

Exercise walk-through

Regulation of Gene Expression ■ 6.5

eXercise

You must be able to

- explain that cells control **which genes** are expressed and when
- describe regulation by **promoters** 启动子 and regulatory proteins
- give the example of an inducible/repressible operon idea

Method — Genes are switched on and off

A cell does not express all its genes at once. **Gene regulation** controls **which** genes are turned on, **when**, and **how much** — saving energy and allowing different cell types.

Method — Promoters and regulatory proteins

RNA polymerase binds a gene's **promoter** to start transcription. **Regulatory proteins** can block or help this binding — acting as switches.

Method — Turning genes on or off

- A **repressor** protein can bind and **block** transcription (off).
- An **activator** can **help** transcription (on).

Signals from the environment can control these proteins, so gene expression responds to conditions.

Method — A worked idea

A bacterium turns on genes for digesting lactose only **when lactose is present**, saving resources when it is absent — efficient, controlled expression.

Practice 2.1 ■ 1 mark

Does a cell express all its genes at once?

Solution 2.1

Method: Genes are switched on and off

Worked steps

No **B1**.

Practice 2.2 ■ 1 mark

Where does RNA polymerase bind to begin transcription?

Solution 2.2

Worked steps

At the gene's promoter **B1**.

Practice 2.3 ■ 1 mark

What does a repressor protein do?

Solution 2.3

Method: Turning genes on or off

Worked steps

Blocks transcription of a gene **B1**.

Exam-style 3.1 ■ 1 mark

A protein that blocks transcription of a gene is a(n)

A activator

B repressor

C ribosome

D polymerase

Solution 3.1

Method: Turning genes on or off

A activator

B repressor



C ribosome

D polymerase

Worked steps

B — a repressor.

Exam-style 3.2 ■ 2 marks

A bacterium expresses lactose-digesting genes only when lactose is present.

- (a) Explain the advantage of this control.
- (b) State the general role of regulatory proteins in this.

Solution 3.2

Method: A worked idea

Worked steps

(a) The cell makes the digesting enzymes only when they are useful, saving energy and resources when lactose is absent **M1 A1**. (b) Regulatory proteins switch the genes on or off in response to the lactose signal **B1**.

Exam-style 3.3 ■ 2 marks

Explain why gene regulation is essential for a multicellular organism to have different cell types.

Solution 3.3

Method: Genes are switched on and off

Worked steps

Different cell types express different sets of genes; regulation turns the right genes on in each cell, so the same genome can produce specialized cells **M1** **A1**.