

Cell specialization

What is differentiation?

Cell specialization

How do gradients affect gene expression in an early embryo?

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What are the two properties of stem cells?

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Name two stem cell niches in adult humans.

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Totipotent, pluripotent, multipotent: what can each form?

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Name some of the largest and smallest human cells.

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What is the SA:V of a cube of side L?

Cell specialization

Why does SA:V constrain cell size?

The concentration of a signal molecule differs with position, so cells in different positions express different genes.

The development of unspecialized cells into specialized cells by expressing different genes.

Bone marrow and hair follicles.

They can divide endlessly and differentiate along different pathways.

Large: egg (about 110 μm), neurons with long axons, striated muscle fibres. Small: sperm, red blood cells (about 7-8 μm).

Totipotent: any cell type, including placenta. Pluripotent: any body cell. Multipotent: a limited range of related cells.

Exchange depends on surface area but the need for exchange depends on volume, which increases faster as a cell grows.

$6L^2 \div L^3 = 6 \div L$, so SA:V falls as L increases.