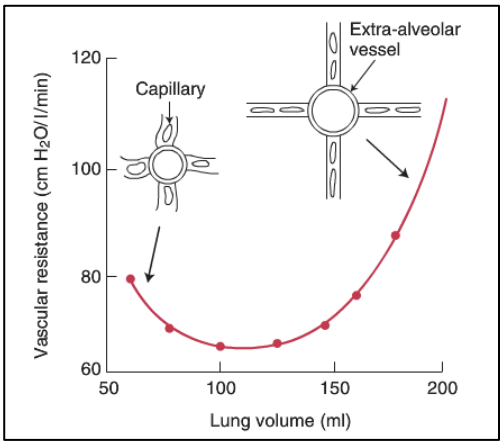
Q16 Discuss the factors affecting pulmonary vascular resistance (Sept 2009)

Pulmonary Vascular Resistance – resistance to flow through the pulmonary vasculature.



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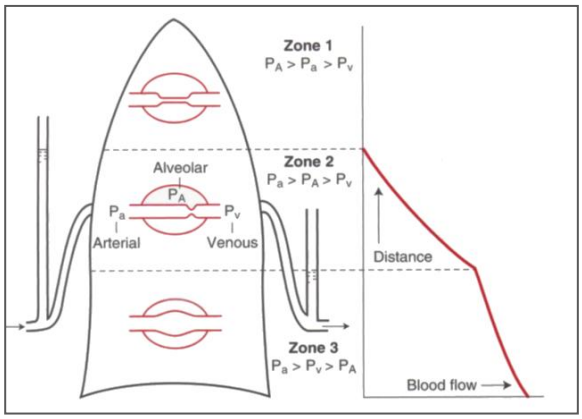
The factors contributing to changes in PVR include:

1. **RECRUITMENT AND DISTENTION** → PBF can adapt to large changes in CO with only small increases in PVR, due to recruitment of previously underperfused pulmonary vessels and distension of the entire pulmonary vasculature.

2. **LUNG VOLUMES** → At low lung volumes compression of the extra-alveolar vessels increases PVR; at high lung volumes the intraaveolar vessels are compressed → the least resistance is at FRC.

3. **GRAVITY AND WEST'S ZONES OF THE LUNG** →
   - In **Zone 1** the PAP is just sufficient to raise blood to the apex of the lung. Any increase in alveolar pressure (eg; PEEP) or decrease in precapillary pressure (eg hypotension due to haemorrhage) will cause the alveolar pressure to exceed the precapillary pressure → no flow. PA>Pa>Pv
   - In **Zone 2,** PAP increases because of the hydrostatic effect and now exceeds alveolar pressure. Blood flow is determined by arterial – alveolar pressure differences. Pa>PA>Pv
   - In **Zone 3**, venous pressure exceeds alveolar pressure. Pa>Pv>PA
   - A **Zone 4** is sometimes referred to where an increase in extra alveolar vessel pressures due to gravity increases resistance. Hence at the very base there is a reduction in flow compared to zone 3.



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4. **AUTONOMIC INFLUENCE** → Alpha adrenergic stimulation → vasoconstriction, beta-adrenergic stimulation → vasodilatation, cholinergic stimulation → vasodilatation

5. **METABOLIC CONTROL** → local vasodilators (NO, prostacyclin) and vasoconstrictors (serotonin, histamine, noradrenaline, hypercapnoea)

6. **HYPOXIC PULMONARY VASOCONSTRICTION** → basal NO synthesis is inhibited in the presence of low PAO2 and results in vasoconstriction