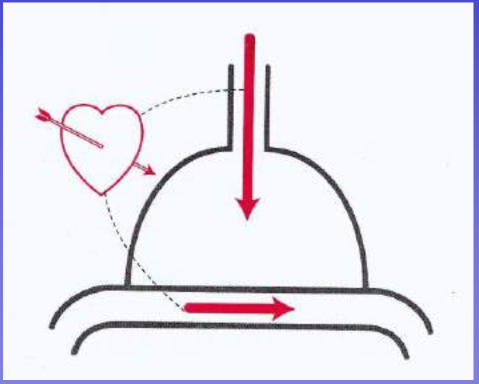
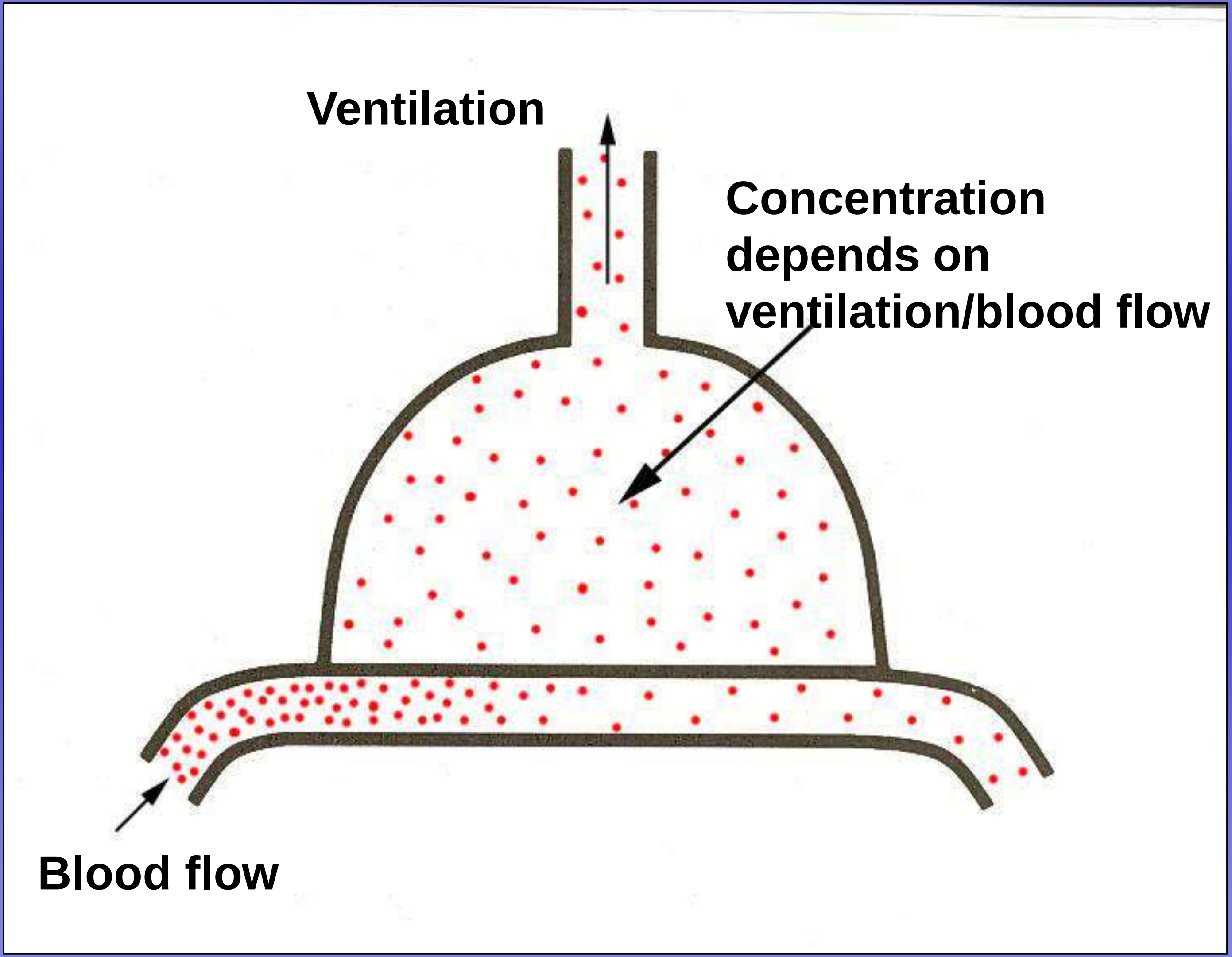
Lectures on respiratory physiology

