Stem Cells

Answer the questions below.

1. Explain what is meant by a risk factor.

   A lifestyle or genetic factor that makes a person more likely to develop a disease (such as cancer).

2. State two lifestyle risk factors.

   Poor diet, sedentary lifestyle, smoking, excessive alcohol or drug consumption, exposure to UV radiation or chemicals.

3. Give an example of a specialised cell.

   Red blood cell, root hair cell, neuron, sperm cell

4. Explain how red blood cells are specialised for their function.

   They have a large surface area which allows them to carry as much oxygen as possible around the body to cells where it is needed.

5. Describe the differences between animal cells and plant cells.

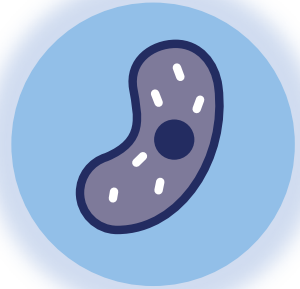
   Plant cells contain a cell wall, chloroplasts and a vacuole, while animal cells do not.

Do Now

Stem Cells

B3.1.14

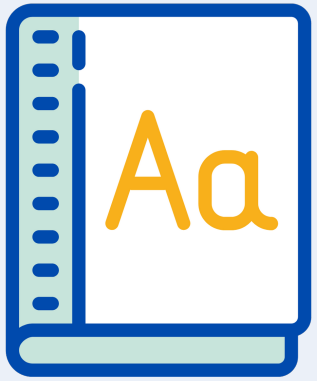
Science
Mastery



Following this lesson, students will be able to:

- State the definition of a stem cell
- Describe the differences between embryonic and adult stem cells and the stem cells from meristems
- Explain the ethical objection to the use of stem cells

Key Words:



stem cell | **embryonic** | **bone marrow**

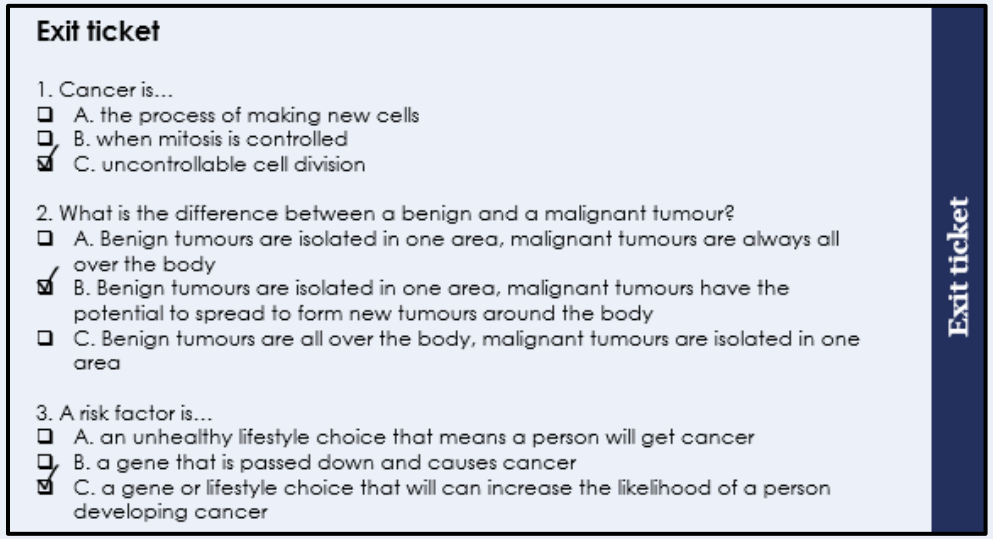
differentiation | **meristem** | **cloning**

Lesson Objectives

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
  - **reteach**, **explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.



