

Stem Cells

1. In a developing embryo, tissues such as muscle and nerve are produced by

- A somatic cells dividing by meiosis
- B germline cells dividing by meiosis
- C somatic cells dividing by mitosis
- D germline cells dividing by mitosis.

2 Which row in the table shows the type of stem cell that has the potential to form the greatest variety of specialised cells?

	Type of stem cell	State of differentiation
A	embryonic	differentiated
B	tissue	differentiated
C	embryonic	undifferentiated
D	tissue	undifferentiated

3. Embryonic stem cells can be used therapeutically to differentiate and replace any damaged or diseased tissue.

This is because they are

- A multipotent and specific genes are switched on
- B pluripotent and all genes are switched on
- C multipotent and specific genes can be switched on
- D pluripotent and all genes can be switched on.

4. The following list shows some procedures in which stem cells can be used:

- 1. Corneal repair
- 2. Drug testing
- 3. Skin regeneration.

Which procedures involve the therapeutic use of stem cells?

- A 1 only
- B 2 only
- C 1 and 3 only
- D 1, 2 and 3

5 Which line in the table below describes correctly cell division in a specific cell type?

	Cell Type	Type of cell division	Chromosome number in cells produced
A	somatic	meiosis	diploid
B	somatic	meiosis	haploid
C	germline	mitosis	haploid
D	germline	mitosis	diploid

Stem Cells & Cancer

- 6 Which row in the table matches the type of cell division that occurs in germline cells with a description of the gametes produced?

	Type of division	Gametes produced
A	mitosis	diploid
B	mitosis	haploid
C	meiosis	diploid
D	meiosis	haploid

- 7 Which row in the table describes research and therapeutic uses of stem cells?

	Research use	Therapeutic use
A	To provide information on cell differentiation	To test drugs
B	To test drugs	To provide information on cell differentiation
C	To study how diseases develop	To repair damaged tissue
D	To repair damaged tissue	To regenerate damaged skin

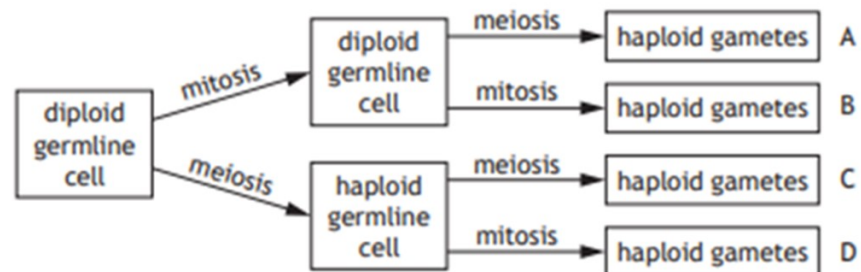
- 8 Each type of human cell has a different structure and function because

- A they contain different genes
- B different genes are expressed in each
- C some genes are lost during differentiation
- D some genes are gained during differentiation.

- 9 Which row in the table describes one type of cell division?

	Type of division	Parental cell type	Cells produced
A	mitosis	germline	somatic
B	meiosis	somatic	somatic
C	meiosis	germline	gametes
D	mitosis	somatic	gametes

10. Which pathway describes the production of haploid gametes from diploid germline cells?



11. Which of the following is **not** a use of stem cells?

- A Skin grafts
- B Drug testing
- C IVF treatment
- D Bone marrow transplant

Stem Cells & Cancer

12. Which row in the table describes research and therapeutic uses of stem cells?

	Research use	Therapeutic use
A	to repair damaged tissue	to study how diseases develop
B	to test drugs	to provide information on cell differentiation
C	to study how diseases develop	to repair damaged tissue
D	to provide information on cell differentiation	to test drugs

