

# Cork Institute of Technology

## Bachelor of Science in Cell and Molecular Biology – Award

December 2004

### **Molecular Biology**

(Time: 3 Hours)

Answer **Question 1** and **three** others.

Examiners: Prof. R. O’Kennedy

Use a separate answer book for **Question 1**.

Dr. A. Coffey

- Q1. (a)** Why will one plasmid often show up as more than a single band in an agarose gel after electrophoresis?
- (b)** How would you measure the concentration of DNA using a spectrophotometer?
- (c)** Why do many buffers in molecular biology contain Tris (tris-hydroxymethyl-aminomethane) and EDTA (Ethylene Diamine Tetra-acetic Acid)?
- (d)** How does calcium chloride make the *E. coli* cells competent for uptake of DNA?
- (e)** Explain how you would set up and perform a restriction digest of DNA.
- (f)** In a conjugation experiment in which you had  $1.2 \times 10^6$  donor cells per ml, you count 43 transconjugant colonies on the zero dilution plate after plating out 0.1 ml of the mating mix. Calculate the number of transconjugants per ml (in scientific notation) and from there calculate the conjugation frequency per donor.
- (g)** Briefly describe how you would obtain DNA from blood.
- (h)** Briefly explain the principle behind using adsorption columns for isolation of nucleic acids.
- (i)** Outline the typical temperatures used in a PCR cycle and explain what happens at each temperature.
- (k)** Explain the principles behind the Southern Blot. (10x4 = 40 marks)

- Q2. (a)** Discuss the *E. coli* promotor and describe how it influences the initiation of DNA transcription. (10 marks)
- (b) Discuss two different ways that RNA stem-loop structures can end transcription of DNA to mRNA. (10 marks)
- Q3. (a)** What is transduction? Distinguish between specialised and generalised transduction. (6 marks)
- (b) Give a general account of bacterial plasmids. (14 marks)
- Q4. (a)** Detail the steps involved in mRNA processing in eukaryotic cells. (10 marks)
- (b) Explain alternative splicing and also its significance as it occurs in eukaryotic genes. (10 marks)
- Q5. (a)** Explain the influence of telomeres on cellular aging in eukaryotes. (8 marks)
- (b) Detail, with the aid of diagrams, the different orders of DNA coiling/folding in the human chromosome. (12 marks)