

Exercise walk-through

2.1

The History, Nature and Practice of Biology

GAC Science

Method — Key knowledge: observed structures support a bounded interpretation rather than every life process

A **cell** 细胞 is the basic structural and functional unit of living organisms.

Prokaryotic 原核 cells have DNA without a membrane-bound nucleus.

Eukaryotic 真核 cells typically contain a nucleus and other membrane-bound structures; some specialised cells lack particular structures. A missing feature in a low-quality image is not proof that the organism lacks it. Biology studies structure, function and change using suitable observations and investigations.

Method — Source A: text or task brief

Historical context: Robert Hooke's *Micrographia* was published in 1665 and used the word cell for the tiny spaces he observed in cork. This selected event is not the entire development of cell theory. Sources checked 2 October 2026: Royal Society history and digitised *Micrographia*.

Fictional prepared structural records, supplied as verified descriptions for this written task: sample A has a membrane, cytoplasm and DNA not enclosed in a nucleus.

Sample B has a membrane, cytoplasm, a nucleus, a cell wall and chloroplasts. A separate image shows a cell 30.0 mm long on the printed page; its actual length is given as 0.0500 mm. These records are not live specimens and do not show reproduction or every life process.

Method — Source B: response or review record

A student writes: “A has no DNA because it has no nucleus. B is a plant-like eukaryotic cell, so every cell in every plant must contain chloroplasts. The printed cell is actually 30 mm long. Its shape proves that it grows faster than A.”

The teacher proposes a separate, approved study of growth under two light conditions using comparable seedlings, controlled watering and a defined growth measure. No growth observations or light-condition results are supplied.

Method — Worked example: distinguish a verified structural record from a limited picture

Known: A's verified description places DNA outside a membrane-bound nucleus. Why identify it as prokaryotic? The stated organisation of DNA, not a claim that DNA is absent, supports that interpretation. B's supplied nucleus and chloroplasts support a plant-like eukaryotic interpretation. A drawing alone cannot establish growth rate or all structures of an organism.

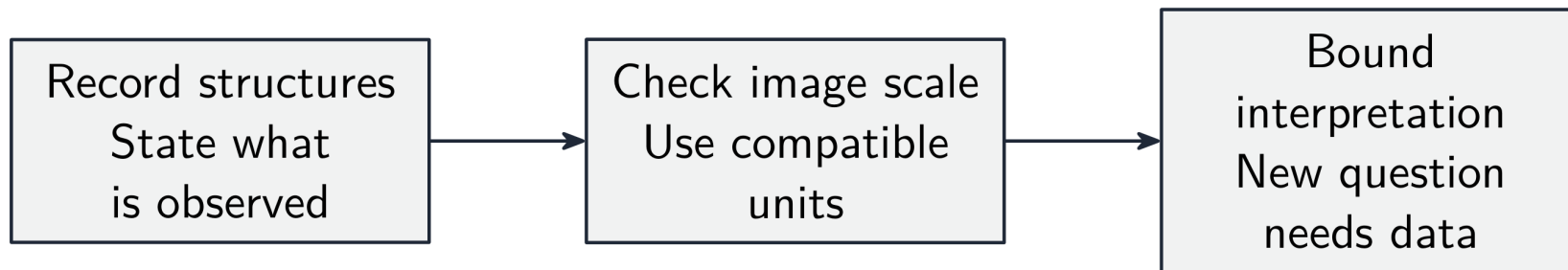
$$M = \frac{L_{image}}{L_{actual}}$$

$$M = \frac{30.0 \text{ mm}}{0.0500 \text{ mm}} = 600$$

Magnification is a ratio with the same units cancelled; it does not make the real cell longer.

Method — Worked example: distinguish a verified structural record from a limited picture

Why identify it as prokaryotic?



Exercises 2.1-2.3

2.1 Identify the publication and year associated with the supplied Hooke observation. [2]

2.2 Classify A and B from their supplied structural records. [2]

2.3 Calculate the image magnification and explain why it has no length unit. [3]

Exercises 2.1-2.3

2.1 Identify the publication and year associated with the supplied Hooke observation. [2]

2.1

: Micrographia.: 1665. This date concerns the supplied historical event, not a claim that Hooke alone established all cell theory.

2.2 Classify A and B from their supplied structural records. [2]

2.2

: A is prokaryotic because DNA is not enclosed in a nucleus.: B is plant-like eukaryotic from its nucleus, wall and chloroplasts.

2.3 Calculate the image magnification and explain why it has no length unit. [3]

2.3

: magnification = image length / actual length.: $M = 30.0 \text{ mm} / 0.0500 \text{ mm} = 600.$: compatible length units cancel; it may be stated as $\times 600$.

Exercises 2.4·3.1

2.4 Correct THREE unsupported structural or scale claims in the student note. [3]

3.1 Explain how the proposed growth investigation should produce a fair, bounded comparison using six points. [6]

Exercises 2.4·3.1

2.4 Correct THREE unsupported structural or scale claims in the student note. [3]

2.4

each: A does have recorded DNA; chloroplasts in B do not establish that all plant cells contain them; 30 mm is the printed image length, while actual supplied length is 0.0500 mm. Growth is addressed separately in the evaluation.

3.1 Explain how the proposed growth investigation should produce a fair, bounded comparison using six points. [6]

3.1

each: define light conditions as the changed factor; choose a specified growth measure and period; use comparable seedlings; keep watering or other stated conditions comparable; obtain approved safe procedures and repeated observations; do not infer results from cell shape or report a growth effect before data exist.

Exercise 3.2

3.2 Write an 80–110-word record summary separating structural interpretation, scale and the proposed investigation. [8]

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3.2

Local analytic rubric, 8 ×: recognise A's DNA; classify A; classify B with evidence; avoid universal chloroplast claim; state real image distinction; give ×600 ratio; reject shape-based growth claim; describe the approved investigation as pending; coherent truthful 80–110 word response. Example: “The supplied description supports a prokaryotic interpretation of A because its DNA is not enclosed in a nucleus; it does not lack DNA. B has a nucleus, wall and chloroplasts, supporting a plant-like eukaryotic interpretation. These structures do not show that every plant cell has chloroplasts. The printed cell length is 30.0 millimetres, while its supplied actual length is 0.0500 millimetres, giving a magnification of six hundred. Shape alone does not establish growth rate. The proposed light comparison needs an approved procedure, comparable seedlings, controlled watering and a defined growth measure before any result is reported.”