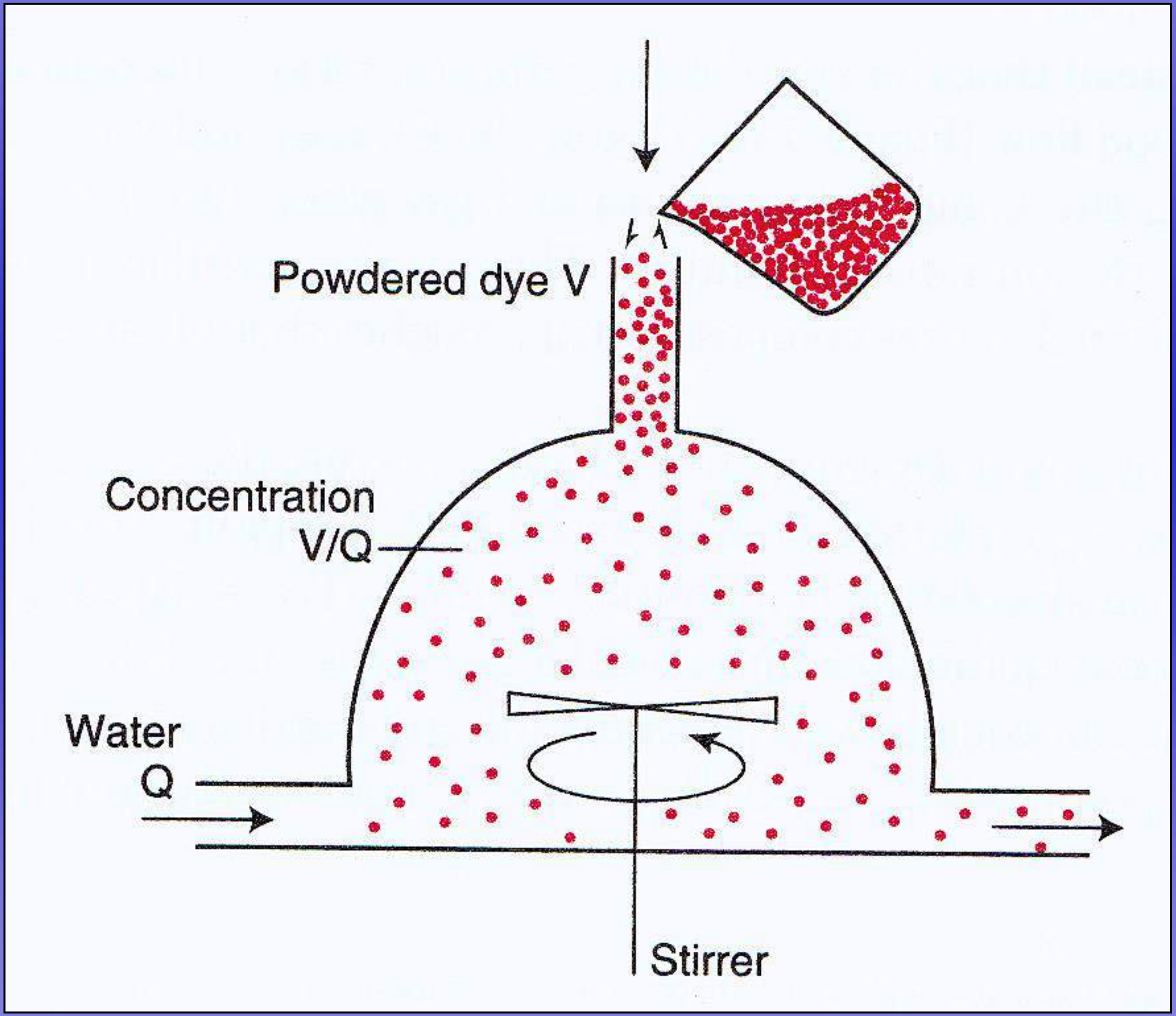
Pulmonary Gas Exchange II



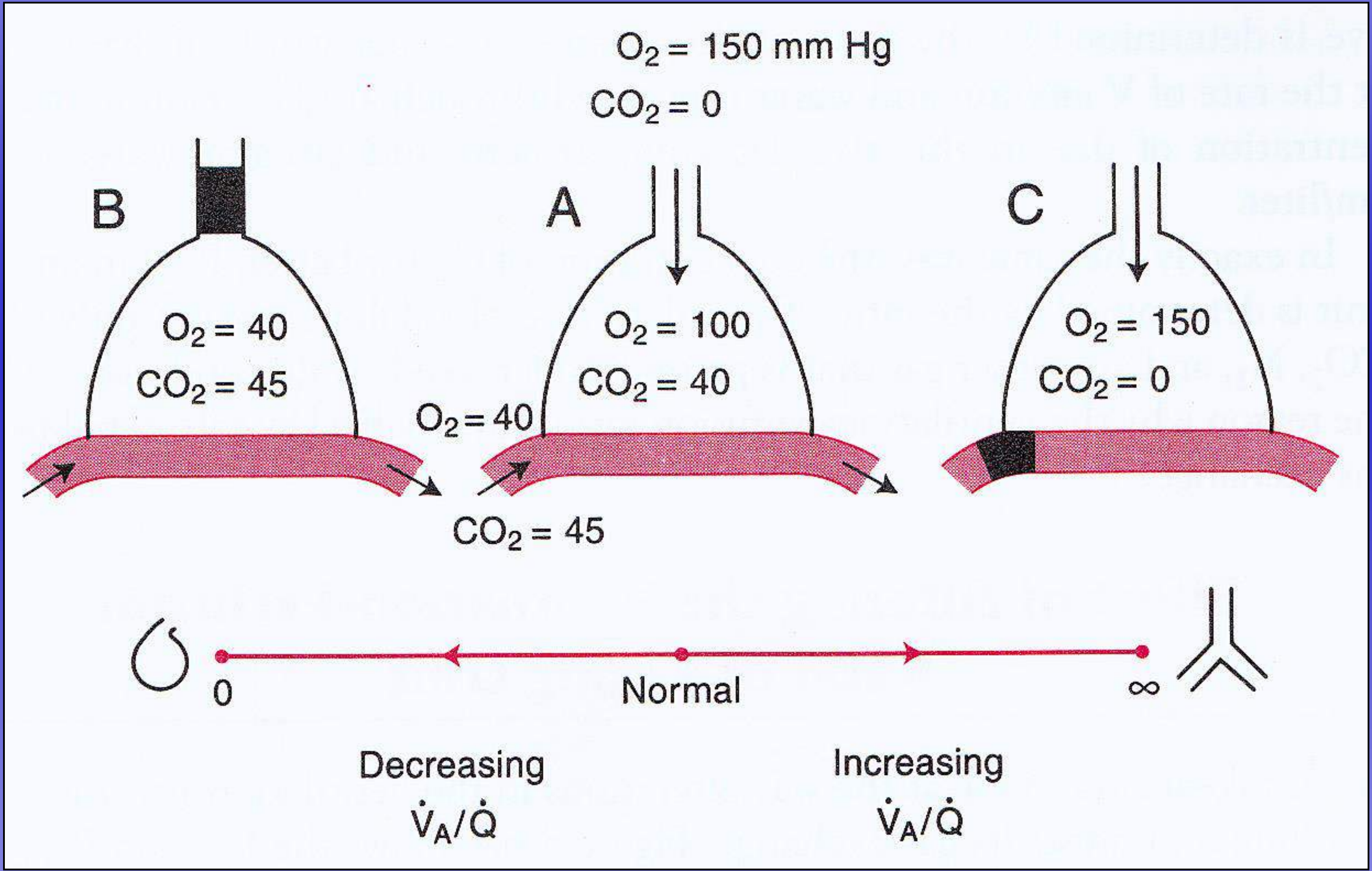
Key role of ventilation-perfusion ratio



Model showing the importance of the ventilation-perfusion ratio



