

Cell Size

Molecules	= 1 nm
Thickness of cell membrane	= 10 nm
Viruses	= 100 nm
Bacteria	= 1 μ m
Organelles	= up to 10 μ m
Eukaryotic cells	= up to 100 μ m

Surface area to volume ratio (SA:V)

Surface area: affects the rate of exocytosis and endocytosis.

Volume: affects the rate of chemical activity, heat and waste production, resource consumption.

Volume is inversely proportional to SA:V (i.e. when V $\uparrow$, SA:V $\downarrow$)

- Food/oxygen enters and wastes leave through the surface of cells
- Rate of substance crossing the membrane depends on surface area (endocytosis)
- More metabolic activity in a larger cell means more food and oxygen required
- Large volume means longer diffusion time and more wastes produced
- Excess heat generated will not be lost efficiently (with low SA:V)

Cell Differentiation

- Different genes are activated in different cells.
- Depends on gene expression regulated mostly during transcription.
- Cells are committed to a pathway of development.

Stem Cells

- Capacity to divide (pluripotent or totipotent)
- Able to differentiate along different pathways
- Derived from blastocysts/ left over from IVF/ placenta/ umbilical cord/ adult tissues
- Replace dysfunctional cells with functioning ones
- Identify desired type of stem cell and grow in culture
- Develop biochemical solution that will cause cells to differentiate into desired cell type
- Implant cells into patient's tissues
- Danger of rejection of cells therefore need to suppress immune system
- Ensure new cells do not become overgrown

Examples

- Retinal cells: cure glaucoma and macular degeneration
- Skin cells: treat serious burn
- Nerve tissue: repair spinal injuries / regain movement for paralysis
- Hematopoietic cells: restore bone marrow cells killed by chemotherapy drugs for leukaemia