Bio390 **Atherosclerosis and Resistance**

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Atherosclerosis is a common condition where arteries are narrowed by deposits of material termed plaque. If the flow of blood is to continue at its usual rate, a higher pressure is required. A consequence of atherosclerosis is elevated blood pressure. High blood pressure, in turn, has many undesirable effects, one of them being that the heart must work harder and less efficiently to circulate blood. **Estimate the increase in blood pressure required to maintain normal cardiac output when the radii of the arteries in the systemic circulation are decreased by an average of 10%.**

ANS:***1.52X***

This is the same as saying that r = 0.9. Since R = $\frac{(8 * \eta * L)}{(\Pi * r^4)}$ and if we assume that the values of the other parameters in the resistance equation remain constant, then:

$$R \propto \frac{1}{(r^4)} = \frac{1}{(0.9^4)} = 1.52$$

Using the general flow equation, $Q = \frac{\Delta P}{R}$, to keep the flow constant (we'll call it 1.0 vols/time) we can find the pressure difference required:

$\Delta P = R * Q = 1.52$.

In the overall circulation, this would require that the mean arterial pressure would need to increase by 1.52X -- for example, from 80 to 120 mm Hg.
Likewise, in the arterial system, if we assumed that the diastolic pressure remained constant (in fact it would probably increase due to the higher resistance, see class notes) the systolic pressure would need to increase by 1.52X. For example, if before the narrowing the BP was 120/60, then after, it would be 151/60 (ΔP increases from 60 by 1.52 X to 91, systolic pressure = diastolic P + ΔP).