Effects of changing the ventilation-perfusion ratio



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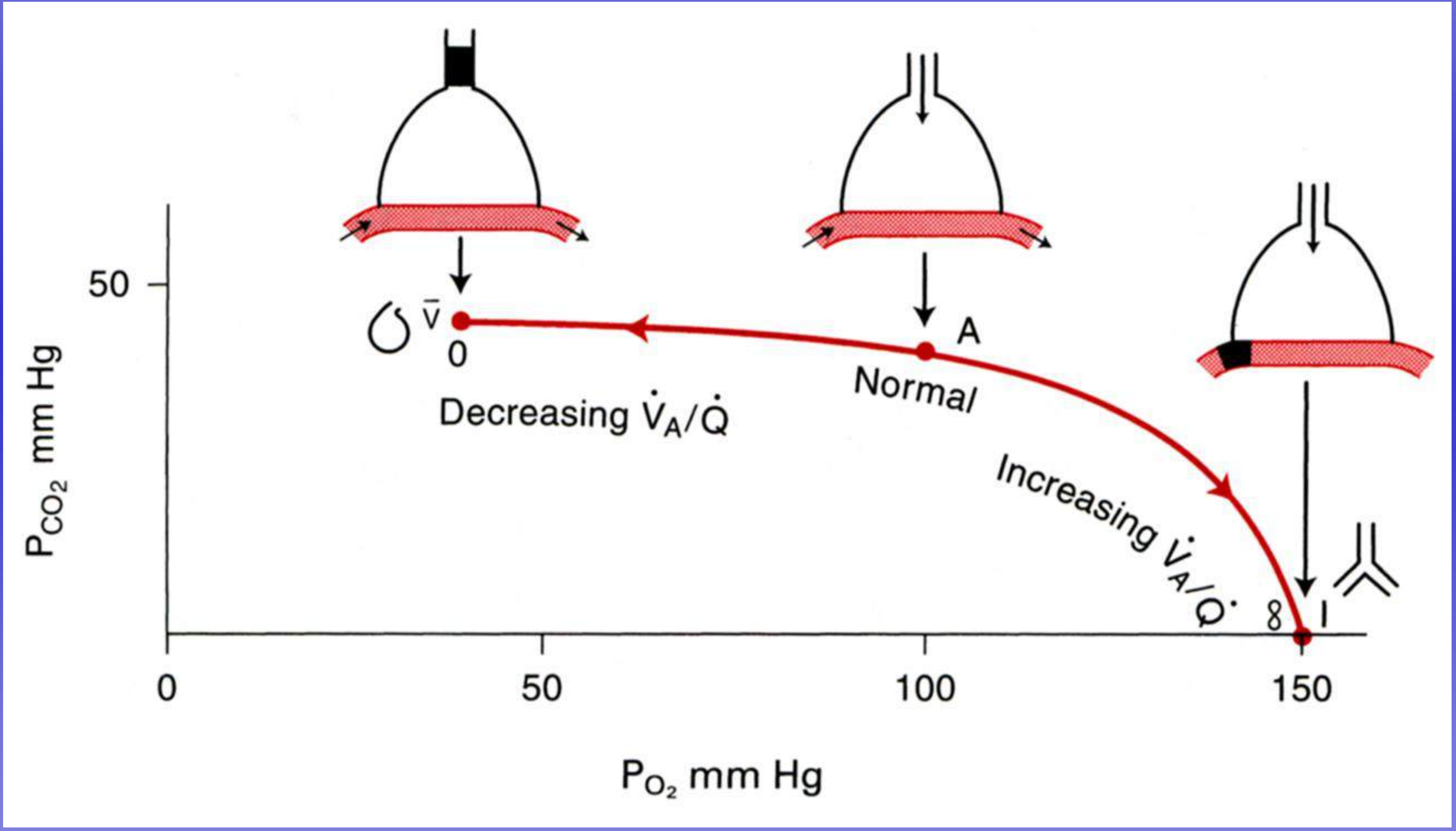
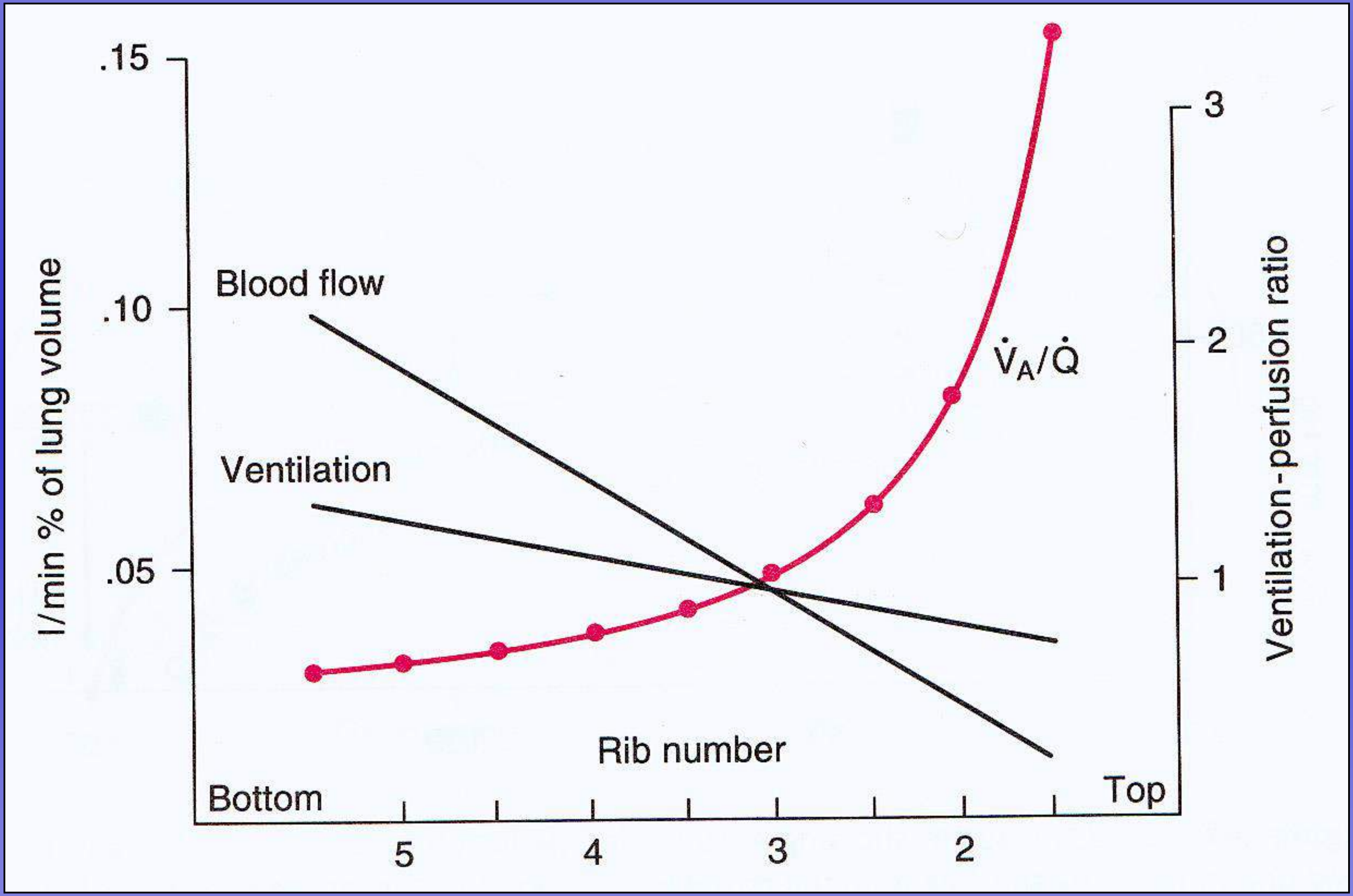
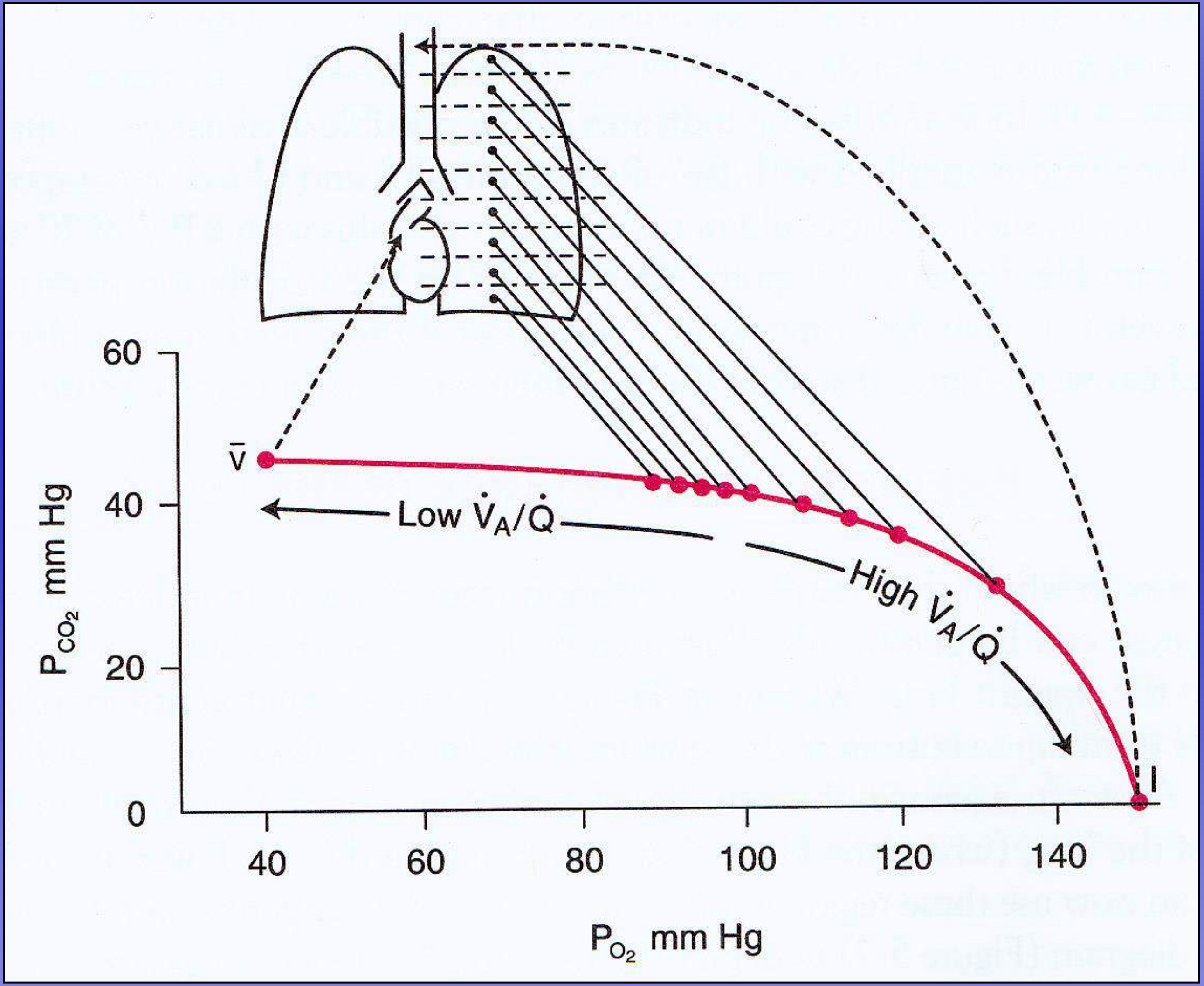


