*This is the **Foundation Separate** version — Higher Tier content has been removed.*

Stem cells are undifferentiated cells that can divide and develop into specialised cell types. They have important roles in growth, repair and medical research.

- A stem cell is an undifferentiated cell that can divide (by mitosis) and differentiate into specialised cell types.
- Embryonic stem cells: found in early embryos — can differentiate into ANY cell type (totipotent). Used in research and potentially in medicine.
- Adult stem cells: found in specific tissues (e.g. bone marrow). More limited — can only produce certain cell types (e.g. blood cells).
- Therapeutic cloning: a cloned embryo is made with the same DNA as the patient → embryonic stem cells are extracted → used to grow replacement tissue. Avoids immune rejection.
- Uses of stem cells: treating leukaemia (bone marrow transplant), potentially treating Parkinson's, diabetes, spinal cord injuries.
- Ethical concerns: obtaining embryonic stem cells requires destroying a human embryo — raises questions about when life begins.
- Plant meristem cells at root tips and shoot tips are equivalent to stem cells — can differentiate into any plant cell type. Used to clone plants rapidly.

Key Terms

Stem cell	Undifferentiated cell that can divide and differentiate into specialised cell types
Differentiation	Process by which a stem cell becomes a specific specialised cell type
Totipotent	Able to differentiate into any cell type in the body (embryonic stem cells)
Therapeutic cloning	Creating a cloned embryo to obtain embryonic stem cells with matching DNA to a patient
Meristem	Region of actively dividing, undifferentiated cells in plants (root and shoot tips)

■ **Exam Tip:** When evaluating stem cells, always give BOTH benefits (can treat serious diseases, replace damaged tissue) AND ethical concerns (embryo destroyed, religious objections, risk of tumour formation). A balanced answer gains more marks.