اكتشاف الخلية ونظريتها – الدرس الأول من الوحدة الثانية

تم تحميل هذا الملف من موقع المناهج الإماراتية
موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف التاسع المتقدم ⇦ أحياء ⇦ الفصل الأول ⇦ ملفات متنوعة ⇦ الملف
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إعداد: Elhaddad Ahmed

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2	شرح الجزيئات الكبيرة (Macromolecules) – اللبنات الأساسية للحياة الدرس الثالث من الوحدة الأولى
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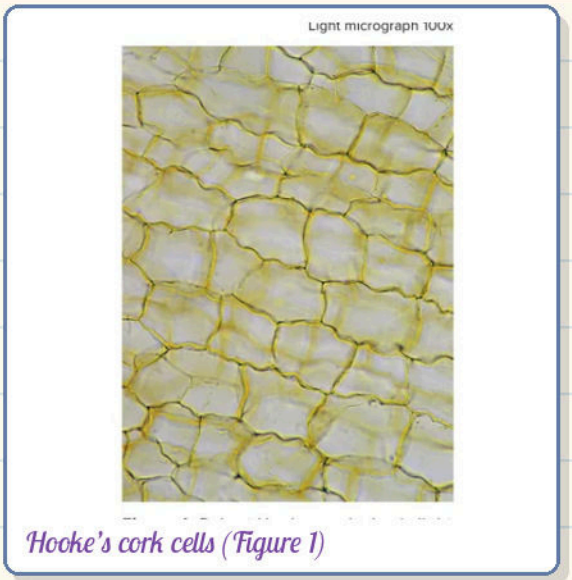
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Cell Discovery & Theory

*my handwritten summary * figures * tables * quizzes*

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Hooke's cork cells (Figure 1)

Key questions

1. How did microscopes reveal cells?
2. What are the three cell theory principles?
3. How do cell types differ?

Inside this notebook

Step-by-step notes, timelines, microscope comparisons, clear diagrams, MCQ practice and a full answer key.

Words to master

cell | microscope | cell theory | magnification | resolution | TEM | SEM | STM | prokaryote | eukaryote | nucleus | organelle

THE BIG IDEA

Microscopes made the invisible world of cells visible. All living organisms are made of cells.

Small cells. Huge discoveries!

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1. The first look at cells

Why did cells remain hidden?

Cells are extremely small. Before microscopes were invented, people did

1665 - Robert Hooke

Hooke used a simple microscope to study thin cork. He saw small, box-shaped spaces and named them cells.

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Light micrograph 100x

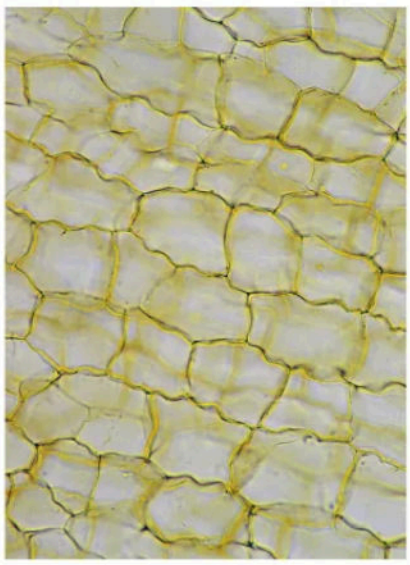


Figure 1 - dead cork cells

Why "cells"?

The spaces reminded Hooke of the tiny rooms used by monks. The cork cells were dead, so he saw empty chambers.

Remember

Hooke did not see a living cell's inner parts.

Anton van Leeuwenhoek

In the late 1600s, he designed microscopes and saw living microscopic organisms in pond water, milk and other samples.

Two discoveries

Hooke: named cells in cork. Leeuwenhoek: observed living microscopic organisms.