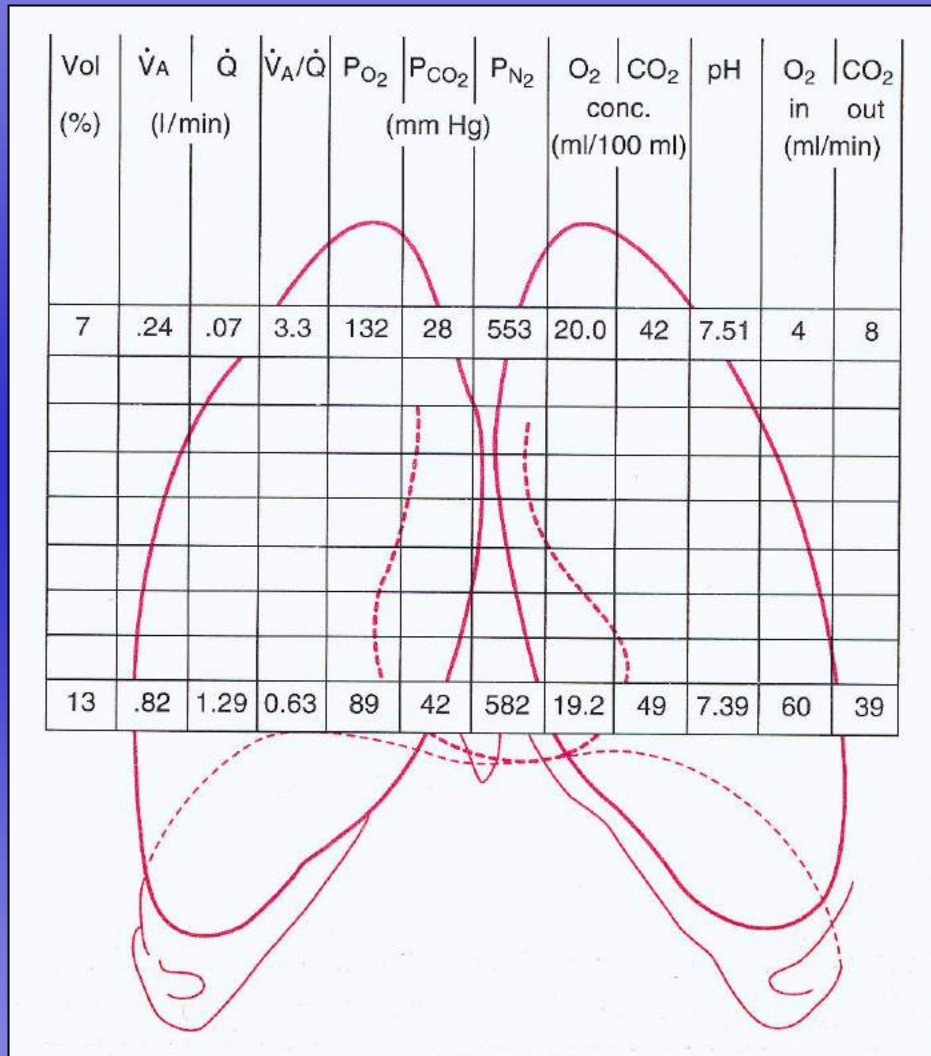
Distributions of ventilation and blood flow in the upright lung



Ventilation-perfusion ratios down the upright lung

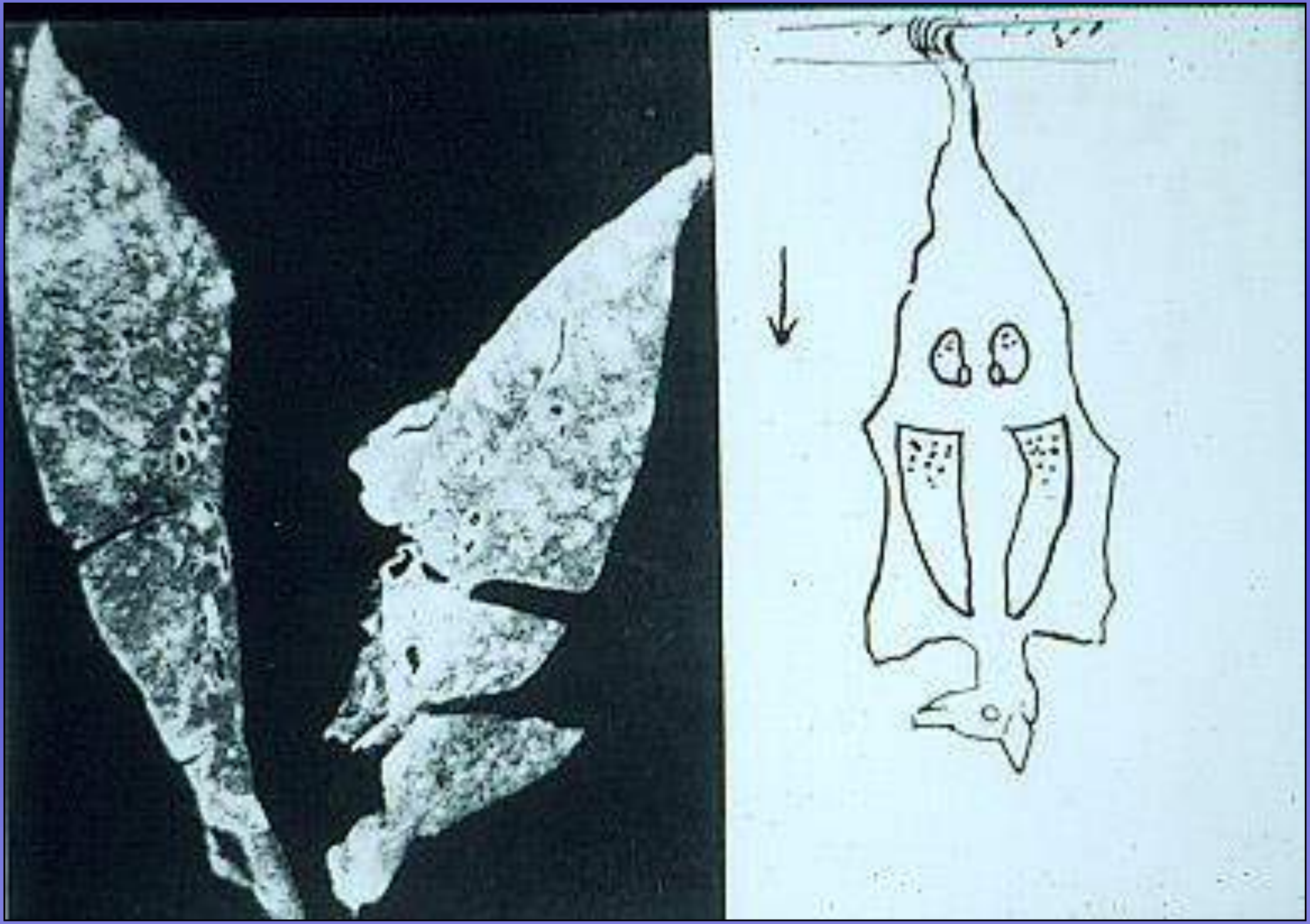


Regional differences of gas exchange



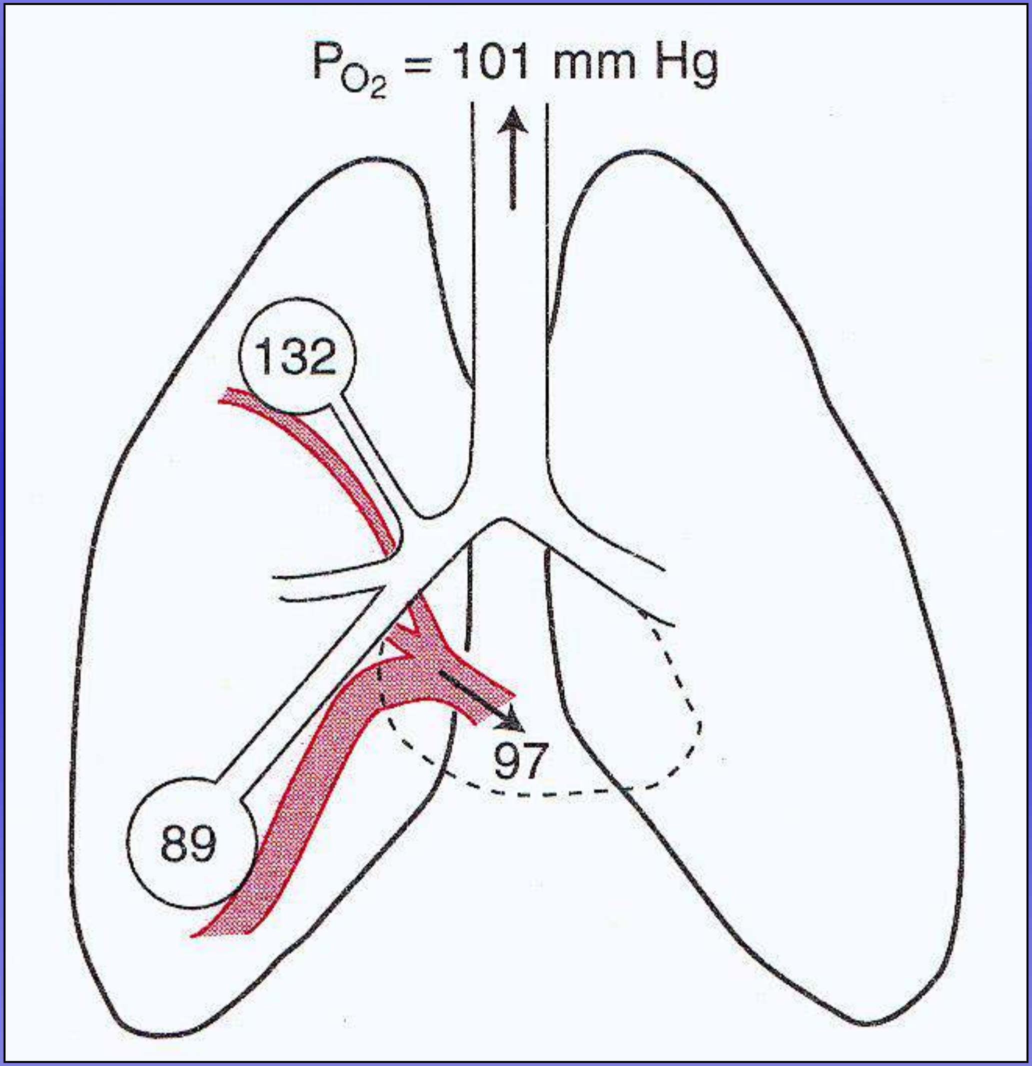
Vol (%)	$\dot{V}_A$ (l/min)	$\dot{Q}$ (l/min)	$\dot{V}_A/\dot{Q}$	P_{O_2} (mm Hg)	P_{CO_2} (mm Hg)	P_{N_2} (mm Hg)	O_2 conc. (ml/100 ml)	CO_2 conc. (ml/100 ml)	pH	O_2 in (ml/min)	CO_2 out (ml/min)
7	.24	.07	3.3	132	28	553	20.0	42	7.51	4	8
13	.82	1.29	0.63	89	42	582	19.2	49	7.39	60	39

