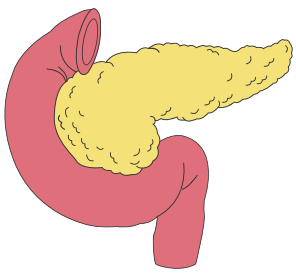
Stem Cells: GCSE Biology

Content

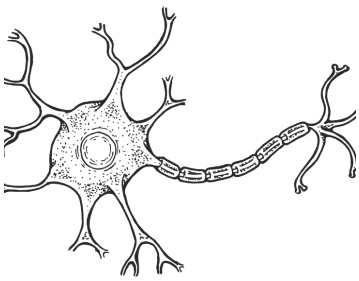
1. Introduction

- Cells with the ability to divide repeatedly to produce more similar cells that also differentiate are called **stem cells**.
- These are **unspecialized**, that is, they do not have a specific function.
- They give rise to cells that **specialize** in different functions.
- For example, stem cells develop into pancreatic cells and help in digesting sugar.
- Another example, cells in the lungs are designed to exchange gases.

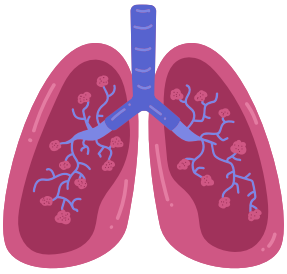
Real-life examples



Pancreatic cells digest sugar



Nerve cells in brain transmit signals



Lung cells exchange gases

Stem Cells: GCSE Biology

2. Where are Stem Cells Found?

- Stem cells are found in both plants and animals.
- **In plants**, stem cells are present in **meristems**.
- It includes the regions of **apical meristem** (root and shoot), **lateral meristem** (sides of stem and root), and **intercalary meristem** (base of leaves and internodes).
- **In animals,** these cells are found in early-stage embryo and are called **embryonic stem cells**.
- Apart from this, these can be observed in most adult tissues, known as **adult stem cells**.

3. What are the functions of Stem Cells?

- The major functions of stem cells are - **Differentiation, tissue growth,** and **repair.**
- Stem Cells **differentiate** into specialized cells in both plants and animals.
- After growth, they are found as adult stem cells that, in humans, allow **tissue growth**.
- Cells that get old or are damaged need replacement. Stem cells replace these cells to **repair the tissue**.

4. Advantages of Using Stem Cells in Medicine

- **Diseases** caused by **damaged cells** can be **treated** using **stem cells**.
- Treatment of diseases such as **type I diabetes**. E.g., Bone marrow transplantation to cure a blood disease.
- Study of stem cells can help appropriate **drug development** for humans.
- With this, there is **no need to test drugs on humans**, as can be done in lab settings.
- For example, testing on transparent young zebrafish.

