

Exercise walk-through

1.11

DNA, replication and the genetic code (statements 2.9–2.12)

Pearson Edexcel · International A-Level · Biology

Atheroma, clot, catastrophe

Damage : smoking, hypertension, LDL cholesterol harm the endothelium

Plaque : inflammation and LDL deposition narrow and stiffen the artery

Clot : thromboplastin converts prothrombin to thrombin; fibrinogen becomes fibrin

Read a health study like an examiner

Your turn

Gum disease correlates with endothelial damage. List three checks before claiming causation.

- A. Who was sampled, how selected, how many?
- B. Were confounders like smoking, age, diet controlled?
- C. Is there a mechanism and a dose-response pattern?

DNA copies itself semi-conservatively

Unzip : helicase breaks the hydrogen bonds between the strands

Template : each old strand pairs with free nucleotides by complementary base pairing

Join : DNA polymerase links the nucleotides into a new strand

Exercises 2.1·2.3

2.1 Name the three components of a mononucleotide and the bond joining nucleotides in a strand. [2]

2.2 Explain why the two strands of DNA are described as antiparallel and complementary. [2]

2.3 State what is meant by a degenerate code and one consequence of degeneracy. [2]

Exercises 2.1·2.3

2.1 Name the three components of a mononucleotide and the bond joining nucleotides in a strand. [2]

2.1 Pentose sugar, phosphate group, nitrogenous base; phosphodiester bonds between sugar and phosphate of adjacent nucleotides.

2.2 Explain why the two strands of DNA are described as antiparallel and complementary. [2]

2.2 The sugar-phosphate backbones run in opposite directions (one 5'→3', the other 3'→5') – antiparallel; each strand's base sequence determines the other's exactly (A with T, G with C) – complementary.

2.3 State what is meant by a degenerate code and one consequence of degeneracy. [2]

2.3 Most amino acids are coded for by more than one triplet; many base substitutions change nothing because the new triplet still codes for the same amino acid.

Exercises 3.1·3.2

3.1 DNA from bacteria grown for many generations in ^{15}N is mixed into a centrifuge tube with DNA from bacteria grown in ^{14}N only, alongside DNA from bacteria shifted to ^{14}N for exactly one and exactly two rounds of division. State how many bands appear in each sample and where each lies (heavy, intermediate, light), and explain which replication models each result excludes. [6]

3.2 A section of a coding (sense) DNA strand reads ATG GGT TTA CCG. Write the sequence of the template strand, the mRNA transcribed from it, and the first two anticodons that pair with that mRNA. [5]

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3.1 ^{15}N -only: one heavy band; ^{14}N -only: one light band. One round: a single intermediate band – excludes conservative replication, which would give heavy plus light bands. Two rounds: half intermediate and half light – excludes dispersive replication, which would give only intermediate.

3.2 A section of a coding (sense) DNA strand reads ATG GGT TTA CCG. Write the sequence of the template strand, the mRNA transcribed from it, and the first two anticodons that pair with that mRNA. [5]

3.2 Template: TAC CCA AAT GGC. mRNA (from template): AUG GGU UUA CCG. First two anticodons pair with AUG and GGU: UAC and CCA.

Exercise 3.3

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3.3 Degeneracy: the new triplet may still code for the same amino acid, or for one with similar chemistry, leaving the protein functional. Deleting a base shifts the reading frame: every triplet from that point on is read differently, usually producing a completely different – and often prematurely stopped – amino-acid sequence.