Tuberculosis in the base of the lungs in the bat

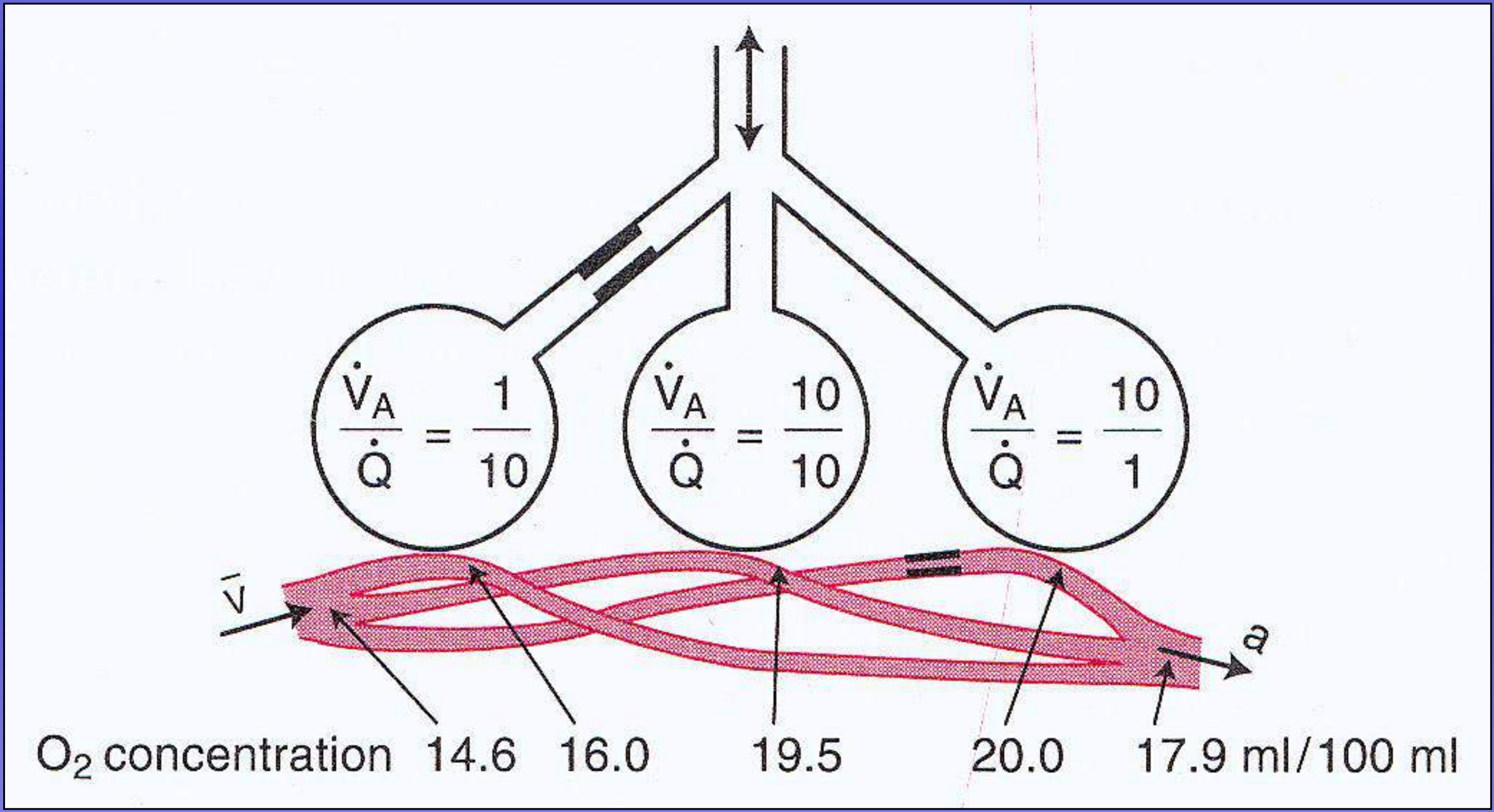


Calcification in the apices of the lungs

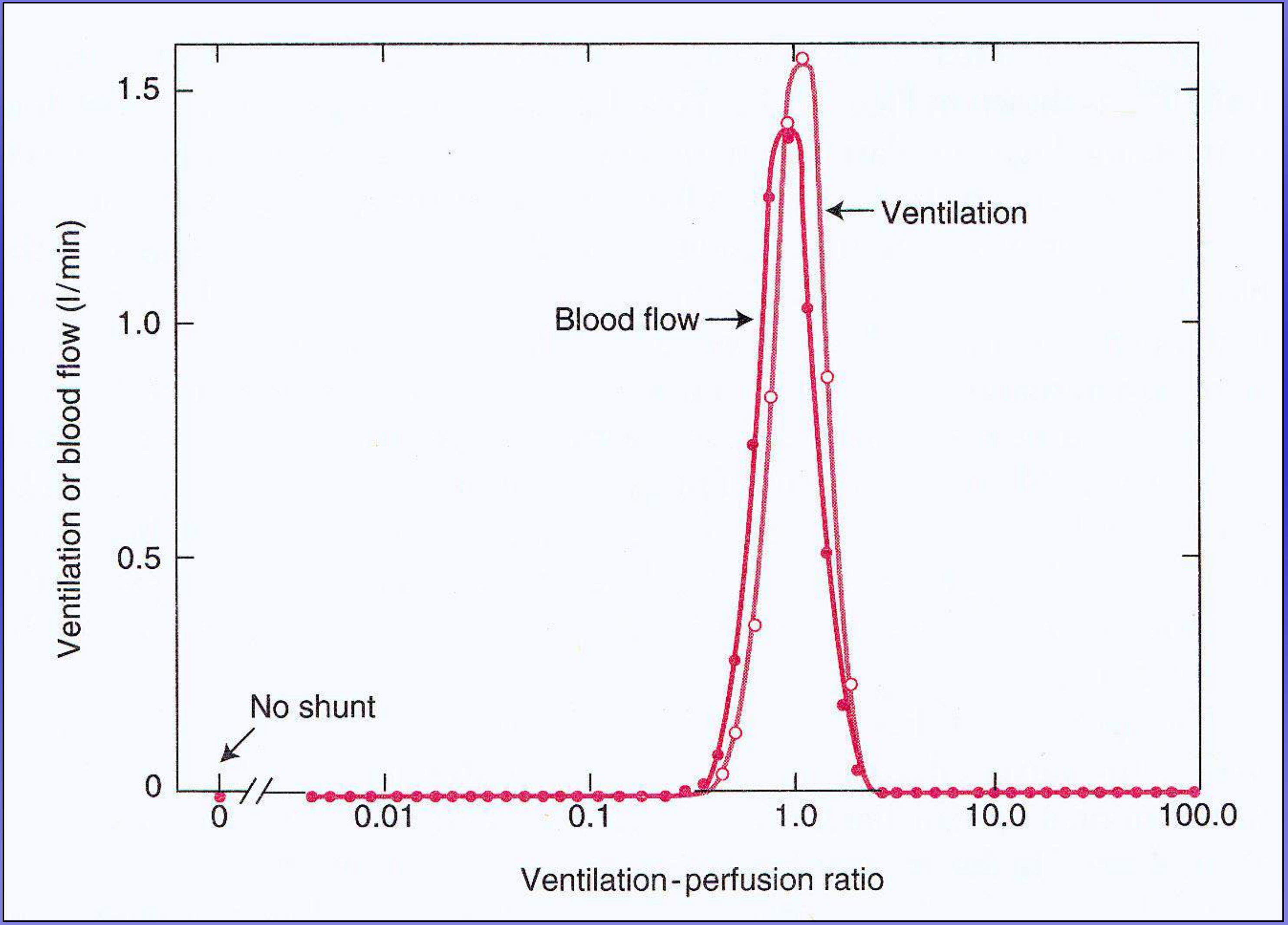
Cause of an alveolar-arterial PO_2 difference



