "safe" window on the expiratory limb of the pressure-volume curve
- APRV is similar in this as it used high MAPs and small tidal volumes on the inspiratory limb of the pressure-volume curve

## PHYSICS INVOLVED IN GAS-EXCHANGE DURING HFOV

As opposed to conventional mechanical ventilation (CMV) which uses bulk flow during in and expiration for gas exchange - HFOV works as a result of a set of physical phenoma

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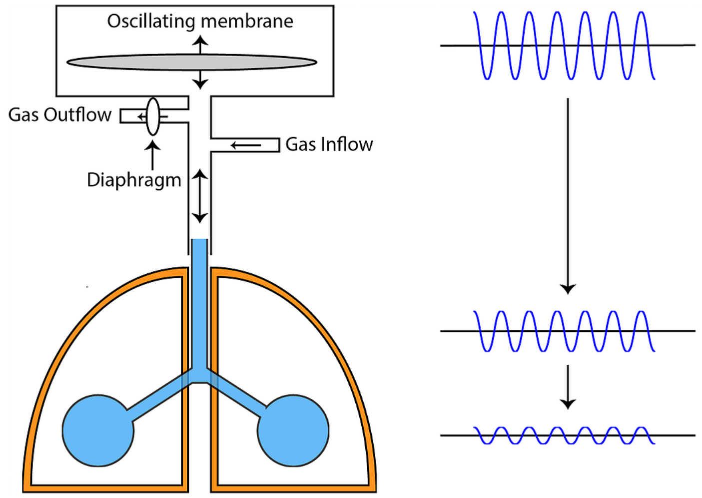
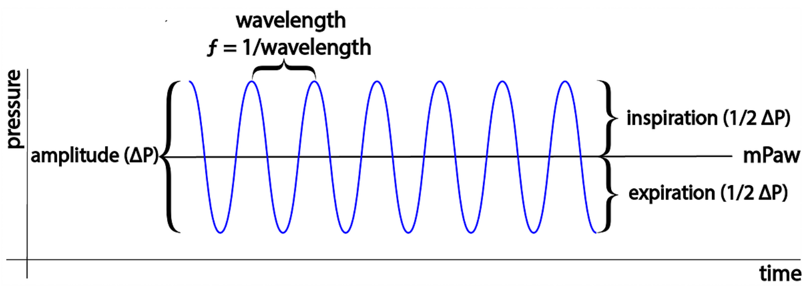
## GENERAL HFOV VENTILATOR SET-UP




- The circuit features gas inflow as well as outflow. The mean airway pressure is generated through gradual changes in obstruction to gas outflow via a diaphragm.
- The membrane generates gas oscillations inside the circuit. The initial amplitude is dampened as it progresses from the membrane down to the alveoli.

## SETTINGS / VARIABLES




- The operator sets
  - mPaw (Mean Airway Pressure)
  - Frequency (ƒ)
  - Amplitude (ΔP)
  - Inspiratory time (Ti) in % of respiratory cycle
- This results in a waveform that undulates around a mean airway pressure.
- Half of the amplitude generates positive pressure (inspiration) while the other half generates negative pressure (expiration)

## TO IMPROVE OXYGENATION

- Increase mPaw
- Increase FiO2
- Increase inspiratory time (Ti)

## TO IMPROVE VENTILATION

- Increase amplitude (ΔP)
- Decrease frequency (ƒ)
- Decrease inspiratory time (Ti)
- Deflate ETT cuff

## VYAIRE(TM) 3100A/B

- This is the most commonly used HFOV ventilator
- The manufacturing companies have changed over time but the model remains the same
- There are two models:
  - 3100A
    - For children and adults (initially aimed at patients < 35kg)
    - Currently manufactured
    - Consumables available
  - 3100B
    - For children / Adults > 35kg
    - Currently no longer manufactured
    - Consumables available