Deacon's Challenge
No 116 - Answer

A metabolic disease is known to result in decreased plasma activity of enzyme X.
X was measured in 100 normal subjects and 100 individuals with the disease in question:

	95% confidence limits
Normal subjects	*830 - 1222 U/L*
Disease group	*108 - 892 U/L*

Calculate the diagnostic sensitivity and specificity of this test at a decision limit (diagnostic cut-off point) of 830 U/L.

Values of the normal deviate (z-score) and P are:

P(%)	*10*	*5*	*2*	*1*	*0.2*	*0.1*
z	*1.65*	*1.96*	*2.33*	*2.58*	*3.09*	*3.29*

FRCPath, Spring 2010

Specificity is the percentage of negative results obtained in individuals which do not have the disease. In this question the decision level used (830 U/L) is actually identical to the lower reference limit of the normal population. The 95% confidence interval includes 95% of results, 5% of these will fall outside of this range; 2.5% below the lower limit and 2.5% above the upper limit. Since the diseased group have reduced enzyme activity, 2.5% of results from the normal group will be classified as false positives, the remainder will be true negatives. Therefore:

Specificity = 100% - 2.5% = **97.5%**

Sensitivity is obtained from data in the diseased group. First calculate the *z*-score for this group at the decision level used:

$$z = \frac{\text{Decision level - Mean}}{\text{SD}}$$

The 95% confidence limits include the mean ± 1.96 *SD* and so spans 2 x 1.96 *SD*

$$SD = \frac{\text{Upper limit - lower limit}}{2 \times 1.96} = \frac{892 - 108}{3.92} = \frac{784}{3.92} = 200 \text{ U/L}$$

The population mean is the mean of the 95% confidence limits:

$$\text{Mean} = \frac{892 + 108}{2} = \frac{1000}{2} = 500 \text{ U/L}$$

$$z = \frac{\text{Decision level - Mean}}{\text{SD}} = \frac{830 - 500}{200} = \frac{330}{200} = 1.65$$

From the *z*-score table a z value of 1.65 corresponds to a probability of 10%. Therefore 10% of results will fall outside of the range for mean±decision level. 5% will be greater than mean + decision level and will be false negatives, the remainder are true positives. Since sensitivity is the percentage of positive results obtained for individuals with the disease it follows that:

Sensitivity = 100% - 5% = **95%**

Question 117

A 75-year old patient had a convulsion four days after a partial hip replacement. She is found to have a serum sodium concentration of 108 mmol/L. Her estimated weight is 55 kg. Estimate the volume of 2.7% saline required to increase her serum sodium concentration to 125 mmol/L. State clearly any assumptions you make. (Atomic weights of sodium 23, chlorine 35.5).

FRCPath, Spring 2010

Intensive Course on Screening for Down's Syndrome
9th–11th May 2011
Wolfson Institute of Preventive Medicine
Barts & The London School of Medicine & Dentistry

◆ Comprehensive coverage of theoretical and practical aspects of screening for Down's syndrome

◆ New information on advances in first and second trimester biochemical and ultrasound screening

Further details are available from the Wolfson Institute website:
www.wolfson.qmul.ac.uk/epm/screening/

or from Cecily Cromby, Wolfson Institute of Preventive Medicine,
Charterhouse Square, London EC1M 6BQ
Tel: 020 7882 6258 Fax: 020 7882 6290 Email: c.f.cromby@qmul.ac.uk