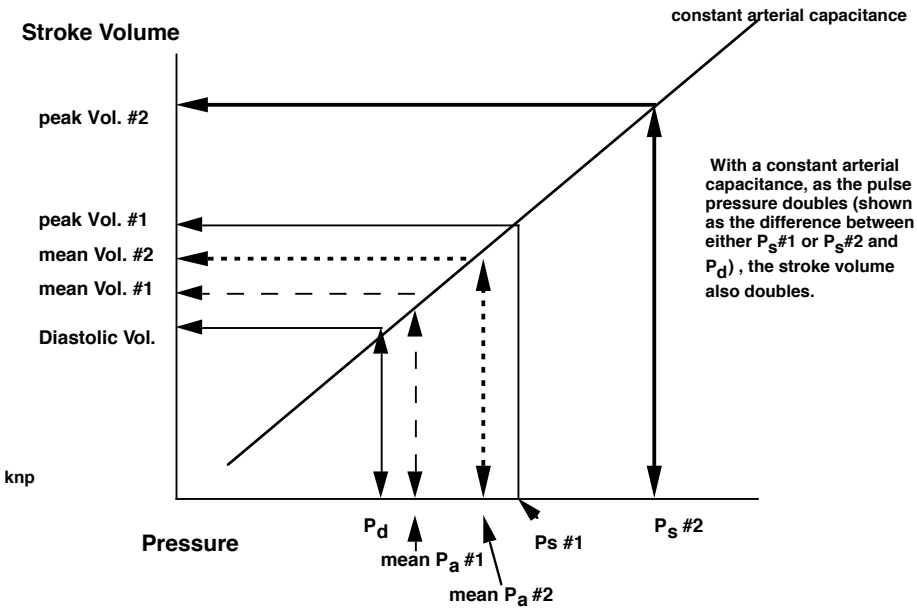
Physiology
Biology 390

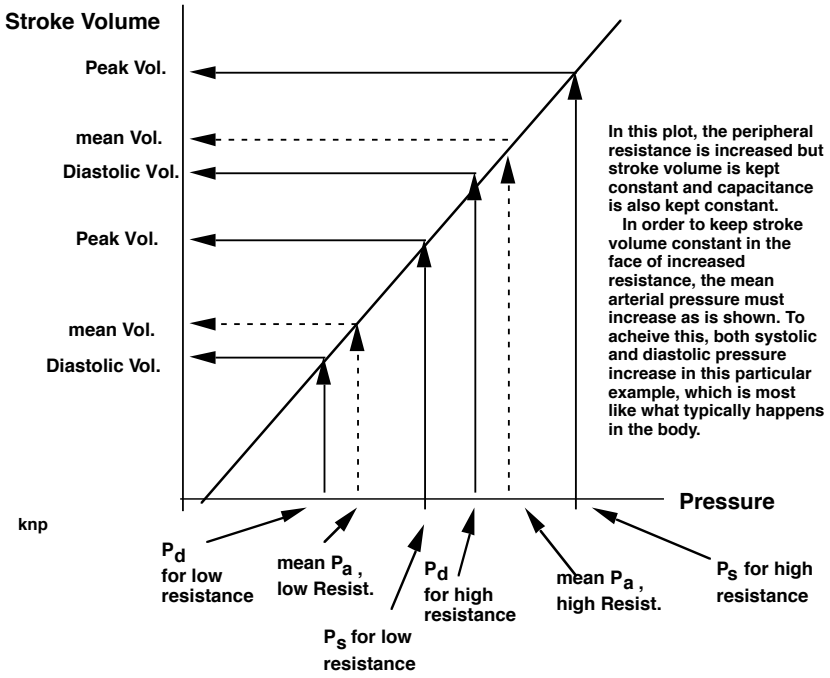
Blood Pressure/Stroke Volume Study Questions



1. Why does the mean arterial pressure increase?

2. Using the flow equation $\dot{Q} = \frac{\Delta P}{R}$, explain the graph above. Does R remain constant in the two situations (low and High SV)?

2. Given:



Let's work our way through this one:

The arterial system can be seen as having two resistances: one at the entrance from the heart and one on the arteriole end.

1. Why can we largely ignore the resistance in the aorta itself or simply combine it with the arteriole resistance (hint – what about its magnitude?)

2. Given the flow equation for stroke volume, $\dot{Q} = \frac{\Delta P}{R}$, which resistance (see above) matters for adding blood to the aorta or pulmonary artery and why? What are the pressures that matter for ΔP (systolic?, diastolic?, Mean arterial?, RA pressure?)?

3. For a given cardiac output and total blood volume, what factor most determines the amount of minimum artery volume and therefore diastolic pressure?

4. Using your answers from above:

(a) If the peripheral resistance on the arteries doubles but the resistance near the aortic valve remains constant, explain what happens to inflow and outflow into the artery in going from an initial steady state (the lower diastolic and systolic pressures and volumes) to new steady state (the higher diastolic and systolic pressures)? HINT: think of the relative magnitudes of in-flows and out-flows compared to arterial volume – in short, think of the water tank model, yet again.

(b) Why does the mean arterial pressure increase in this example?

(c) What happens to the venous (RA) pressure (based on what you learned when we considered Guyton's models of circulation in the last class)?

(d) Given your answer to (c) what happens to contractility of the heart (and what is the likely avenue of this change) that allows the heart to maintain the same stroke volume at the higher resistance? What must happen to the work of the heart (nothing hard here)? Explain all of this this several part question(d) in terms of afterload, resistance, and pulse pressure.