

Exercise walk-through

Gene Expression and Cell Specialization ■ 6.6

eXercise

You must be able to

- explain that specialized cells express **different genes** from the same genome
- describe **differentiation** 分化
- link expressed genes to a cell's structure and function

Method — Same genome, different genes on

Every body cell has the **same DNA**, yet a nerve cell and a muscle cell look and act differently. This is because they express **different subsets** of genes.

Method — Differentiation

Differentiation is the process by which an unspecialized cell becomes specialized, by switching on the genes for that cell type and switching off others.

Method — Genes shape structure and function

A muscle cell expresses genes for contractile proteins; a pancreatic cell expresses the insulin gene. The **genes turned on** determine the cell's proteins, structure, and job.

Method — A worked example

A red blood cell expresses the hemoglobin gene strongly (to carry oxygen); a skin cell does not — same DNA, different expression.

Practice 2.1 ■ 1 mark

Do specialized cells in one body have the same or different DNA?

Solution 2.1

Method: Same genome, different genes on

Worked steps

The same DNA **B1**.

Practice 2.2 ■ 1 mark

What is differentiation?

Solution 2.2

Worked steps

The process by which an unspecialized cell becomes specialized **B1**.

Practice 2.3 ■ 1 mark

Why does a muscle cell differ from a nerve cell?

Solution 2.3

Method: Same genome, different genes on

Worked steps

They express different genes **B1**.

Exam-style 3.1 ■ 1 mark

Two cells in the same organism differ mainly because they

- A** have different DNA
- B** express different genes
- C** have no genes
- D** lack ribosomes

Solution 3.1

Method: Same genome, different genes on

A have different DNA

B express different genes 

C have no genes

D lack ribosomes

Worked steps

B — express different genes.

Exam-style 3.2 ■ 1 mark

A stem cell becomes a specialized muscle cell.

- (a) Name this process.
- (b) Explain how the same genome produces a specialized cell.

Solution 3.2

Worked steps

(a) Differentiation **B1**. (b) The cell switches on the genes needed for the muscle-cell type and switches off others, so the same DNA yields a specialized cell **M1 A1**.

Exam-style 3.3 ■ 2 marks

Explain why a pancreatic cell makes insulin but a skin cell does not, even though both have the insulin gene.

Solution 3.3

Worked steps

Both have the gene, but only the pancreatic cell expresses (transcribes and translates) it; in the skin cell the insulin gene is switched off **M1** **A1**.