Cell Division and Stem Cells extended response marking key

Mitosis and meiosis are two important cellular processes which take place in the human body.

1. Compare and contrast the processes of mitosis and meiosis, highlighting their similarities and differences, and discuss their significance in the life cycles of humans. [7 marks]

|  |  |
| --- | --- |
| **1 Mark per each comparison** | **Marks** |
| **Mitosis vs Meiosis** |  |
| **Similarities** |  |
| Both produce new cells | 1 |
| Both start with a single cell | 1 |
| **Differences** |  |
| 4 stages/8 stages | 1 |
| Happens in somatic cells/happens in germ cells | 1 |
| Purpose is cell proliferation/purpose is sexual reproduction | 1 |
| Produces 2 diploid daughter cells/Produces 4 haploid daughter cells | 1 |
| Genetic variation doesn’t change/genetic variation increases | 1 |

1. During mitosis and meiosis, errors may sometimes occur which may cause certain diseases. Identify an example for each process, and explain how they are caused:

[4 marks]

|  |  |
| --- | --- |
|  | **Marks** |
| **Mitosis** |  |
| Cancer/tumours | 1 |
| Rapid, uncontrolled cell growth. | 1 |
| **Meiosis** | 1 |
| Non-disjunction/failure for chromosomes to separate during meiosis | 1 |
| Examples may include trisomy or monosomy. Include specific disease. Down syndrome, Klinefelter syndrome etc. | 1 |

Stem cells are promoted as “the way of the future” for the treatment of many illnesses Define the term stem cell and explain three the differences between adult and embryonic stem cells. [8 marks]

|  |  |
| --- | --- |
| **Definition– any 2 of the following** | **Marks** |
| Cell that is not specialised. | 1 |
| Cell capable of repeated mitosis. | 1 |
| Cell can differentiate into specialised cells. | 1 |
| **Total** | **2** |
| **Differences- any 3 linked differences** |  |
| Adult cell- multipotent. | 1 |
| Embryonic- pluripotent. | 1 |
| **Total** | **2** |
| Embryonic stem cell cultured from frozen embryos. | 1 |
| Adult stem cell taken from adult tissue/s. | 1 |
| **Total** | **2** |
| Embryonic stem cell may be rejected by recipient’s body. | 1 |
| Adult stem cells are not rejected | 1 |
| **Total** | **2** |
| More ethical issues linked to use of embryonic stem cells. | 1 |
| Cells derived from patient’s own tissue so no real ethical concerns. | 1 |
| **Total** | **2** |
| **Accept any other valid answers** |  |
| **Total** | **8** |

Discuss the ethical concerns surrounding the use of embryonic stem cells in scientific research and medical applications. Identify and explain a potential alternative to the use of embryonic stem cells.

[8 Marks]

|  |  |
| --- | --- |
|  | **Marks** |
| Embryonic stem cells derived from embryos at blastocyst stage | 1 |
| Extraction requires destruction of human embryo | 1 |
| Arguments made that human life begins at conception/fertilisation | 1 |
| Therefore, destruction of embryo would be akin to murder/loss of life | 1 |
| **Alternative to ESCs** |  |
| Induced pluripotent stem cells iPSCs | 1 |
| Cells derived from skin/blood cells that are reprogrammed back in embryonic-like pluripotent state | 1 |
| No destruction of embryo required | 1 |
| However, because the "reprogramming" process introduces genetic modifications, the safety of using iPSc in patients is uncertain. | 1 |
| **Accept any other valid answers** |  |
| **Total** | **8** |