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2. Microscopes through time

A short discovery timeline

1. **1590** — Hans and Zacharias Janssen: early compound microscope with two lenses.
2. **1665** — Robert Hooke: cork cells and the name "cell".
3. **1683** — Anton van Leeuwenhoek: single-celled living organisms.
4. **1838-55** — Cell nucleus described; plant and animal cells studied; cell division proposed.
5. **1939** — Ernest Everett Just publishes Biology of the Cell.
6. **1981** — Scanning tunneling microscope (STM) developed.
7. **2008** — Structured illumination microscopy improves high-resolution 3-D imaging.

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The point

Better technology brought new details and new evidence, so scientists refined cell theory over time.

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3. The cell theory

Who put the ideas together?

Evidence from many scientists led to the modern cell theory. Three important names are linked to its development.

Scientist	Contribution
Matthias Schleiden (1838)	All plants are composed of cells.
Theodor Schwann (1839)	Animals are also composed of cells.
Rudolf Virchow (1855)	Cells arise from previously existing cells.

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The THREE principles to remember

1. **1. All living things are made of cells**
   Organisms contain one cell or many cells.

2. **2. Cells are the basic unit**
   Cells are the basic structures and functional units of living things.

3. **3. Cells come from existing cells**
   A new cell forms by division of a preexisting cell.

Think about it

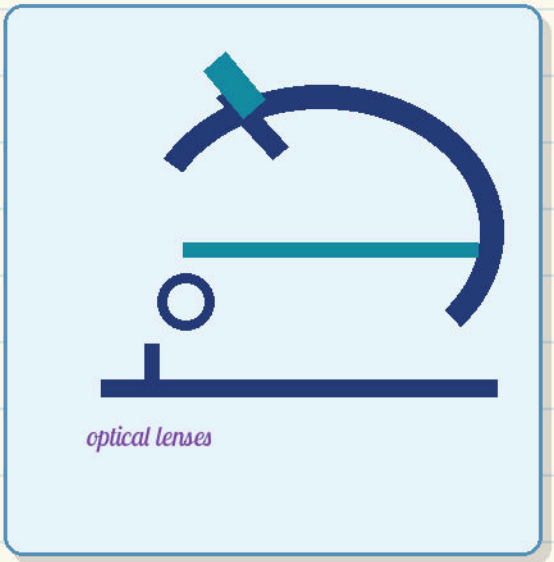
A cell does not appear spontaneously from nonliving material. New cells inherit genetic material from parent cells.

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4. Optical microscopes

A microscope uses light and lenses

An optical microscope focuses visible light through lenses. A compound light microscope uses several lenses to magnify an object.



optical lenses

Magnification

Each lens enlarges the image. Total magnification is found by multiplying the magnification of each lens.

$$10\times \times 10\times = 100\times$$

Magnification is NOT resolution

Magnification makes an image larger. Resolution lets us distinguish small details. The properties of visible light limit resolution.

Term	Meaning
Magnification	How many times larger the image looks.
Resolution	How clearly two nearby details can be seen.

Remember

The lesson gives a typical maximum light-microscope magnification of around 1000×.

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5. Electron microscopes

Why use electrons?

To see details too small for optical microscopes, scientists use electron beams. Electron microscopes can reveal much finer structures.

TEM - transmission electron microscope

Electrons pass through an extremely thin slice of a specimen. The resulting image reveals structures INSIDE the sample.

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How a TEM image is made



A useful comparison

TEM advantage	TEM limitation
Very high magnification; cell details	Specimens must be dead, thin and prepared.

Source detail

The textbook describes TEM magnification up to about 500,000×.

