

Combined Science - Biology - KS4
Cell Biology

Stem cells and the use of stem cells

(Downloadable student document)

Miss Wong



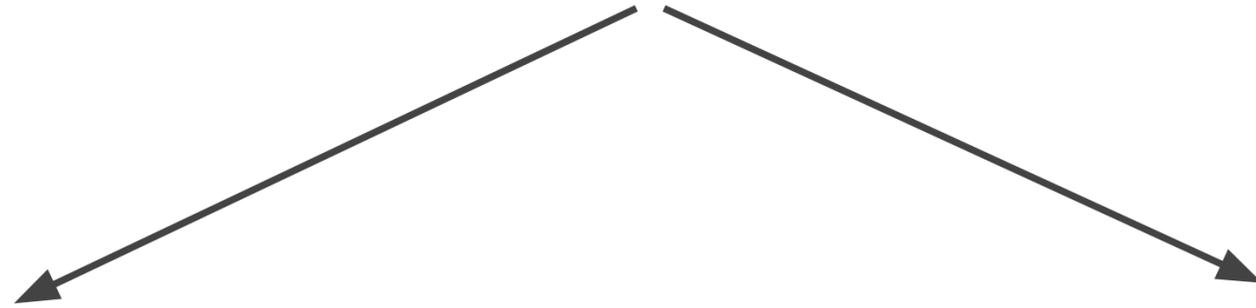
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Human stem cells



Human stem cells

Human stem cells



Embryonic stem cells

- Can differentiate into all types of cells.
- Taken from embryos.

Adult stem cells

- Can only differentiate into certain type of cells, e.g. blood cells.
- Taken from bone marrow of adults.



Embryonic stem cells

Advantages:

- Create many embryos in lab or come from donated embryos
- Painless technique
- Treat many diseases
- Become any type of cell

Disadvantages:

- Destroys embryo
- Rights for embryos/embryo cannot consent
- Unreliable
- Cancer



Adult stem cells

Advantages:

- No ethical issues
- Can treat some diseases
- Procedure is (relatively) safe
- Reliable technique
- Quick recovery

Disadvantages:

- Risk of infection
- Can only treat a few diseases
- Procedure can be painful



Pause the video to complete your task

Quick concept check:

- 1. Why is the use of embryonic stem cell controversial?**
- 2. Which type of stem cells can differentiate into more types of specialised cells?**

Resume once you're finished



Answers

1. Because an embryo cannot give consent to how it will be used and some embryos may be disposed.
2. Embryonic stem cells



Exam question

Scientists have been able to make working thyroid cells from stem cells.

They use embryonic stem cells.

How are embryonic stem cells different to adult stem cells?

OCR, Specimen J250/07

[1]



Exam question

Scientists have been able to make working thyroid cells from stem cells.

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How are embryonic stem cells different to adult stem cells?

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[1]

**Embryonic stem cells can become all cell types of the body /
adult stem cells are thought to be limited to differentiating
into different cell types of their tissue of origin (1)**



Exam question

ii. The dividing cell is a stem cell.

Describe the function of stem cells.

OCR, 2019 J250/01

[2]



Exam question

ii. The dividing cell is a stem cell.

Describe the function of stem cells.

OCR, 2019 J250/01

[2]

to provide different cells or specialised cells ✓

for development / growth / repair ✓



The kidneys in people with ARPKD have not developed normally.

Stem cells could be used to repair the damaged kidneys.

Discuss reasons **for and against** using stem cells to treat ARPKD.

OCR, 2018 J250/02

Reasons for -----

Reasons against -----

[3]



The kidneys in people with ARPKD have not developed normally.

Stem cells could be used to repair the damaged kidneys.

Discuss reasons for and against using stem cells to treat ARPKD.

reasoned argument for

12

- **avoids the need for dialysis ✓**
- **avoids need for a kidney transplant ✓**
- **avoids need to wait for a donor ✓**
- **avoids the risk of rejection (as they are their own stem cells) ✓**

reasoned argument against

- **stem cells could introduce viral infections ✓**
- **may change into unwanted cells / tumours ✓**
- **may involve the destruction of embryos ✓**

[3]



Therapeutic cloning



Pause the video to complete your task

What are the steps of therapeutic cloning.

Stem cells are available for therapeutic use.

The cells are stimulated to divide and develop into an embryo.