Exit ticket

1. Cancer is…
   - ☐ A. the process of making new cells
   - ☐ B. when mitosis is controlled
   - ☑ C. uncontrollable cell division

2. What is the difference between a benign and a malignant tumour?
   - ☐ A. Benign tumours are isolated in one area, malignant tumours are always all over the body
   - ☑ B. Benign tumours are isolated in one area, malignant tumours have the potential to spread to form new tumours around the body
   - ☐ C. Benign tumours are all over the body, malignant tumours are isolated in one area

3. A risk factor is…
   - ☐ A. an unhealthy lifestyle choice that means a person will get cancer
   - ☐ B. a gene that is passed down and causes cancer
   - ☑ C. a gene or lifestyle choice that will can increase the likelihood of a person developing cancer

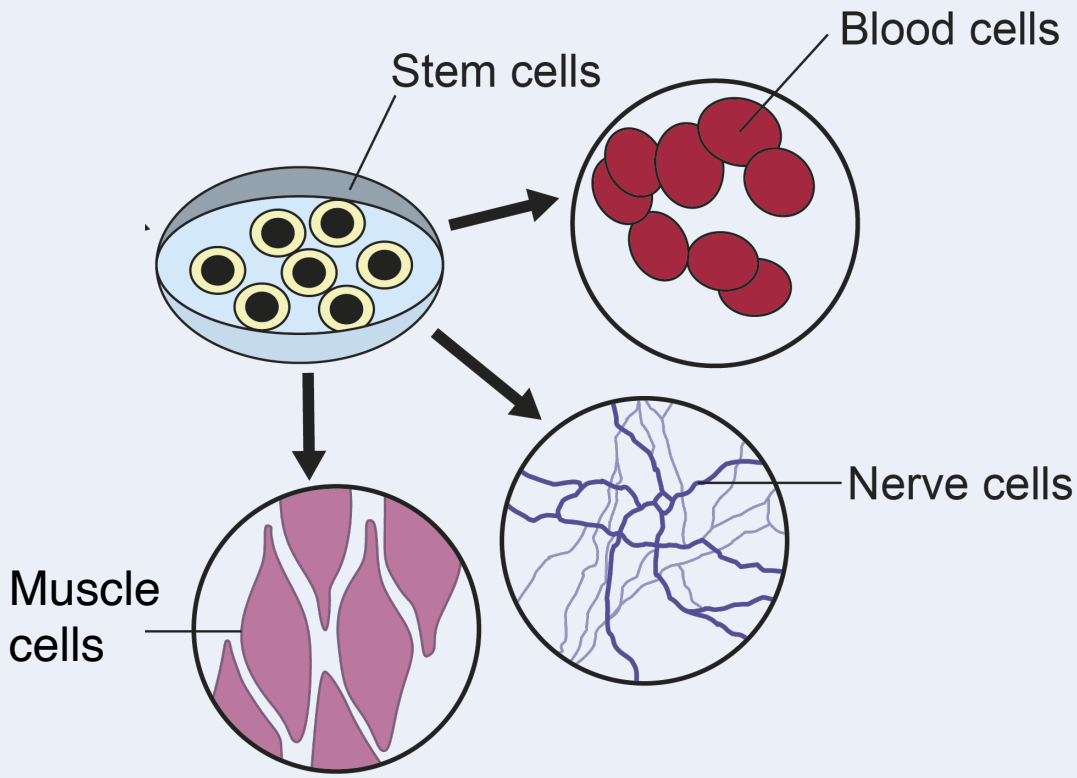
Exit ticket

Fix-it

Stem Cells

As cells **differentiate** into **specialised cells** they acquire the specific structures needed for that cell type

Stem cells are cells that are **capable of differentiating** into specific cell types



Stem cells from **developing embryos** (embryonic stem cells) can differentiate into **all human cell types** to develop into a foetus

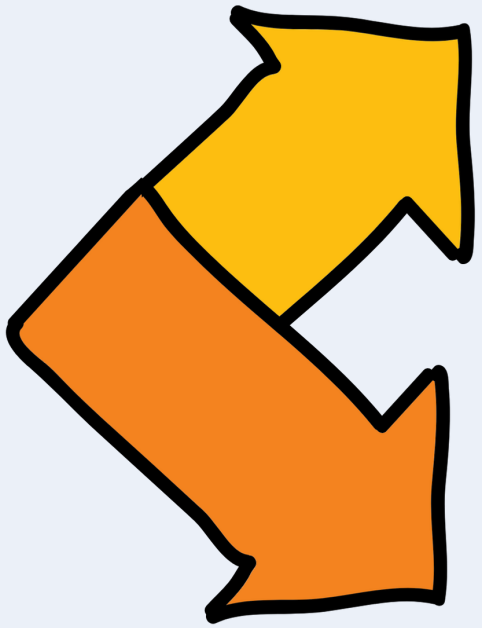
Adult bone marrow contains stem cells that can differentiate into different types of **blood cell**

Stem Cells

Meristems in plants contain stem cells that can differentiate into **all plant cells** to develop a new plant

Most plants are able to differentiate cell types throughout their lives

Can you explain the difference between these two cell types?