13. The list describes some uses of stem cells.

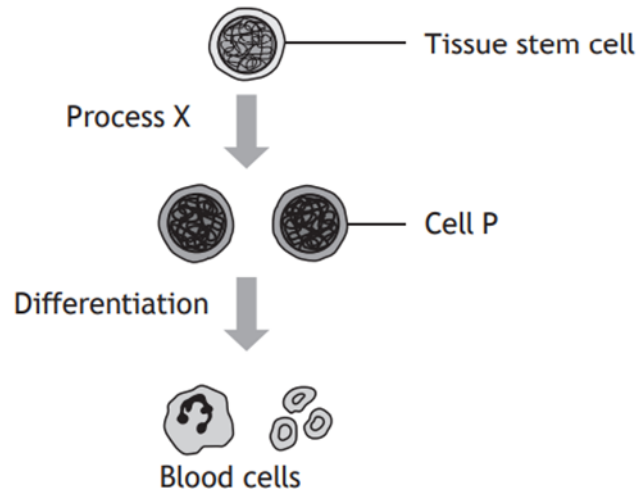
- 1 Studying how cells differentiate
- 2 Researching the development of Parkinson's disease
- 3 Producing skin for skin grafts
- 4 Bone marrow transplants

Which of these uses are **not** therapeutic?

- A 1 only
 - B 1 and 2 only
 - C 2 and 4 only
 - D 3 and 4 only
14. Each type of human cell has a different structure and function because
- A only some of their genes are expressed
 - B they contain different genes
 - C some genes are lost during differentiation
 - D some genes are gained during differentiation.

Stem Cells

1. The diagram shows some stages in the development of blood cells.

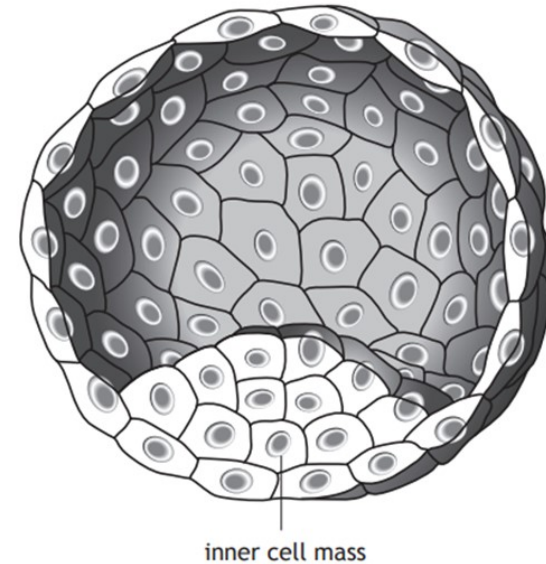


(a) Name process X.

(b) Explain why red blood cells contain haemoglobin after differentiation but white blood cells do not.

c) Describe how a tumour might develop from cell P.

2 The diagram below represents an embryo in the early stages of development and identifies the inner cell mass which is made up of stem cells.



(a) State one feature of stem cells.

1

(b) Stem cells are also found in tissues throughout the adult body.

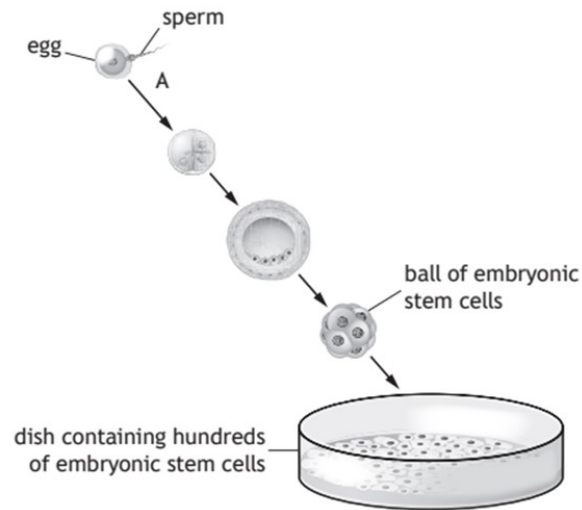
Explain how the function of tissue stem cells differs from that of the stem cells found in the inner cell mass of an embryo.

