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BIOLOGY

THE CONTROL OF GENE EXPRESSION

Level & Board	AQA (A-LEVEL)
TOPIC:	STEM CELLS
PAPER TYPE:	SOLUTION - 1
TOTAL QUESTIONS	6
TOTAL MARKS	37

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Stem Cells - 1

1.

(a)

Produce healthy blood cells

No MDS/faulty/cancerous blood cells

Stem cells divide/replicate

(b)

AZA reduces methylation of DNA/cytosine/gene

Tumour suppressor gene is transcribed/expressed

Prevents rapid/uncontrollable cell division

2.

(a)

Effect of AZA can be compared

Unethical not to treat control group

(b)

$$0.74 \times 180 = 104.4$$

$$0.58 \times 180 = 133.2$$

$$133.2 - 104.4 = 28.8 \sim 29$$

3.

(a)

Effective as D has lower protein than B/C

Not fully effective as D has higher protein than A

Do not know all results for other mice in D

Some of D mice may have been cured

Do not know actual/numerical quantity of protein

Investigation only on mice

Rejection may occur;

Only shows results for 20 weeks/short-time period

(b)

Transplanted stem cells differentiate/specialize

Reduce loss of protein at the glomerulus

4.

(a)

Produce healthy red blood cells

No sickle/faulty/SCD red blood cells produced

Stem/marrow cells continuously divide/replicate

(b)

For gene therapy

No destruction of bone marrow

Donors are not required

Less/no chance of rejection own stem cells

Against gene therapy

Sickle/faulty (red blood) cells still produced

Immune response against genetically modified cells/virus

5.

(a)

The simple term “stem cell” actually refers to many different types of cells. The tissue-specific stem cells, or adult stem cells, replenish tissues throughout our lives. Embryonic stem cells exist only briefly in early development before tissues begin to form.

OR

Unlike embryonic stem cells, which can become any cell in the body (called pluripotent), adult stem cells, which have been found in a wide range of tissues including skin, heart, brain, liver, and bone marrow are usually restricted to become any type of cell in the tissue or organ that they reside called multipotent.

(b) There are four main sources of stem cells, i.e. embryonic tissues, fetal tissues, adult tissues and differentiated somatic cells after they have been genetically reprogrammed, which are referred to as induced pluripotent stem cells iPSCs

(c) Induced pluripotent stem (iPS) cells, are a type of pluripotent stem cell derived from adult somatic cells. They have been reprogrammed through inducing genes and factors to be pluripotent. iPS cells are similar to embryonic stem (ES) cells in many aspects.

6.

(a)

Embryonic stem cells can become anything because they are pluripotent while adult stem cells are limited to what they can become. Also embryonic stem cells can be easily grown in culture.

(b) Although research into adult stem cells is promising, adult stem cells may not be as versatile and durable as are embryonic stem cells. Adult stem cells may not be able to be manipulated to produce all cell types, which limits how adult stem cells can be used to treat diseases.

(c)

iPSC are derived from adult cells by in vitro induction of pluripotency, obviating the ethical dilemmas surrounding the use of embryonic stem cells; they are harvested non-invasively and can be transplanted autologously, reducing immune rejection; and iPSC are the only cell type capable of being differentiated into all of the cell types in healthy skin.

OR

Nuclear reprogramming by ectopic factors results in induced pluripotent stem cells that may have functional equivalence to embryonic stem cells derived

by conventional embryo-dependent methods and possess therapeutic potential through multilineage differentiation.





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