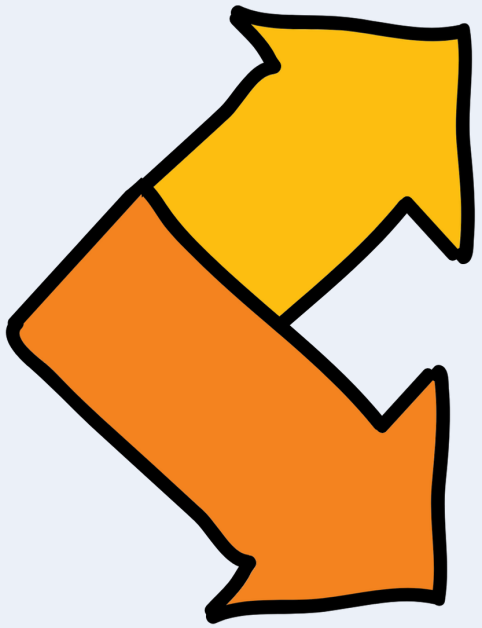


Embryonic stem cells

Adult stem cells

Talk Task

Can you explain the difference between these two cell types?

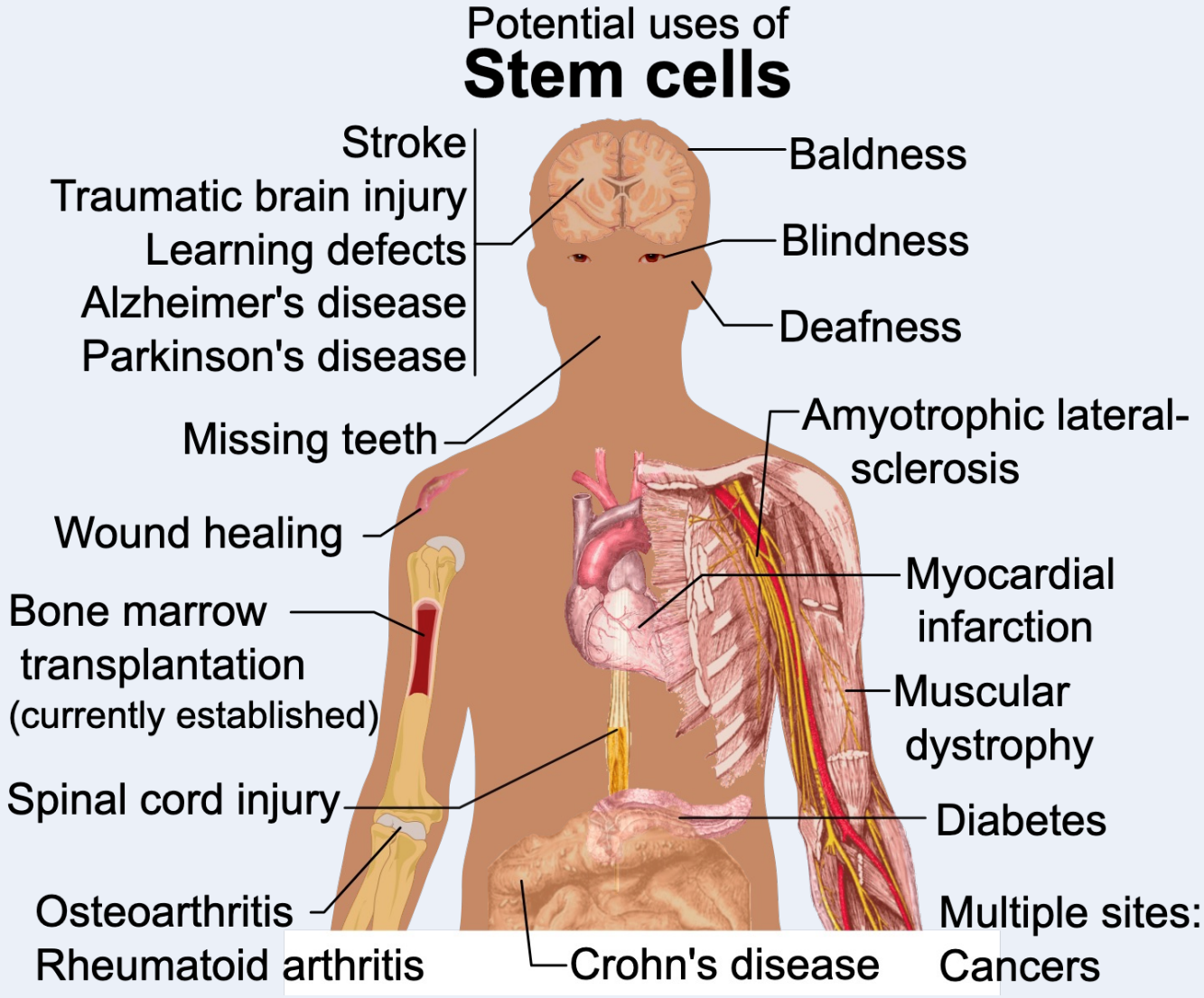


Meristems

Adult stem cells

Talk Task

Stem Cell Uses



Patients suffering with **diabetes** or **paralysis** may be treated with stem cells to help grow back **insulin producing cells** or **motor neurons**

Ethical issues around stem cells

There are **religious** and **ethical** objections to the use of embryonic stem cells

There are potential **health risks** of using stem cells therapeutically, such as viral infection

Quick Quiz

Determine whether each statement is true or false:

1. Stem cells are cells that have the potential to differentiate into other cell types. **True**

2. Stem cells from adult bone marrow can differentiate to form more cell types than embryonic stem cells **False**

3. Stem cells are only found in humans **False**

4. Stem cell therapy can be used to produce new motor neurons for patients suffering from paralysis **True**

5. Some people object to the use of embryonic stem cells because using those stem cells stops a foetus developing **False**

Check for understanding

Drill

1. Define stem cells.
2. Define a specialised cell.
3. What are the two types of stem cells found in animals?
4. State what adult bone marrow stem cells can differentiate into.
5. Where are stem cells in plants found?
6. Give two human conditions that can be treated using stem cells.