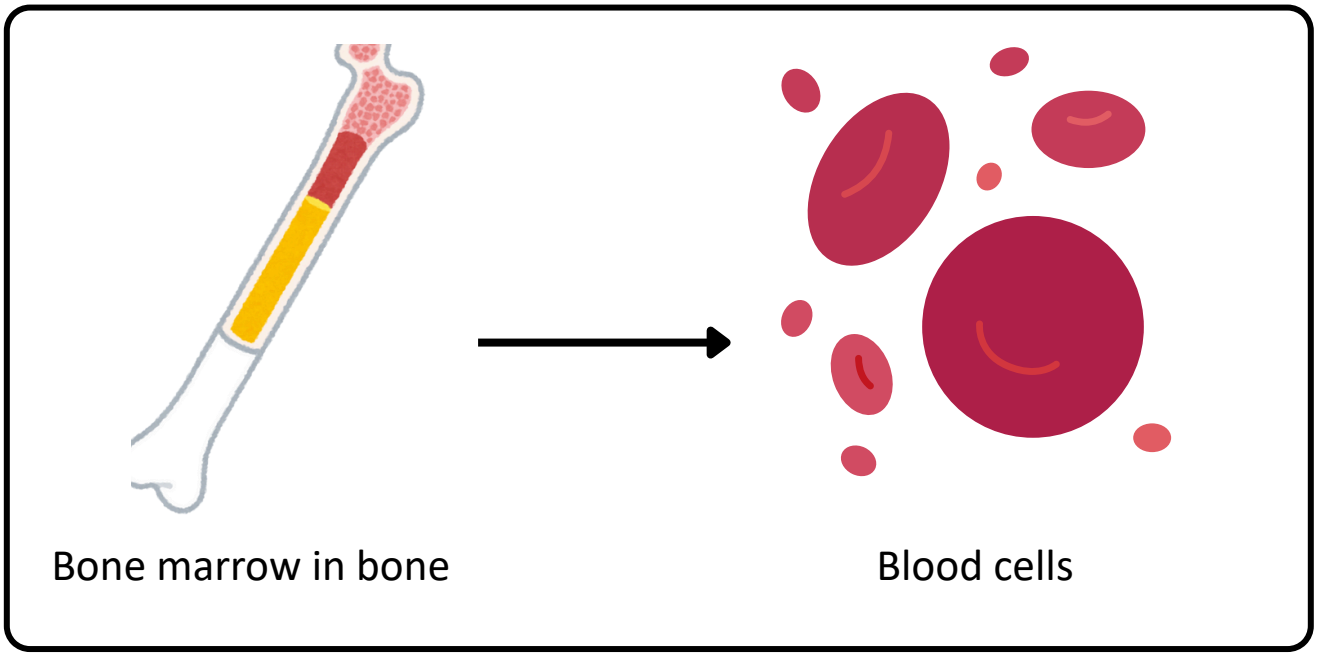
Stem Cells: GCSE Biology

5. Risk of Using Stem Cells In Medicine

- Continued division after replacement of damaged cells can lead to **cancer**.
- Using stem cells to treat a disease involves putting them in the body of the patient. The immune system of the body usually kills these cells.
- The reason the immune system kills these cells is that they are treated as foreign particles.
- It is known as **rejection.**

6. Function of Stem Cells in Bone Marrow

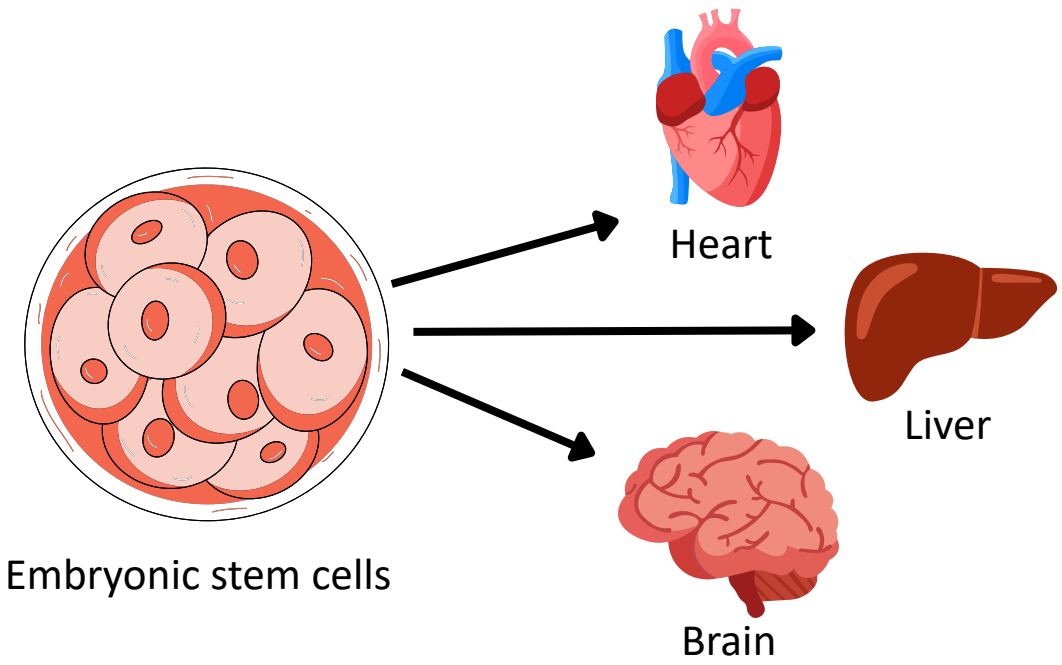
- Stem cells are present in the **middle** of those **bones** in the body that are **long**, like the femur.
- During their whole life, they **divide continuously** and **produce new blood cells**.
- Stem cells can only give birth to those specialized cells that are in the tissue surrounding them.
- Since blood stem cells are found in bone marrow and blood cells surround them, they produce blood cells only.



