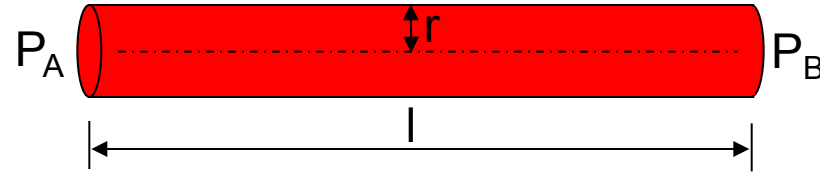# (XX.) Pneumotachography:

estimation of airway resistance

Physiology - practical

Pneumotachography is a method enabling estimation of airways resistance. It measures pressure difference between two ends of tube through which the examined person breathes.

Increased value of airways resistance indicates obstruction of the airways.

Poiseuille - Hagen law

Volume flow (Q) in rigid tube equals directly to pressure gradient between beginning and end of the tube ($\Delta P = P_A - P_B$), the fourth power of its radius (*r*) and indirectly to its length (*l*) and viscosity of the fluid (η)

$$Q = \frac{\pi \cdot \Delta P \cdot r^4}{8 \cdot l \cdot \eta} = \frac{\Delta P}{R}$$

R is tube resistance against to gas flow

Resistance of airways

*Resistance of airways (R_d) results from inner friction between flowing gas and airways wall.*

$$R_d = \frac{\Delta P}{Q} = \frac{8 \cdot l \cdot \eta}{\pi \cdot r_d^4}$$

Small change of airways radius (r_d) causes substantially bigger change of airways resistance to air flow (R_d). Airways obstruction may be caused by chest compression, mucosal swelling, or smooth muscles constriction in airways.

