

Cell specialization · supported focus

Supported focus · HL

Supported scope

- Supported HL focus. First assessment 2025; current subject brief acquired; full Biology guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Specialization · 1.1

Reasoning

A root-hair cell and a red blood cell have different shapes because their functions impose different demands. Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

Specialization · 2.1

Reasoning

Differentiation produces specialized cells through different patterns of gene expression. A root-hair extension increases exchange area. A mammalian red blood cell lacks a nucleus at maturity and contains haemoglobin; this is a specific adaptation, not a rule for all animal cells. differentiation: Development of specialized cell structure and function; gene expression: Use of genetic information to produce a functional product.

Specialization · 3.1

Reasoning

Link a named feature to a mechanism and then to the function. Increased area can support exchange, but membrane proteins, gradients and metabolic demand also matter. Stem cells retain different degrees of developmental potential. Compare scaled drawings of named cells. Label the structure, state the function and explain the causal link. Use tissue-specific examples rather than saying every specialized cell has every adaptation.

Specialization · 4.1

Reasoning

State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution. Known: a spherical model cell has radius 2 units. Surface area/volume = $3/r = 1.5$ per unit. A radius of 4 gives 0.75 per unit. Doubling radius halves this ratio, even though total area increases.

Specialization · 4.2

Reasoning

For a sphere, surface area/volume = $3/r$. Find this ratio when $r = 6$ units. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

Specialization · 5.1

Reasoning

Specialization does not usually require a cell to lose most of its genes. The spherical calculation models geometry; it does not describe every actual cell shape. Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Specialization · 5.2

Reasoning

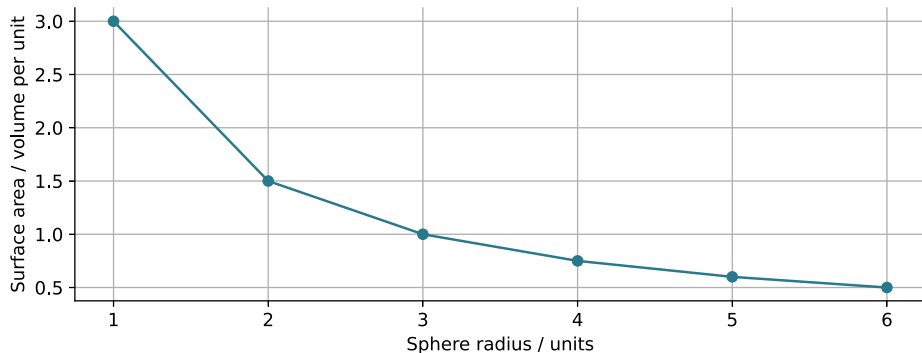
All mature animal cells lack a nucleus. This claim is false: Specialization does not usually require a cell to lose most of its genes. The spherical calculation models geometry; it does not describe every actual cell shape.

Specialization · 5.3

Reasoning

Specialized cells: structure linked to function: Link a named feature to a mechanism and then to the function. Increased area can support exchange, but membrane proteins, gradients and metabolic demand also matter. Stem cells retain different degrees of developmental potential.

Specialization · diagram



- Original teaching diagram: Specialized cells: structure linked to function
- Use the labels and the stated model together.

Specialization · original transfer

Your turn

A spherical cell doubles radius. Compare area, volume and SA/V factors; explain why total area increasing does not remove exchange constraints.

Specialization · transfer reasoning

Method and interpretation

Area $\times 4$, volume $\times 8$, SA/V $\times 1/2$. Exchange capacity per volume falls in the geometric model; actual cell specialization also involves shape, transport and demand.

Check yourself

- Explain differentiation using the stated model.
- Explain gene expression using the stated model.
- Change one value in the original transfer; explain which assumption still matters.