1

Stem Cells & Cancer

3

The diagram shows some of the stages involved in the formation of embryonic stem cells for use in a laboratory.



- (b) Explain how differentiation of tissue stem cells leads to the production of specialised cells such as red blood cells.

1

- (c) Research has developed a type of stem cell that can be cultured in a laboratory directly from a patient's own somatic cells.

Suggest a benefit to the patient of using these stem cells in therapeutic treatments.

1

- (a) (i) Name the type of cells that divide to form sperm and eggs.

1

- (ii) Name the type of cell division occurring at A.

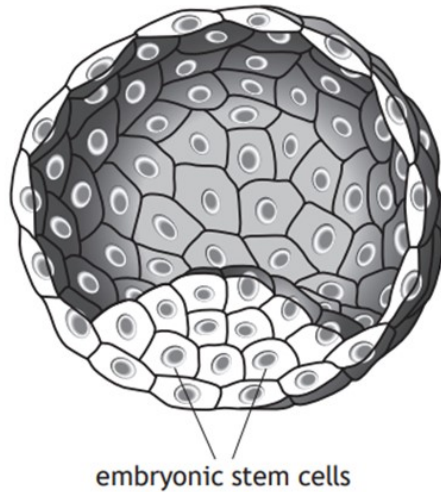
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- (iii) Explain why embryonic stem cells are described as being pluripotent.

1

Stem Cells & Cancer

- 4 The diagram shows an early stage in the development of a human embryo.



- (c) Stem cells can be cultured in the laboratory for research purposes.

State one way in which stem cells are used in research.

1

- (d) Scientists have recently found a way of converting skin cells into embryonic stem cells.

Suggest why this is an advantage from an ethical viewpoint.

1

- (a) (i) The embryonic stem cells shown can differentiate into all body cell types.

State the term that describes this feature of these cells.

1

- (ii) Explain why embryonic stem cells can differentiate into all cell types.

1

- (b) State the number of chromosomes in the nuclei of cells produced when germline stem cells divide by meiosis.

1

Stem Cells & Cancer

- 5 The human body contains many specialised cells, all of which have developed from embryonic stem cells.



nerve cells



liver cells



cardiac muscle cells

- (a) Name the process by which a stem cell develops into a specialised body cell and explain how this process occurs.

Process _____

Explanation _____

- (b) The nucleus of a germline stem cell divides twice during meiosis. Describe what happens to chromosomes during each division.

First division _____

Second division _____

- (c) A company has developed a drug that could be used to treat the symptoms of an inherited disease. Before proceeding to clinical trials using volunteers, the company decides to carry out additional tests in the laboratory using embryonic stem cells.

Suggest **one** ethical consideration that might have influenced this decision to use embryonic stem cells.

- 6 Stem cells have uses in both therapy and research.

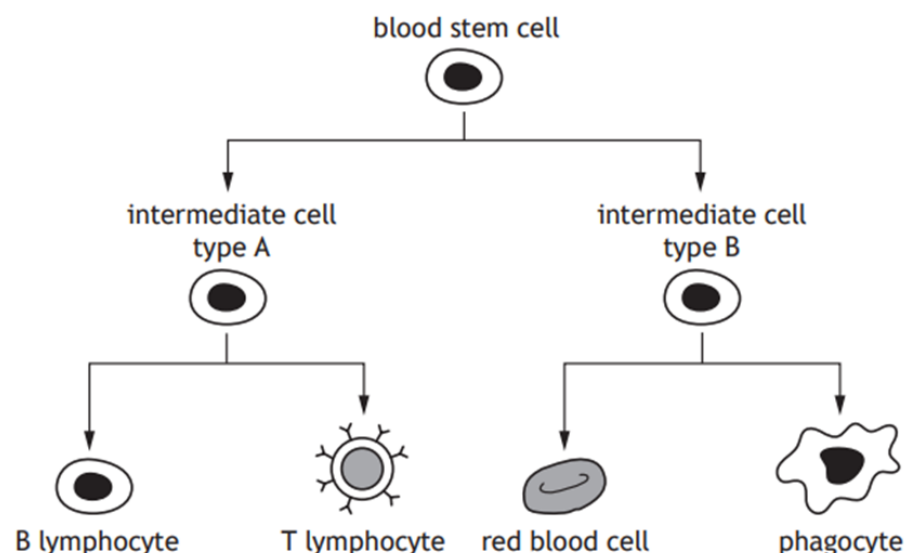
- (i) It has been proposed that tissue cells could be used to repair severely damaged muscle tissue.