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6. SEM and STM

SEM: scanning electron microscope

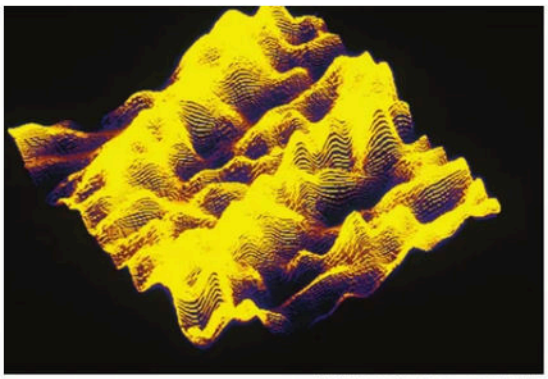
An SEM scans the specimen's surface using electrons. It creates a 3-D-looking image of its OUTSIDE features.

Important limitation

The textbook says SEM can observe nonliving cells and tissues only.

STM: scanning tunneling microscope

An STM moves a charged probe very close to a surface. Electron tunneling allows images of features as tiny as individual atoms.



live specimens.
DNA, the cell's
rial, magnified
tunneling elect

Figure 3 The scar
provides images, s
which cracks and
raised areas appe
Compare and cor
of a STM to those

EMIC VOCABULARY

e possible

Figure 3 - STM image of DNA

Compare

SEM studies surface shape and texture.

STM senses electron tunneling close to a surface.

Interesting!

According to the textbook, STM can be used with live specimens (unlike TEM and SEM).

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7. Compare the microscopes

Match the tool to the job

Type	Uses	Best for	Limitation
Light	Visible light	Living cells; general shapes	Limited resolution
TEM	Electrons pass through	Internal fine details	Dead, very thin slices
SEM	Electrons scan surface	3-D-like exterior	Nonliving specimens
STM	Electron tunneling	Atomic-scale surfaces	Specialized probe setup

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Which would you choose?

- A moving living cell in pond water? Start with a LIGHT microscope.
- Internal cell structures at very high magnification? Choose TEM.
- A detailed image of a specimen surface? Choose SEM.
- A surface with features on the scale of atoms? Choose STM.

Check your thinking

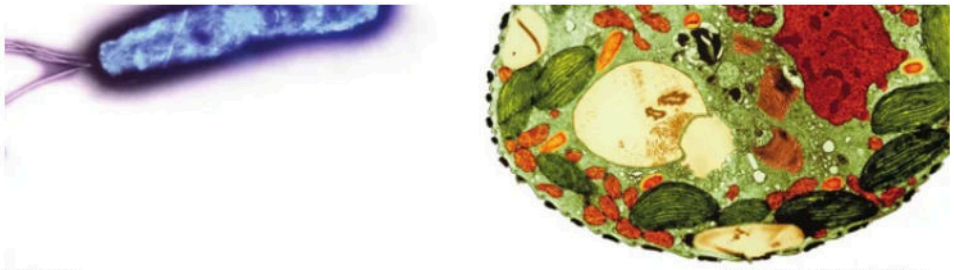
SEM and STM reveal surfaces, but they use different physical methods.

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8. What do all cells share?

Cells can look very different

Cells vary in size, shape and complexity because they perform different jobs. But the cells described in the lesson have some important features in common.



EM 14,000x Color-enhanced TEM 15,000x

okaryotic cell on the left is smaller and appears less complex than the eukaryotic cell on the
'yotic cell has been enlarged for the purpose of comparing each cell's internal structures.

NS

Greek, meaning *true*

CCC CROSSCUTTING CONCEPTS

Structure and Function An analogy is a comparison of two things that c
to explain a concept. A cell's genetic material provides instructions for m
what the cell needs. An analogy for this genetic material, then, might be

Figure 4 - prokaryote and eukaryote

Shared features

1. **Plasma membrane**
   Forms a boundary and controls what enters or leaves a cell.

2. **Genetic material**
   Contains instructions needed to make cell substances.

3. **Energy processes**
   Cells break down molecules to obtain usable energy.

