

Exercise walk-through

# 6.6

## Gene Expression and Cell Specialization

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AP Biology

# Regulation of gene expression

Every cell shares one genome – **differential gene expression**

makes them differ:

**Promoter + factors**  
**transcription factors**  
switch a gene on/off

**Operon**  
bacteria control re-  
lated genes as a group

**Epigenetics – DNA methylation**  
DNA silences a gene  
without changing the sequence

**Hox genes**

are master switches that lay out the body plan.

## Exam tips

- Know the **central dogma** DNA → RNA → protein: transcription makes mRNA, translation reads it in three-base **codons** at the ribosome.
- Remember RNA is single-stranded and uses **U** instead of T; replication is **semiconservative**.
- Every cell has the **same DNA** – cells differ because they express **different genes** (differential gene expression).
- A **mutation** is a change in the DNA sequence and may be harmful, neutral, or beneficial (the raw material for selection).
- Link biotech tools to their jobs: PCR copies DNA; gel electrophoresis separates fragments by size.

## Exercises 2.1-2.3

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**2.1** Do specialized cells in one body have the same or different DNA? [1]

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**2.2** What is differentiation? [1]

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**2.3** Why does a muscle cell differ from a nerve cell? [1]

## Exercises 2.1-2.3

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**2.1** Do specialized cells in one body have the same or different DNA? [1]

**2.1**

- The same DNA
- 

**2.2** What is differentiation? [1]

**2.2**

- The process by which an unspecialized cell becomes specialized
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**2.3** Why does a muscle cell differ from a nerve cell? [1]

**2.3**

- They express different genes

## Exercise 3.1

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**3.1** Two cells in the same organism differ mainly because they

[1]

☐

**A** have different DNA

**B** express different genes

**C** have no genes

**D** lack ribosomes

## Exercise 3.1

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**3.1** Two cells in the same organism differ mainly because they

[1]

☐

**A** have different DNA

**B** express different genes

**C** have no genes

**D** lack ribosomes

**3.1 B**

- express different genes

## Exercise 3.2 (a)

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**3.2** A stem cell becomes a specialized muscle cell.

(a) Name this process.

[1]

## Exercise 3.2 (a)

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**3.2** A stem cell becomes a specialized muscle cell.

(a) Name this process.

[1]

(a)

- Differentiation

## Exercise 3.2 (b)

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**3.2** A stem cell becomes a specialized muscle cell.

(b) Explain how the same genome produces a specialized cell.

[2]

## Exercise 3.2 (b)

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**3.2** A stem cell becomes a specialized muscle cell.

(b) Explain how the same genome produces a specialized cell.

[2]

(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

## Exercise 3.3

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**3.3** Explain why a pancreatic cell makes insulin but a skin cell does not, even though both have the insulin gene. [2]

## Exercise 3.3

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**3.3** Explain why a pancreatic cell makes insulin but a skin cell does not, even though both have the insulin gene. [2]

### 3.3

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