Check for understanding

Drill answers

1. Stem cells are cells that can differentiate into specific cell types
2. A cell that has a particular structure/shape for its function
3. Embryonic stem cells and adult (bone marrow) stem cells
4. Different types of blood cell
5. The meristems
6. Diabetes or paralysis

Check for understanding

I: Describe to rec*all facts, events or processes in an accurate way*

Example question:

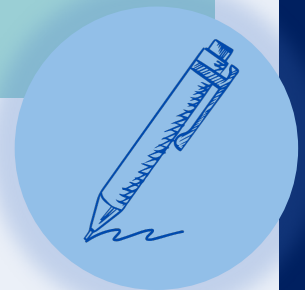
State three advantages of using stem cells from **adult bone marrow** instead of from embryos.

Model answer:

- no ethical issues
- quick recovery
- safe
- we know it works

To 'describe', your answer should:

- Use **bullet points.**
- Include each step of the process in a **logical order.**
- Use **keywords** throughout the answer
- Stay **focused** on the question.



Writing like a scientist

I: Evaluate: *to make a conclusion based on evidence*

Example question:

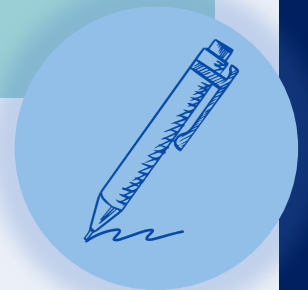
Evaluate the use of embryonic stem cells in treating diseases.

*What are the **advantages** of using stem cells from **embryos** instead of from adult bone marrow?*

- can treat a wide range of disease
- lots available
- using embryos better than wasting them
- no pain

To 'evaluate' your answer should:

- Use the information supplied and our own knowledge to consider the **evidence for and against a point**.
- We may also be required to **include a justified conclusion**. This may sometimes be our opinion.