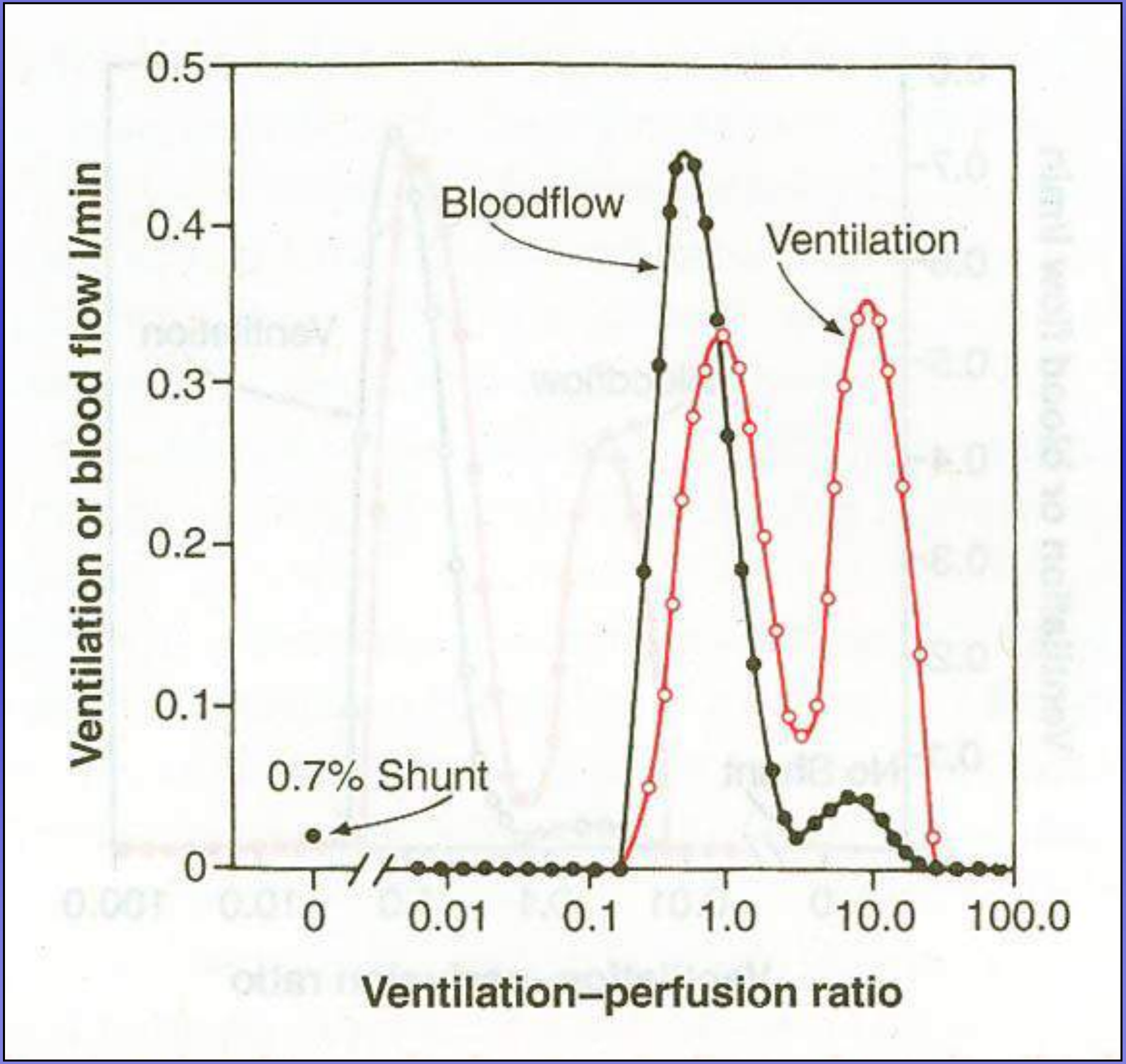
Ventilation-perfusion inequality must cause hypoxemia



Normal distribution of ventilation perfusion ratios



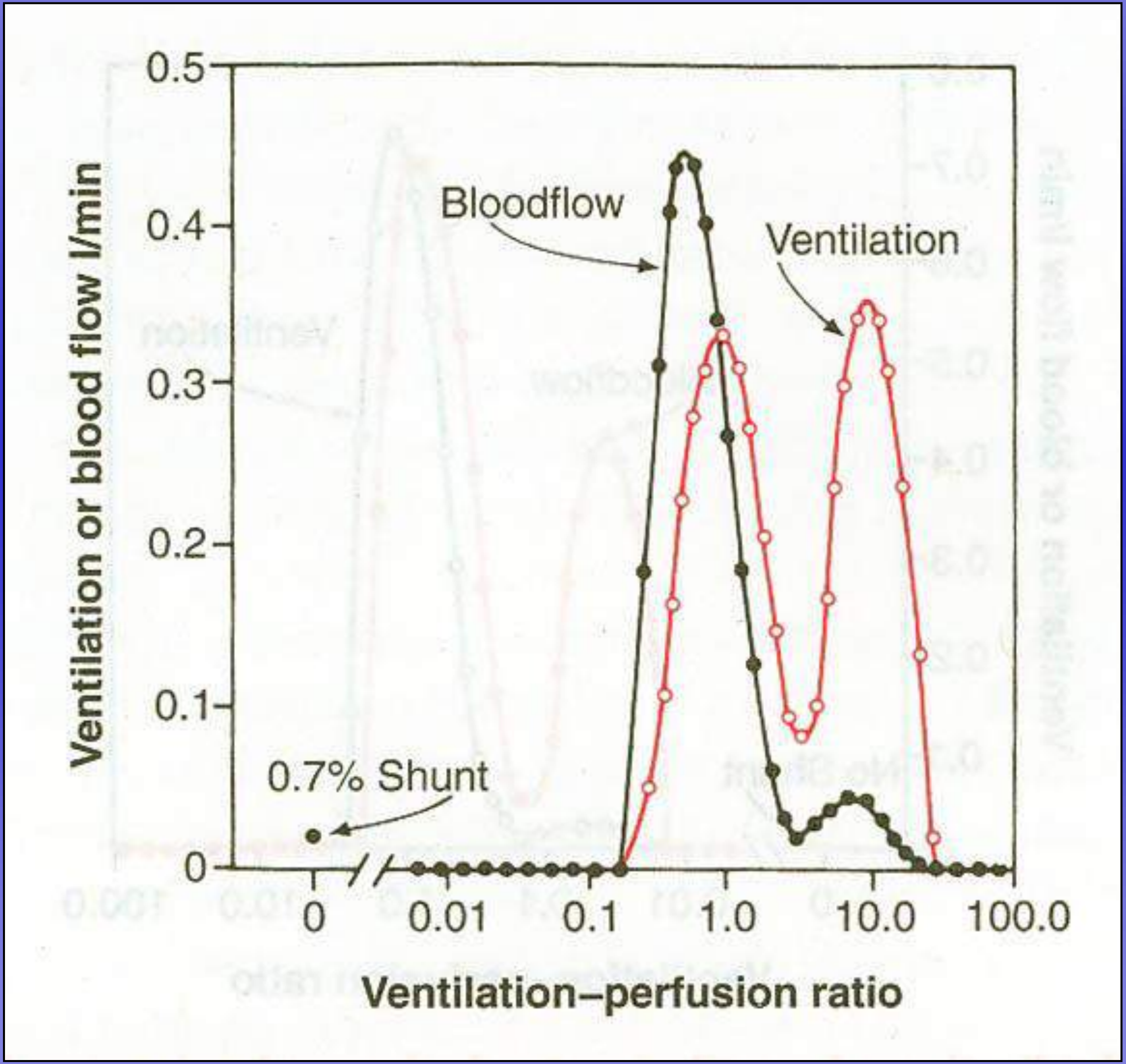
Distribution of ventilation-perfusion ratios in emphysema