Principle of pneumotachograph
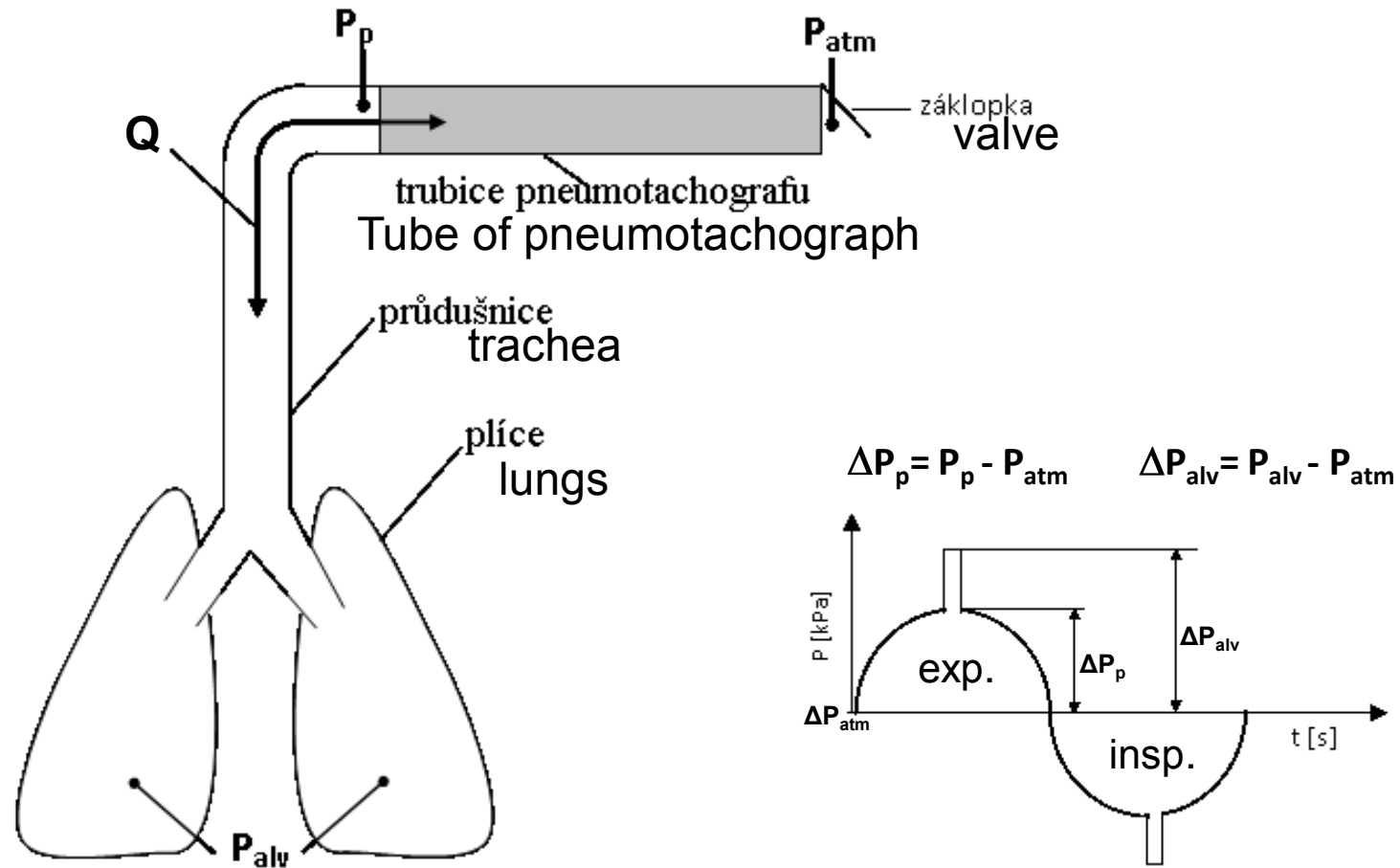
Calculation of airways resistance
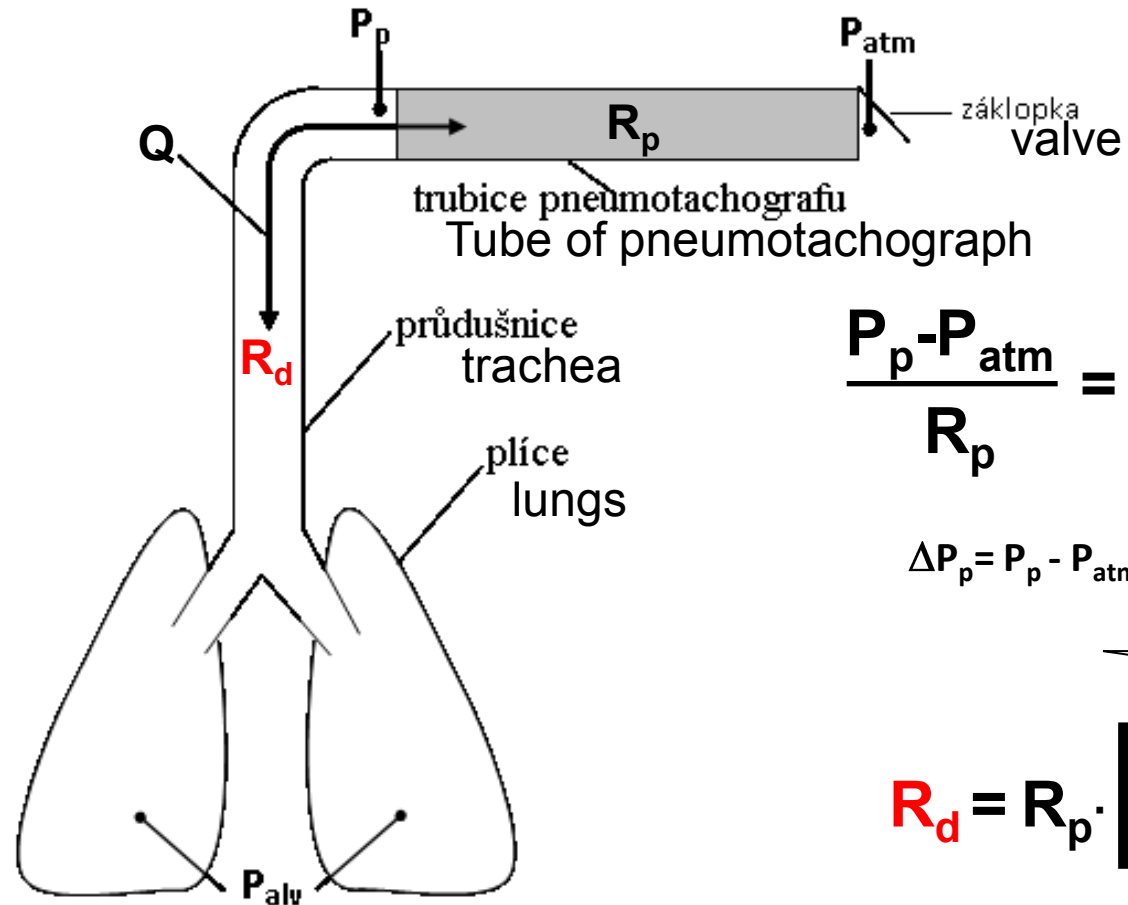
$$\frac{P_p - P_{atm}}{R_p} = Q = \frac{P_{alv} - P_p}{R_d}$$

$$\Delta P_p = P_p - P_{atm} \qquad \Delta P_{alv} = P_{alv} - P_{atm}$$

$$R_d = R_p \cdot \left[\frac{\Delta P_{alv}}{\Delta P_p} - 1 \right]$$

Pictures:

Slide 5, 6 – Physiology and Neuroscience Practicals, Masaryk university 2013