

Exercise walk-through

2.8

Niches, Hardy–Weinberg and conservation (statements 4.19–4.21)

Pearson Edexcel · International A-Level · Biology

A eukaryotic cell is a set of compartments

Structure	Function
Nucleus	stores DNA behind a double membrane
Rough ER	folds and transports proteins from its ribosomes
Golgi	modifies, packages and exports proteins
Mitochondrion	aerobic respiration and ATP

Mitosis preserves chromosome number

Prophase : chromosomes condense, spindle forms



Metaphase : chromosomes line up on the equator



Anaphase : chromatids pulled to opposite poles



Telophase : nuclear membranes reform

Check yourself

Your turn

A pond sample has counts 60, 20, 15 and 5. What is the index of diversity?

- A. $N(N-1)$ over the sum of $n(n-1)$: 9900 over $4150 = 2.39$
- B. add the species counts first, then divide by four
- C. the largest count over the smallest count
- D. species richness times total individuals

Exercises 2.1·2.3

2.1 Classify these adaptations as anatomical, physiological or behavioural: a thick blubber layer; hibernation; bacteria-resistant stomach acid. [3]

2.2 State two conditions for the Hardy-Weinberg equation to hold. [2]

2.3 In a population, $q = 0.2$. State p and calculate $2pq$. [2]

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2.2 Any two: large population, random mating, no selection, no mutation, no migration.

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2.3 $p = 0.8$; $2pq = 0.32$.

Exercises 3.1·3.2

3.1 A population of 4 000 tigers contains 400 that are homozygous recessive for a coat pattern. Calculate q and p , the expected number of carriers, and the expected number of homozygous dominant tigers. [4]

3.2 A wildlife park's tigers show allele frequencies drifting from Hardy-Weinberg predictions within two generations. Suggest two possible causes of the drift, and explain why a small captive population is especially prone to it. [5]

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3.1 $q^2 = 400/4000 = 0.10$, so $q = 0.316$; $p = 0.684$. Carriers = $2pq \times 4000 = 0.433 \times 4000 \approx 1732$; homozygous dominant = $p^2 \times 4000 \approx 1872$.

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3.2 Causes: selection acting on the coat-pattern alleles (one phenotype surviving better); non-random mating among the few available mates; genetic drift – chance hits small samples hard. A small population loses allele variants by sampling error alone: each generation draws few gametes from few parents, so frequencies wander regardless of advantage.

Exercise 3.3

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[6]

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3.3 Advantages: protection from disease, starvation and predators while numbers rebuild; managed mating can maximise heterozygosity and avoid inbreeding. Disadvantages: the facility holds few individuals with limited genetic variety; animals may lose natural behaviours and survival after release is poor; habitat protection would also conserve the whole community, not one species, and costs less per animal once established.