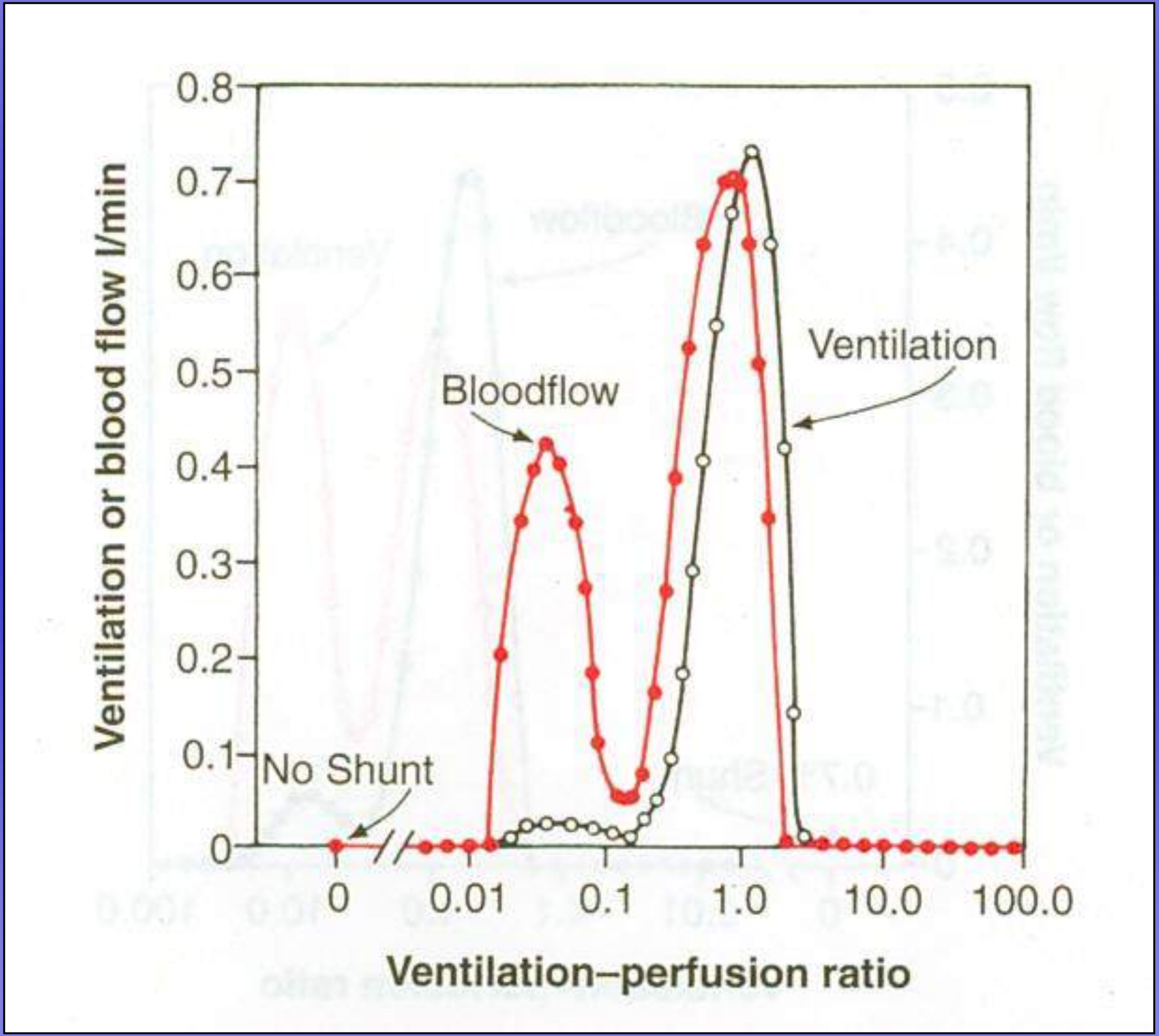
Section of normal lung

Section of lung with severe emphysema

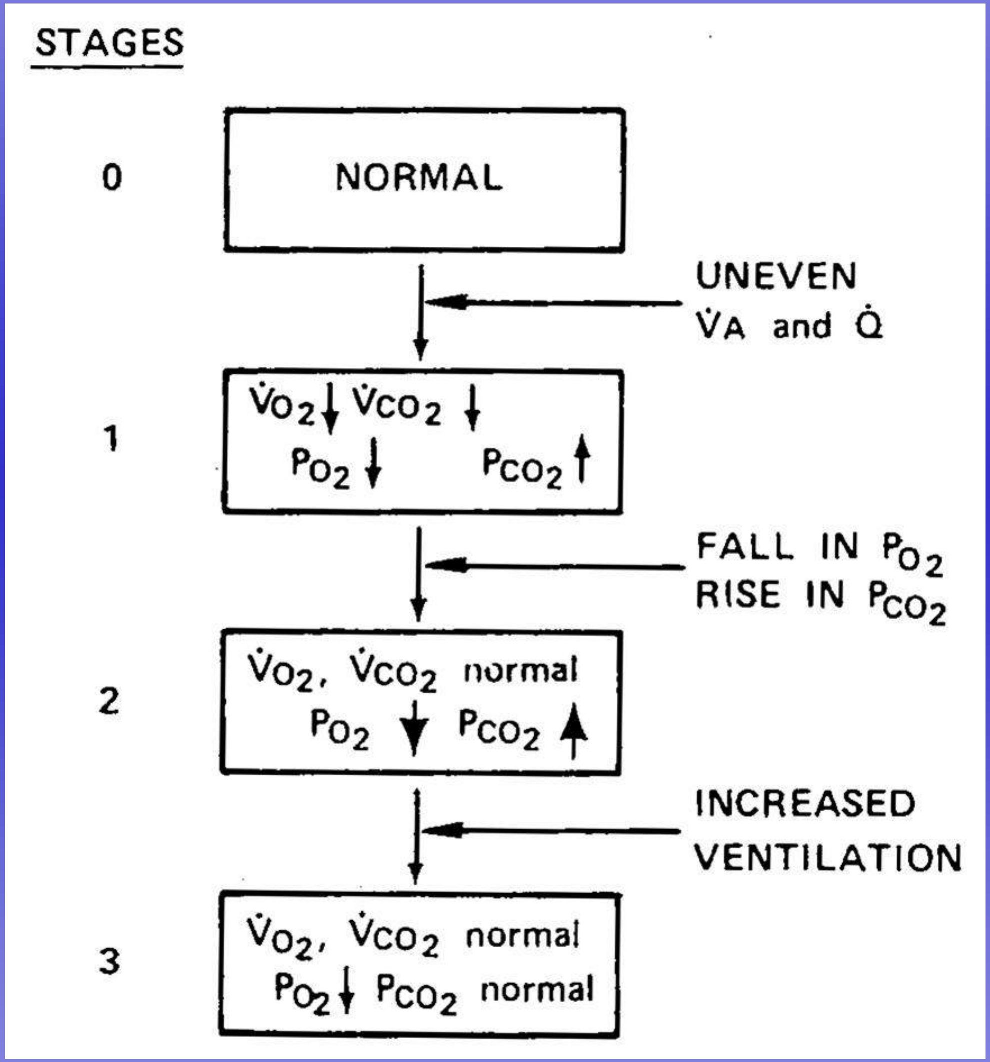
Distribution of ventilation-perfusion ratios in emphysema



