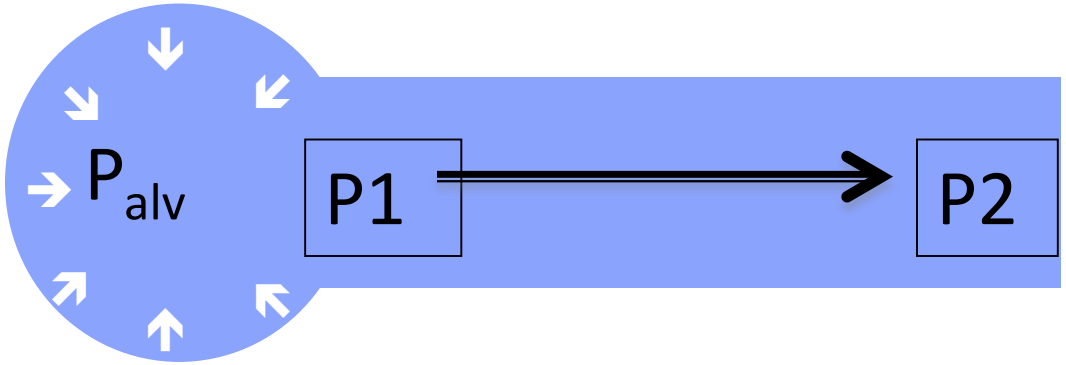
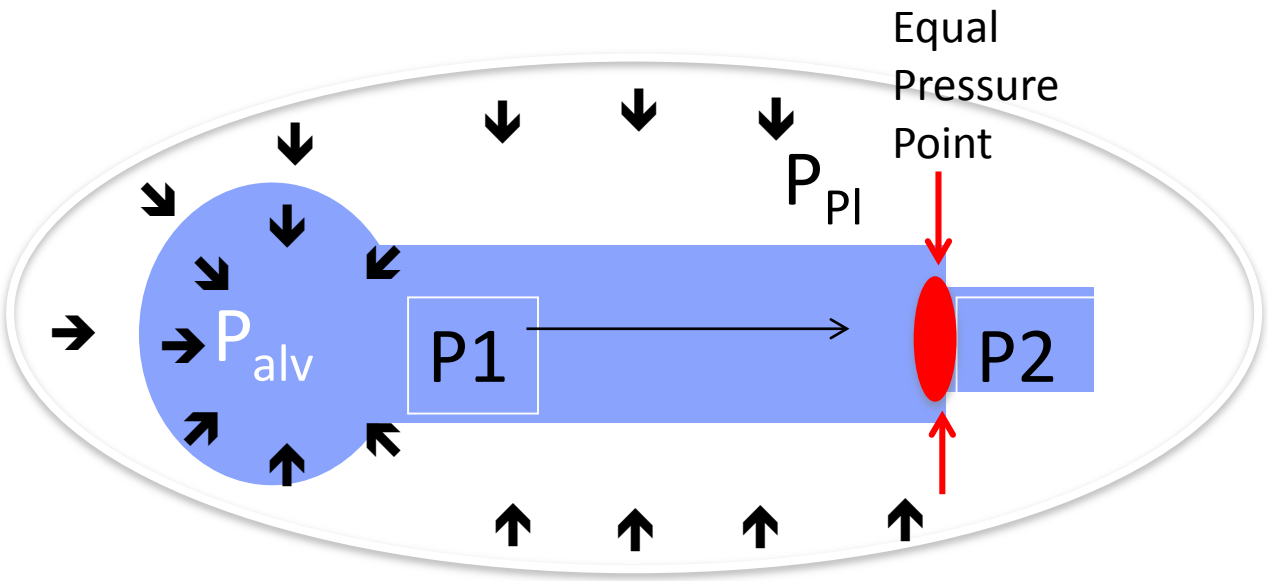
Physiologic Implications Underwater Breathing Apparatus

Physiologic Implications Underwater Breathing

- Increased CO_2 levels
  - CO_2 retention if breathing inadequate to eliminate CO_2 produced.
  - Common in all diving due to ↑WOB
    - Immersion effects
    - Gas density
    - Equipment effects
  - Exacerbated by exercise/work, panic, hyperventilation, dynamic airway compression
- Gas Density
  - increased depth = increased density (Gas law) = decreased flow (Poiseuille's law) = increased WOB
- Immersion Effects
  - P Δ feet to chest ~120cm H_2O, negative static lung load dev when lungs deeper than reg/counterlung
  - Fluid shift to central circulation
    - ↑cardiac afterload, ↑blood to lungs = ↓lung compliance, ↓ VC, ↑ airway resistance, diuresis
- Equipment Effects
  - All underwater breathing equipment increases breathing resistance
    - i.e. Demand valve, dead space in helmet/face masks/hoses
  - Movement of CO_2 from blood to lungs based on gradient/press Δ
    - Rebreathers – if inhaling Co_2 = smaller Δ = less CO_2 ventilated

Dynamic Airway Compression (DAC)





- Normal Expiration – gas flows out along airway because P1 >P2
  - P1 -> P2 declines more quickly with dense gas
- At some point along the tube, airway P = intrapleural P (P_{pl}) = equal pressure point (EPP)
  - Beyond this point, P along airway is less than P_{pl} = airway compression
- Catch 22
  - Harder you try to exhale,
    - higher the P_{Pl} = shift EPP to the left
    - ↑ WOB which ↑ CO_2
- Distal movement of EPP
  - Increased a/w resistance (asthma, gas density), reduced lung elastic recoil, negative static lung load