Deacon's Challenge No. 8 Answer

While trying to follow the National Service Framework guidelines for coronary heart disease, a doctor prescribed a statin to lower the cholesterol of a patient with coronary heart disease. The patient's original cholesterol level was 5.8 mmol/L and at the next visit the doctor was delighted to find that it was just below the target level of 5.0 mmol/L at 4.9 mmol/L and discharged the patient. The patient, a statistician, was less sure the treatment had been responsible. Given that the physiological coefficient of variation for cholesterol is 6% and the analytical coefficient of variation is 3%, calculate the least significant change (at $p<0.05$) in cholesterol as a percentage at his original level, and determine whether the second measurement was significantly different from the first.

(MRCPath Nov 2000)

The total CV is the square root of the sum of the squares of the physiological and analytical CVs:

$$\text{Total CV(\%)} = \sqrt{((\text{Analytical \%CV})^2 + (\text{Physiological \%CV})^2)}$$

$$= \sqrt{(3^2 + 6^2)} = \sqrt{(9 + 36)} = \sqrt{45} = 6.7\%$$

Next calculate the SD:

$$\text{CV(\%)} = \frac{\text{SD} \times 100}{\text{Mean}} \quad \text{therefore SD} = \frac{\text{CV(\%)} \times \text{mean}}{100}$$

Substitute CV = 6.7% and the original level (5.8 mmol/L) as the mean:

$$\text{SD} = \frac{6.7 \times 5.8}{100} = 0.389 \text{ mmol/L}$$

For two results to be significantly different (at $p < 0.05$) they have to be at least 2.8 SDs apart.
(*The derivation of this can be found on p 105 of Clinical Investigation and Statistics in Laboratory Medicine by Richard Jones and Brian Payne, Venture Publications 1997*).

Therefore the least significant change is 2.8 x 0.389 = 1.09 mmol/L

Which expressed as a percentage of the original measurement is $\frac{1.09 \times 100}{5.8} = 18.8\%$

Next calculate the difference between the first and second measurement as a percentage of the first measurement:

$$\frac{(5.8 - 4.9) \times 100}{5.8} = 15.5\%$$

which is less than 18.8% so that the change in cholesterol is not statistically significant. ■

Question No. 9

The absorbance of a solution containing NAD and NADH in a 1cm light path cuvette were 0.337 at 340 nm and 1.23 at 260 nm. The molar extinction coefficients are:

NAD:	1.8×10^4 at 260 nm,	1.0×10^{-3} at 340 nm
NADH:	1.5×10^4 at 260 nm,	6.3×10^3 at 340 nm

Calculate the concentrations of NAD and NADH in the solution.

(MRCPath Nov 1995)