Distribution of ventilation-perfusion ratios in chronic bronchitis



Stages of impairment of gas exchange



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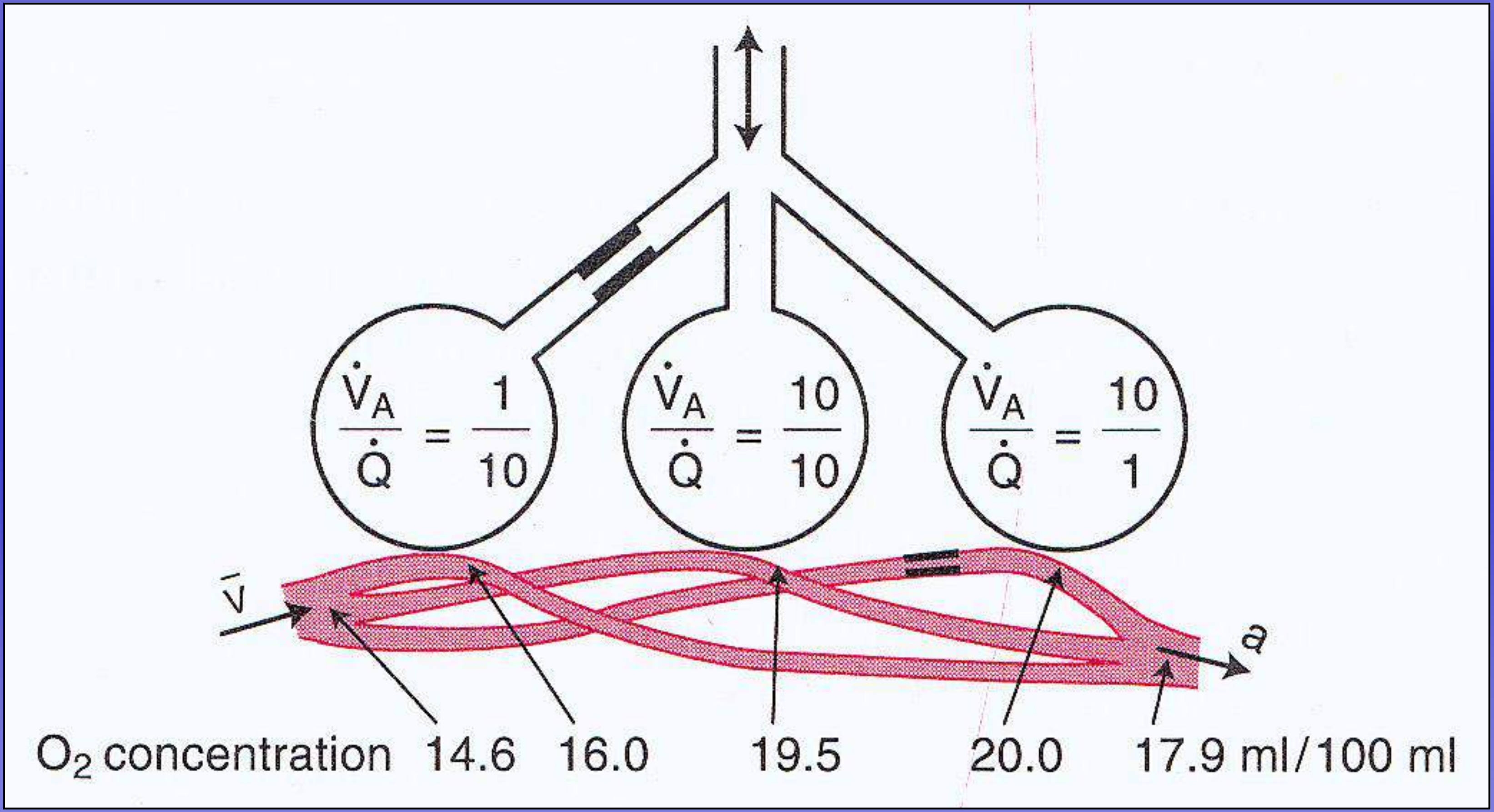

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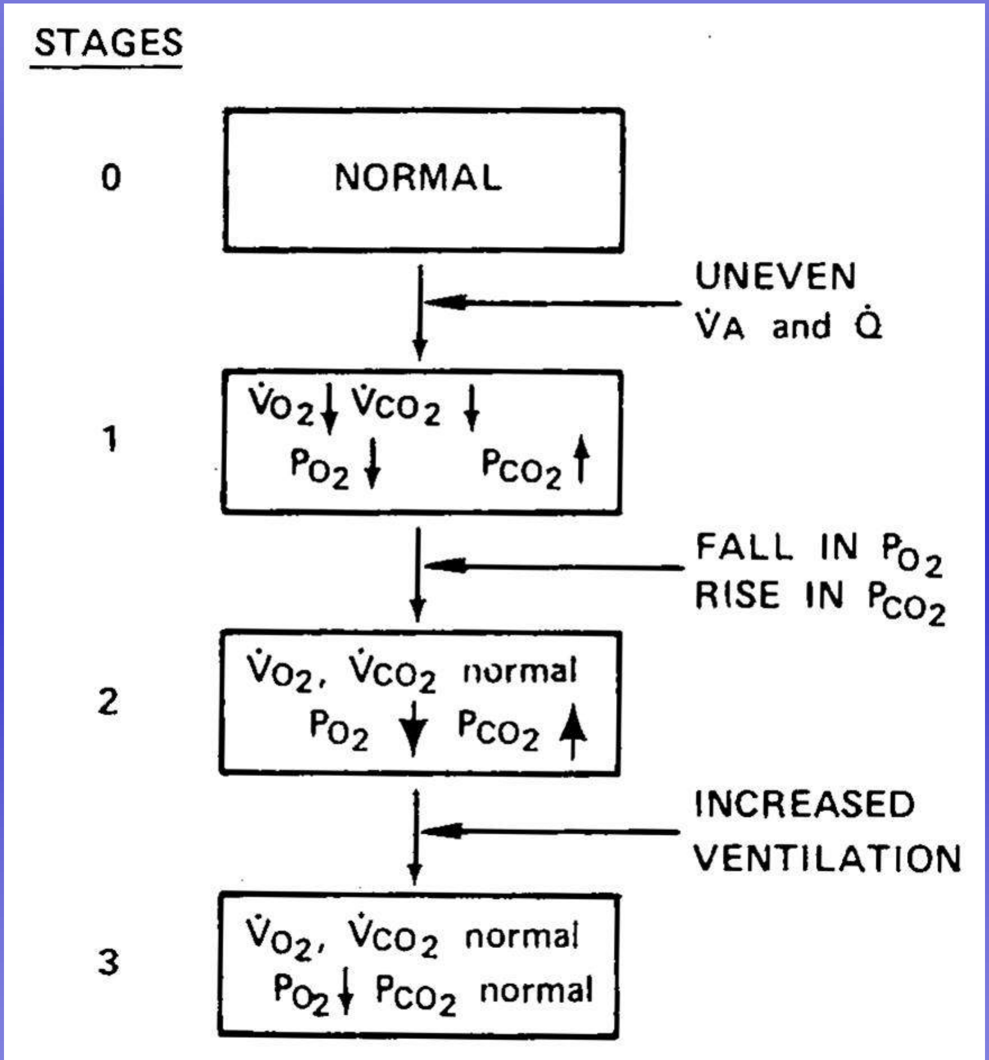

How can we asses the amount of ventilation-perfusion inequality in lung disease?

Suppose the arterial PO_2 is 50 and the PCO_2 is 60 mm Hg

Is ventilation-perfusion inequality present or is there just hypoventilation?

To answer this we use the alveolar gas equation

Using the alveolar gas equation to calculate the alveolar-arterial PO_2 difference

$$P_AO_2 = P_IO_2 - \frac{P_ACO_2}{R} + F$$

$$P_AO_2 = 149 - \frac{60}{0.8}$$

$$P_AO_2 = 74 \text{ mmHg}$$

$$\text{A - a difference} = 74 - 50$$

$$\text{A - a difference} = 24 \text{ mmHg}$$