Suggest how this might be done.

- (ii) State how stem cells can be used as model cells in medical research.

Stem Cells & cancer

- 7 The diagram shows a range of cell types produced by blood stem cells.



- (a) State the location of blood stem cells in the body.

- (b) Use information in the diagram to explain why blood stem cells are described as tissue stem cells.

- (c) Describe one therapeutic use and one research use of stem cells.

Therapeutic use _____

Research use _____

- 8 Table 1 Males

Type of cancer	Number of deaths in 2016	Change in number of deaths since 2007 (%)
Lung	2036	-24.3
Prostate	986	-6.2
Bowel	884	-15.1
Head and neck	377	+17.1
Liver	375	+47.4
Bladder	311	-7.7
Stomach	273	-32.8
Other	3085	—
Total	8327	-12.4

- a). Cancer cells may divide excessively to form a tumour.
 Describe how secondary tumours can then form from this tumour.

1

- b).) Using information from Table 1, explain why it may not be correct to state that there were no male deaths from breast cancer in 2016.

1

2

- c). Since 2007, all people in Scotland between the ages of 50 and 74 have been offered regular screening for bowel cancer.

Suggest how this screening programme may have contributed to the percentage decrease in the number of deaths from bowel cancer between 2007 to 2016.

1

Stem Cells

9. (i) Describe how tissue (adult) stem cells differ from embryonic stem cells.

1

- (ii) Describe how the heart cells produced by the patients as a result of the stem cell treatment in this investigation developed their specialised functions.

1

- b) Much stem cell research is related to the therapeutic value of stem cells.

Give **one other** reason for carrying out stem cell research.

1

- 10 Stem cells are used in research to study how diseases develop.

- (a) (i) State one other research use of stem cells.

1

- (ii) Describe a property of embryonic stem cells, which makes them useful for research.

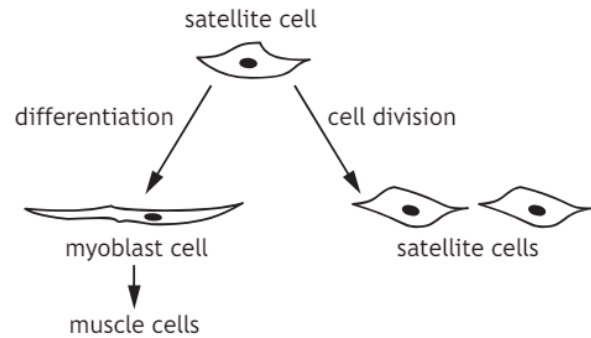
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- (iii) Suggest an ethical reason why medical research may involve the use of embryonic stem cells.

1

Stem Cells

- 11 (a) Human muscles contain satellite cells within the muscle tissue.
The diagram illustrates the division and differentiation of satellite cells.



- (i) Using information from the diagram explain why satellite cells are an example of tissue (adult) and not embryonic stem cells.

1

- (ii) State **one** benefit to the human body of satellite cells differentiating into myoblast cells.

1

- (iii) Satellite cells could be used to treat muscle diseases.

