

Exercise walk-through

2.2

Meiosis, gametes and fertilisation (statements 3.9–3.13)

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 State two differences between mitosis and meiosis in the cells produced. [2]

2.2 Name the two processes in meiosis that produce genetic variation. [2]

2.3 Give two adaptations of a sperm cell and state how each helps fertilisation. [2]

Exercises 2.1·2.3

2.1 State two differences between mitosis and meiosis in the cells produced. [2]

2.1 Meiosis gives four haploid, genetically different cells; mitosis gives two diploid, genetically identical cells.

2.2 Name the two processes in meiosis that produce genetic variation. [2]

2.2 Independent assortment and crossing over.

2.3 Give two adaptations of a sperm cell and state how each helps fertilisation. [2]

2.3 Acrosome contains digestive enzymes to penetrate the egg's coatings; mitochondria-packed midpiece supplies ATP for the flagellum's swimming; (accept flagellum for propulsion).

Exercises 3.1·3.2

3.1 A cell has 4 chromosomes (2 pairs), and its DNA is labelled before meiosis. Explain how independent assortment alone produces genetically different gametes in this cell, state how many different combinations of chromosomes the gametes could receive, and explain what crossing over would add to this variety. [5]

3.2 Describe the events of fertilisation in a mammal from the sperm reaching the egg to the fusion of nuclei, including how further sperm are prevented from entering. [5]

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3.1 In meiosis I each homologous pair separates, and which member of a pair goes to which pole is random; with 2 pairs the combinations are $2^2 = 4$. Crossing over in prophase I swaps chromosome sections between homologous chromatids, creating new allele combinations on the same chromosome that assortment alone cannot make.

3.2 Describe the events of fertilisation in a mammal from the sperm reaching the egg to the fusion of nuclei, including how further sperm are prevented from entering. [5]

3.2 The sperm's acrosome releases enzymes that digest a path through the zona pellucida and follicle cells; the sperm's membrane fuses with the egg's membrane and the nucleus enters; the fusion triggers the cortical reaction – cortical granules release contents that harden the zona pellucida; the sperm and egg nuclei fuse, restoring diploidy.

Exercise 3.3

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3.3 One male nucleus fuses with the egg cell nucleus to form the diploid zygote that becomes the embryo; the other fuses with the two polar nuclei to form the triploid endosperm that nourishes the seed; two fusion events occur, hence double fertilisation.