AP BIOLOGY • EXERCISE SHEET

6.6 Gene Expression and Cell Specialization

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

Objective

Build the skills to answer exam questions on **gene expression and cell specialization**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

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.

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.

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.

A worked example

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

2 Practice

Now apply the methods above.

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

2.2 What is differentiation? [1]

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

3 Exam-style questions

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

3.2 A stem cell becomes a specialized muscle cell.

(a) Name this process. [1]

(b) Explain how the same genome produces a specialized cell. [2]

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

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **6.6 Gene Expression and Cell Specialization** lesson on the **Learn** page;
- read the **Gene Expression and Cell Specialization** section of the AP Biology handout on the **Know** page.

Solutions

2.1 The same DNA.

2.2 The process by which an unspecialized cell becomes specialized.

2.3 They express different genes.

3.1 B —express different genes.

3.2 (a) Differentiation. (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.

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.