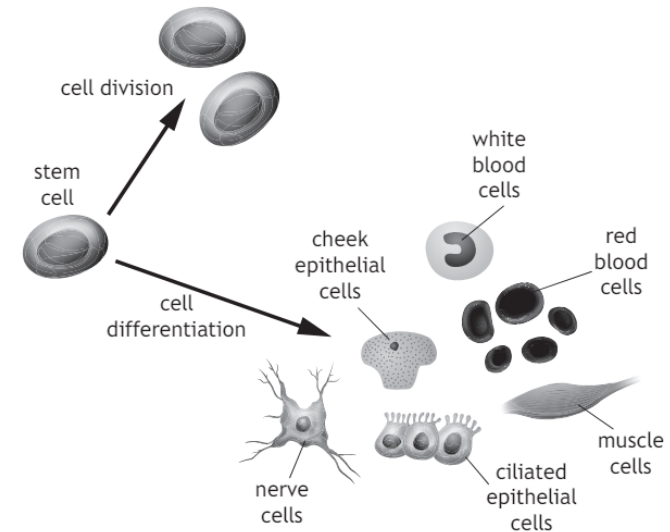
Give **one** ethical reason for using satellite cells instead of embryonic stem cells in order to treat such diseases.

1

- (b) Give **one** example of how stem cells are used as model cells in medical research.

1

12. Stem cells are unspecialised cells which can be found in embryonic and adult tissue.



- (a) Explain how the diagram above indicates that the stem cell shown is an embryonic and not a tissue (adult) stem cell.

1

- (b) After a stem cell differentiates, only certain genes are expressed.
Explain how this results in different cell types.

1

- (c) Give **one** therapeutic use of stem cells.

1

- (d) State **one** ethical issue relating to the use of embryonic stem cells.

1

Stem Cells

1. C
2. C
3. D
4. C
5. D
- 6.D
- 7.C
8. B
9. C
10. A
11. C
12. C
13. B
14. A

1a) Mitosis (self renewal)

1b) certain genes ON & others genes OFF to make specific protein (haemoglobin) in RBC.

C) excessive cell division as cells fail to adhere to regulatory signals.

2. a) pluripotent/produce all cell types

B) tissue only differentiate into certain cell types

3a (i) germline

(ii) mitosis

(iii) can differentiate into all cell types

4a (i) pluripotent

(ii) embryo needs to make all cells of human body

b) 23

c) drug testing/learn more about disease processes/cell growth OR differentiation

D) prevents destruction of embryos

5a) differentiation

Certain genes are turned ON & others OFF to make specific proteins for that cell type.

B) homologous chromosomes are pulled to opposite poles by spindle fibres

Chromatids are pulled to opposite poles by spindle fibres

C) prevents animal testing

6a (i) Tissue stem cells can differentiate into muscle cells in lab which form muscle tissue that can be grafted into damaged muscle.

(ii) for drug testing/to learn more about disease processes

7a) bone marrow

B) only differentiate into cells of the blood.

C) therapeutic—corneal transport OR grow skin for skin transplant

Research—model cells for drug testing/learn more about diseases

To learn more about cell growth/differentiation

8a) cells fail to adhere to one another and spread to a different location

b) may be found in the OTHER category

c) earlier detection/start treatment at an earlier stage

9. a (i) embryonic stem cells differentiate into all types of cells (pluripotent) OR

tissue stem cells differentiate into only a few types of cells (multipotent)

(ii) certain genes switched On & other genes turned OFF to produce specific proteins

10. a (i) for drug testing

(ii) pluripotent OR any gene can be switched ON.

(iii) prevents animal testing

11a (i) only produce one tissue type

(ii) can produce muscle cells for growth or repair of muscles.

(iii) embryos are not destroyed when using satellite cells

B) for drug testing OR to study disease processes

12 a) produces different types of cells

B) only certain proteins produces specific to cell.

C) corneal repair OR to grow skin for skin regeneration

D) embryo is destroyed