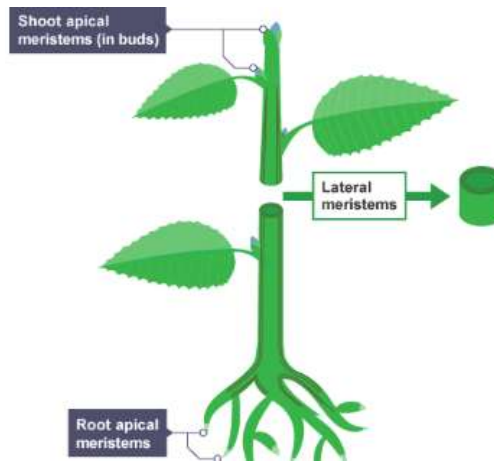


1.4. Cellular Differentiation

Cellular differentiation is the process by which an unspecialised cell becomes altered to have a specific **structure** and **function** as a result of expressing **genes** characteristic for a particular type of cell. Once a cell becomes differentiated it only expresses the genes that produce the **proteins** characteristic for that type of cell.

Differentiation in plant cells

Within plants, **meristems** are regions of unspecialised cells that are capable of cell division. Meristems are found at the tips of **shoots** and **roots** (known as **apical** meristems, which contribute to growth in height) and in between the xylem and phloem tissues (known as **lateral** meristems, which contribute to growth in width).

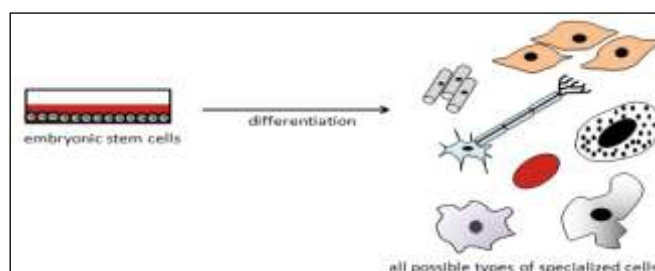


Differentiation in animal cells

Stem cells are unspecialised somatic cells found in animals that can divide to make copies of themselves and/ or differentiate into specialised cells depending on gene **expression**.

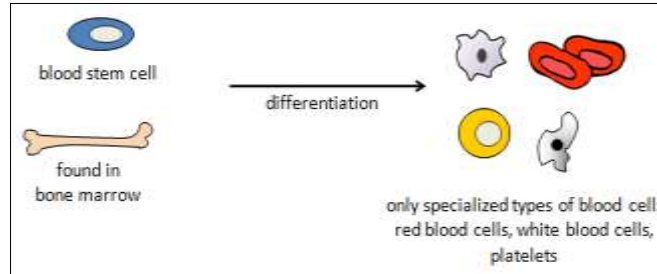
Embryonic stem cells

Cells in the very early embryo can differentiate into all cell types that make up the organism (**pluripotent**). These cells don't self-renew in vivo, but can under the right conditions in the lab. It is then they are termed embryonic stem cells and are used as a source of stem cells in research.



Tissue (adult) stem cells

Tissue stem cells are needed for growth, repair and renewal of tissues. They replenish differentiated cells that need to be replaced and give rise to a more limited range of cell types (**multipotent**), e.g. blood stem cells found in the bone marrow produces the various blood cell types.



Stem cell research

Stem cell research provides information on how cell processes such as cell growth, differentiation and gene regulation work. Stem cells can be used as model cells to study how **diseases** develop or for **drug testing**. As a result of research, stem cells are now being used to treat a number of **medical** conditions in humans.

Therapeutic uses of stem cells

- Stem cells of burns victims can be used to grow new skin in the lab for **grafting**. As the new skin has been grown from the patient's own stem cells, it will not be rejected.
- Stem cells within donated bone marrow give patients suffering from **leukaemia** the ability to make healthy blood cells via bone marrow transplant.
- Stem cells from a patient's eye can be used to grow new corneal tissue to replace damaged cornea, restoring **sight**.

Ethical Issues

The use of human embryos for research is currently high on the ethical and political agenda in many countries. Many groups of people have criticised the use of embryonic stem cells due to the ethics of creating, using and **destroying** potential embryos for research. In Great Britain stem cell research is closely **regulated** by the government. Any research team that wish to use stem cells must obtain a **licence** giving them permission to begin their research.