Stem Cells: GCSE Biology

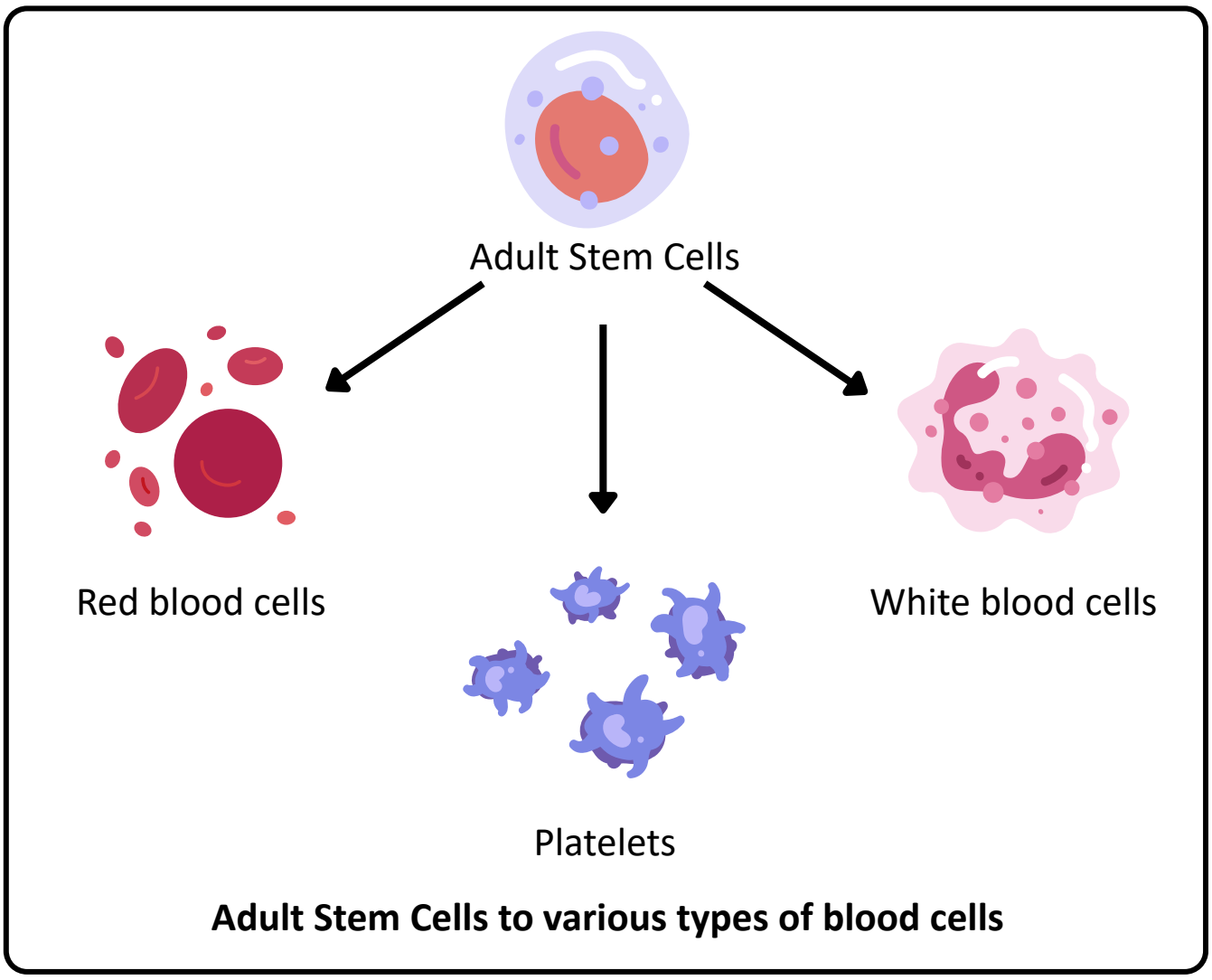
7. Comparison of Adult Stem Cells with Embryonic Stem Cells

Comparison on the basis of -	**Embryonic Stem Cells**	**Adult Stem Cells**
Types of specialized cell they produce	Any type of specialized cell	Type of cells is in the tissue around them
Their functions	Development to make organs	Tissue growth and replacement of old or damaged cells



Stem Cells to different specialized stem cells that develop into organs

Stem Cells: GCSE Biology



Adult Stem Cells to various types of blood cells

8. Roles of Meristems in Plant Growth

- In plants, the **roots** and **shoots** are the areas where **growth** happens.
- **Meristems** are **stem cells** found in these regions.
- The cells in meristems divide continuously by **mitosis**.
- These take part in **elongation** as the length of the cells increases.
- Refer to 7.Plant Meristem Elongation in Cell Differentiation & Specialization.

Stem Cells: GCSE Biology

FAQs :

1. **What are stem cells?**
Stem cells are undifferentiated cells that undergo division to make more similar cells and differentiate into specialized ones.

2. **What are the types of stem cells in animals?**
In animals, there are two types of stem cells. These include embryonic stem cells and adult stem cells.

3. **What are stem cells used for in medicine?**
Stem cells are used for the treatment of diseases, replacement of damaged cells, and drug research.

4. **What are the risks of using stem cells in medicine?**
Usage of stem cells in medicine involves the risk of cancer and rejection by immune system.

5. **What is the function of adult stem cells?**
Adult stem cells are responsible for tissue growth and cell repair.