1.2.3 Stem cells

AQA GCSE Biology (Higher)
Question and answer notes

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How to use these notes

These notes cover everything you need to know for this part of the specification. They have been written in question-answer format to make them easier for you to study from.

In order to study successfully, I recommend you do the following for each question and answer:

- Read it carefully and make sure you **understand** it.
- **Memorise** the answer.
- **Practice** applying your understanding to past exam questions.

A good way to memorise information is to use **retrieval practice**. This is when you practise retrieving information from your memory. You could do this by making a flashcard for each question with the question on one side and the answer on the other. Or you could use a flashcard app. Alternatively, use a sheet of paper to cover up the answer so you can only see the question. Try to answer the question and then check how you did.

You should practise retrieving each answer from your memory until you can do it perfectly. Even once you can retrieve the answer perfectly, your ability to retrieve it will probably fade as time passes without practising. Therefore you will need to keep going back to the questions that you have previously mastered and practising them again. However, each time you re-learn the answer, the memory will be stronger and will last longer than the time before.

What are stem cells?
Stem cells are unspecialised cells in multicellular organisms that can undergo cell division to produce more stem cells and can differentiate to become specialised cells.

What are the two different types of stem cells in animals?
In animals, there are:

- Embryonic stem cells, which are found in embryos
- Adult stem cells, which are found in mature animals.

What are the differences between embryonic stem cells and adult stem cells?
Embryonic stem cells can differentiate into any cell type from that organism.
Adult stem cells can only differentiate into certain cell types - usually the cell types of the organ they are found in.

How are new blood cells made?
New blood cells are made from adult stem cells that are located in the bone marrow. These stem cells can differentiate into all the different types of blood cells.

Where are plant stem cells found?
Plant stem cells are located in regions called meristems. These are usually found at the tips of roots and shoots.

What cell types can a plant stem cell differentiate into?
A plant stem cell can differentiate into any cell type that is found in that plant.

How can human embryonic stem cells be obtained for research and medical treatment?
Human stem cells can be obtained from a human embryo. The embryo is destroyed in the process.
Leftover embryos from IVF can be used for this, or embryos can be created using the patient's DNA in a process called therapeutic cloning.

What is the advantage of using therapeutic cloning rather than using embryos from IVF?
Embryos produced through therapeutic cloning are genetically identical to the patient's cells, so the patient's body will not reject them.

What can be done with human embryonic stem cells once they have been obtained?
Once human embryonic stem cells have been obtained, they can be cloned to produce more of them, and they can be made to differentiate into most human cell types.

How might human embryonic stem cells be used in the future?
In the future, it may be possible to use human embryonic stem cells to treat many different medical conditions, including diabetes and paralysis.

What are some of the problems with using human stem cells?
When transferring stem cells from one person to another, there is a risk of transfer of viral infection.
Also, some people have ethical or religious objections to the use of human stem cells - especially embryonic stem cells.

How can plant stem cells be used to make more plants?
Plant stem cells can be extracted from plant meristems and grown into new plants. This makes a clone of the original plant.

What are the advantages of using stem cells to clone plants?
Using stem cells to clone plants is quick and relatively cheap.

What are some uses of plant cloning?
Rare plant species can be cloned to protect them from extinction.
Crop plants with desirable features, such as disease resistance, can be cloned to produce more genetically identical plants for farmers to grow.