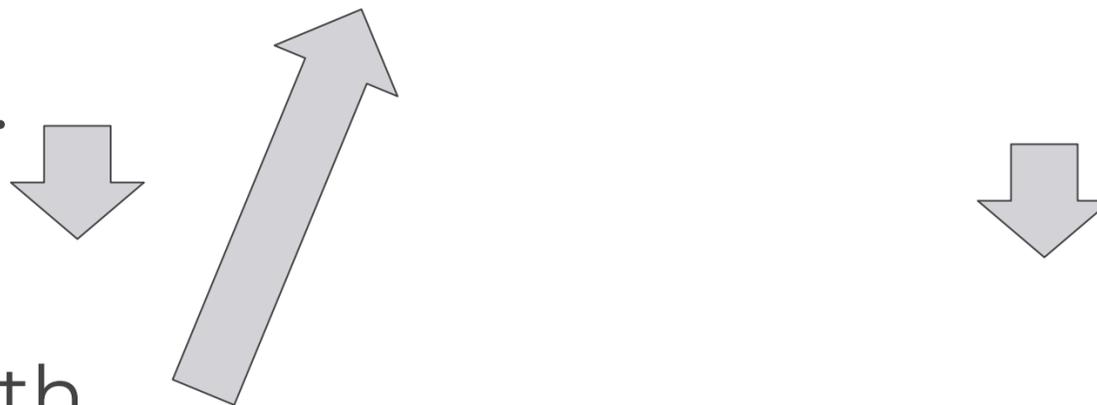
Resume once you're finished



Pause the video to complete your task

Answers

A body cell is taken from the patient. The nucleus is separated from the cell.



The nucleus from the patient's cell is fused with an empty egg cell from the donor.

Resume once you're finished



Plant stem cells



Plant meristems

Plant meristems are located in the tips of roots and shoots. Plants can be cloned through making cuttings and propagation.

This allows selected traits to be preserved.



Pause the video to complete your task

Quick concept check:

- 1. How do we call the region in which plant stem cells are found?**
- 2. Suggest why plant stem cells are important in farming.**

Resume once you're finished



Exam style question

A scientist was trying to preserve a rare plant species. She located the stem cells of the plant using the microscope and then used the stem cells to grow more plant individuals of the same species.

1. Where would the scientist find stem cells in the plant? (1)
2. The stem cells are 2mm under the microscope. It has been magnified by 400 times. What is the actual size of the cell? (3)
3. The scientist stimulated the stem cells to grow into more stem cells. Suggest which type of cell division should be involved. (1)
4. Compare the genetic content of the daughter plants compared to the mother plant. Explain your reasoning. (2)



Answers to exam style question

A scientist was trying to preserve a rare plant species. She located the stem cells of the plant using the microscope and then used the stem cells to grow more plant individuals of the same species.

1. The **meristem** located at the shoot tip or root tip.
2. $2 \text{ mm} = 2000\mu\text{m}$. Therefore $2000 \div 400 = 5\mu\text{m}$
3. **Mitosis** or mitotic cell division.
4. The mother and daughter plants are **genetically identical** as they are **clones**.



Independent practice



Independent practice

1. What is a stem cell?
2. What are embryonic stem cells?
3. A student argues that stem cells shouldn't be used in scientific research. Using your knowledge and understanding, give the advantages of using embryo stem cells in research T
4. Where can meristems be found in a plant?
5. Why are meristems important for humans to use?
6. Explain the use of meristems in plants for human benefits (hint: agriculture).
7. What is an adult stem cell?
8. State 3 advantages of using adult stem cells:
9. Using adult stem cells is not necessarily better than embryonic stem cells. Explain why.



Independent practice

1. An undifferentiated cell that can become any type of cell.
2. Stem cells present in embryos.
3. They can cure many diseases. The cells can differentiate into any needed cell. The embryos can be created in a laboratory (or might come from donated embryos) and collecting the cells is painless to the embryo.
4. Tips of shoots and roots.
5. They can be used to make clones of mature plants.
6. Save plants from extinction or for research so that we can understand structures of plants and protect them. Make lots of clones to sell for food, or for horticulture.
7. A stem cell taken from adult bone marrow.
8. Any 3 from
 - a. (No ethical issues) patient can give permission
 - b. Can treat some diseases
 - c. Procedure is (relatively) safe / doesn't kill donor
 - d. Tried and tested / reliable technique
 - e. Patients recover quickly from procedure
9. Because they are not able to treat all genetic diseases and are painful to obtain. Therefore their effectiveness is not high.