Writing like a scientist

We: Evaluate: *to make a conclusion based on evidence*

Example question:

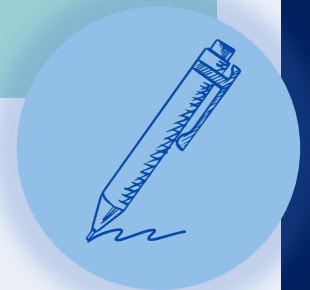
Evaluate the use of embryonic stem cells in treating diseases.

*What are the **disadvantages** of using stem cells from **embryos** instead of from adult bone marrow?*

- harm / death to embryo
- (relatively) untested / unreliable / may not work
- embryo doesn't have a 'choice'

To 'evaluate' your answer should:

- Use the information supplied and our own knowledge to consider the **evidence for and against a point**.
- We may also be required to **include a justified conclusion**. This may sometimes be our opinion.



Writing like a scientist

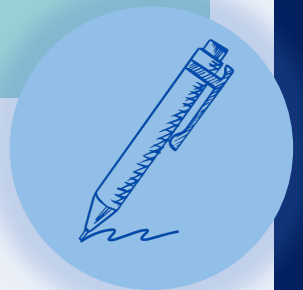
We: Evaluate: *to make a conclusion based on evidence*

Evaluate the use of embryonic stem cells in treating diseases. Some points of view are given in the table below.

For stem cell research	Against stem cell research
Offers a treatment to many incurable diseases	It is against certain religions to stop life from developing, even at 3 days embryos are considered as living things
Diverts resources to treatments that really work rather than patients remaining on transplant list for years	Embryonic stem cells are unstable and could cause tumours
Less lab animals and money could be wasted testing new drugs	The use of stem cells has potential risks such as transfer of viral infection

To 'evaluate' your answer should:

- Use the information supplied and our own knowledge to consider the **evidence for and against a point**.
- We may also be required to **include a justified conclusion**. This may sometimes be our opinion.



Writing like a scientist

You: Evaluate *to make a conclusion based on evidence*

Example question:

Evaluate the use of stem cells from embryos or from adult bone marrow for treating human diseases. You should give a conclusion to your evaluation.

Model answer:

<u>embryo stem cells</u>

pros
- can treat a wide range of disease
- lots available
- using embryos better than wasting them
- no pain

cons
- harm / death to embryo
- (relatively) untested / unreliable / may not work
- embryo doesn't have a 'choice'

<u>adult bone marrow stem cells</u>

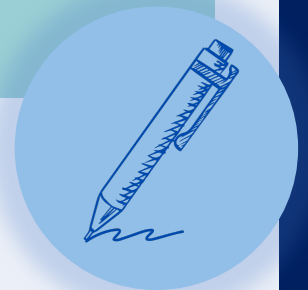
pros
- no ethical issues
- quick recovery
- safe
- we know it works

cons
- risk of infection
- only a few diseases can be treated
- painful

To 'evaluate' your answer should:

- Use the information supplied and our own knowledge to consider the **evidence for and against a point**.
- We may also be required to **include a justified conclusion**. This may sometimes be our opinion.

Conclusion to evaluation:
A reasoned conclusion from the evidence



Writing like a scientist

Answer the questions below.

1. Choose the best description of stem cells.

- [x] A. Cells that can differentiate to form different specialised cells
- [ ] B. Cells that can undergo cell division
- [ ] C. Cells that can differentiate to form one type of specialised cell

2. Why are embryonic stem cells considered more useful therapeutically than adult bone marrow stem cells?

- [ ] A. They can be cloned to form new organisms with desired features
- [x] B. They can differentiate to from different types of cell rather than just blood cells
- [ ] C. They can differentiate to form a foetus with many different types of cell

3. A religious/ethical objection to the use of embryonic stem cells is…

- [ ] A. The embryo would be destroyed if it was not used
- [ ] B. The embryo could be used to create designer babies
- [x] C. The embryo cannot give its permission to be used

Exit ticket

Feedback

Lesson B3.1.14	
What was good about this lesson?	What can we do to improve this lesson?

Send us your feedback by clicking this link
or by emailing sciencemastery@arkonline.org
Thank you!