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9. The two cell types

Prokaryotic versus eukaryotic

Feature	Prokaryotic cells	Eukaryotic cells
Nucleus	No membrane-bound nucleus	Have a membrane-bound nucleus
Organelles	No membrane-bound organelles	Many specialized organelles
Complexity	Generally smaller, simpler	Generally larger, more complex
Organisms	Single-celled, e.g. bacteria	Single-celled or multicellular
Size	Reference group	About 10–100× larger (typical)

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Do not mix them up!

Unicellular

PRO-karyote

No membrane-bound nucleus; usually a simpler cell.

Bacteria, Archea

Multicellular

EU-karyote

A nucleus and many distinct organelles.

Plant, Animal, protistes

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10. Origin of cell diversity

Why are there two cell types?

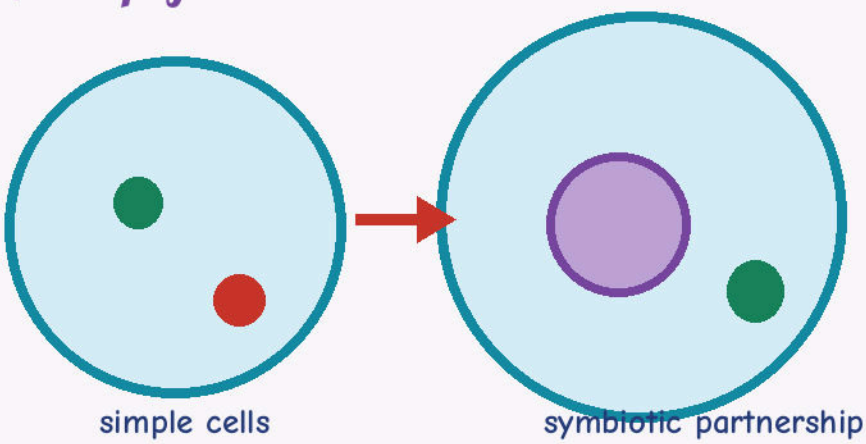
The textbook notes that eukaryotic cells may have evolved from simpler prokaryotic cells millions of years ago.

The endosymbiont theory

A prokaryotic cell lived inside another cell in a relationship that benefited both. This may have helped eukaryotic cells evolve.

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A simplified idea



Why is this important?

Eukaryotic cells are larger and contain specialized organelles. This diversity made more complex forms of life possible.

Remember

Endosymbiosis is presented as a proposed explanation for eukaryotic cell origins.

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11. Vocabulary & recap

Words to know

Term	Simple meaning
Cell	Basic unit of structure and function in living things.
Cell theory	Three principles that describe cells and how new ones arise.
Magnification	How much larger an image is than an object.
Resolution	Ability to see two close features separately.
Plasma membrane	Boundary that controls entry and exit.
Prokaryote	Cell lacking a membrane-bound nucleus.
Eukaryote	Cell with a membrane-bound nucleus.
Organelle	Specialized structure with a cellular function.
Endosymbiosis	Theory involving a mutually beneficial cell relationship.

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The lesson at a glance

- Better microscopes revealed more about cells.
- Cell theory describes living things, cells and cell origin.
- Light microscopes and electron-based instruments reveal different details.
- Cells are grouped as prokaryotic or eukaryotic.

Memory trick

Plants (Schleiden) ⊠ animals (Schwann) ⊠ new cells (Virchow).

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Section review - multiple choice

Circle the best answer. Answers are on the next page.

1 Who named "cells" after studying thin cork with a microscope?

(A) Robert Hooke
(B) Theodor Schwann
(C) Rudolf Virchow
(D) Ernst Ruska

2 What did Hooke observe in his sample of cork?

(A) Living bacteria
(B) Small, empty chambers
(C) A cell nucleus
(D) Mitochondria

3 Which scientist observed living organisms in pond water?

(A) Anton van Leeuwenhoek
(B) Robert Hooke
(C) Matthias Schleiden
(D) Ernst Just

4 Who concluded that plants are made of cells?

(A) Virchow
(B) Ruska
(C) Schleiden
(D) Schwann

5 Who concluded that animals are also made of cells?

(A) Theodor Schwann
(B) Anton van Leeuwenhoek
(C) Hans Janssen
(D) Robert Hooke

6 Which idea did Rudolf Virchow add to cell theory?

(A) Cells arise from existing cells
(B) All cells contain chloroplasts
(C) Cells appear from air
(D) All cells have a nucleus

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Unit review - microscopes

Circle the best answer. Answers are on the next page.

7 Which statement is NOT one of the three principles of cell theory?

(A) Living things have cells
(B) Cells are basic units
(C) Cells arise spontaneously
(D) Cells come from existing cells

8 Two lenses magnify 10× each. What is their total magnification?

(A) 20×
(B) 100×
(C) 1,000×
(D) 1×

9 What limits the resolution of an optical microscope?

(A) It uses electrons
(B) It cannot view living cells
(C) Properties of visible light
(D) It cannot use lenses

10 What does a transmission electron microscope (TEM) mainly reveal?

(A) Internal details of thin specimens
(B) Only surface texture
(C) Motion of living bacteria
(D) Colors in living cells

11 What is a strength of a scanning electron microscope (SEM)?

(A) Identifies genes
(B) Shows detailed 3-D-like surfaces
(C) Views cells swimming live
(D) Magnifies by two lenses

12 What can an STM image according to this lesson?

(A) Only whole organs
(B) Only cork cells
(C) Surfaces at atomic scale
(D) Only specimens with sunlight

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Unit review - cell types

Circle the best answer. Answers are on the next page.

13 Which feature is shared by prokaryotic and eukaryotic cells?

(A) A membrane-bound nucleus
(B) A plasma membrane
(C) Many membrane-bound organelles
(D) The same size

14 Which statement describes prokaryotic cells?

(A) They always form tissues
(B) They have a nucleus
(C) They lack a membrane-bound nucleus
(D) They are always larger

15 Which structure defines eukaryotic cells?

(A) A cell wall in every cell
(B) A membrane-bound nucleus
(C) No genetic information
(D) Only one cell in an organism

16 What are organelles?

(A) Specialized structures with cell jobs
(B) Lenses used in microscopes
(C) The outer layer of cork
(D) A type of pond organism

17 What does the endosymbiont theory propose?

(A) All cells were once cork
(B) Eukaryotic cells evolved from symbiosis
(C) Viruses invented cells
(D) Microscopes made living organisms

18 A microscope gives 30× with a 5× lens. Replace it with 7×. New total?

(A) 42×
(B) 35×
(C) 30×
(D) 210×

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Answer key

S = Section review U = Unit review

Q	Ans	Why?
S1	A	Hooke named the boxlike spaces he saw in cork in 1665.
S2	B	His cork sample contained dead, box-shaped cells.
S3	A	Leeuwenhoek observed microscopic living organisms.
S4	C	Matthias Schleiden studied plant tissues in 1838.
S5	A	Schwann studied animal tissues in 1839.
S6	A	Virchow proposed that new cells come from old cells.
U1	C	Cell theory rejects spontaneous formation of cells.
U2	B	Total magnification equals 10 × 10 = 100×.
U3	C	The visible-light wavelength limits fine detail.
U4	A	TEM sends electrons through very thin sections.
U5	B	SEM scans specimen surfaces to show depth.
U6	C	STM measures electron tunneling near surfaces.
U7	B	Both cell groups have a plasma membrane.
U8	C	Bacteria are examples of simple prokaryotic cells.
U9	B	Eukaryotes have a nucleus and membrane-bound organelles.
U10	A	Organelles are distinct structures performing cell functions.
U11	B	It proposes ancient symbiosis as a step in eukaryotic origins.
U12	A	Other lens: 30 ÷ 5 = 6×, then 6 × 7 = 42×.

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Well done!

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