



1.4 Tools and Technology

Chapter 1: The Science of Life

Student Objectives

1. List the function of each of the major parts of a compound light microscope.
2. Compare two kinds of electron microscopes.
3. Describe the importance of having the SI system of measurement.
4. State some examples of good laboratory practice.



Microscopes as Tools

- Tools are objects to improve the performance of a task.
- **Microscopes** are tools that extend human _____

_____. They are used to study _____

_____.

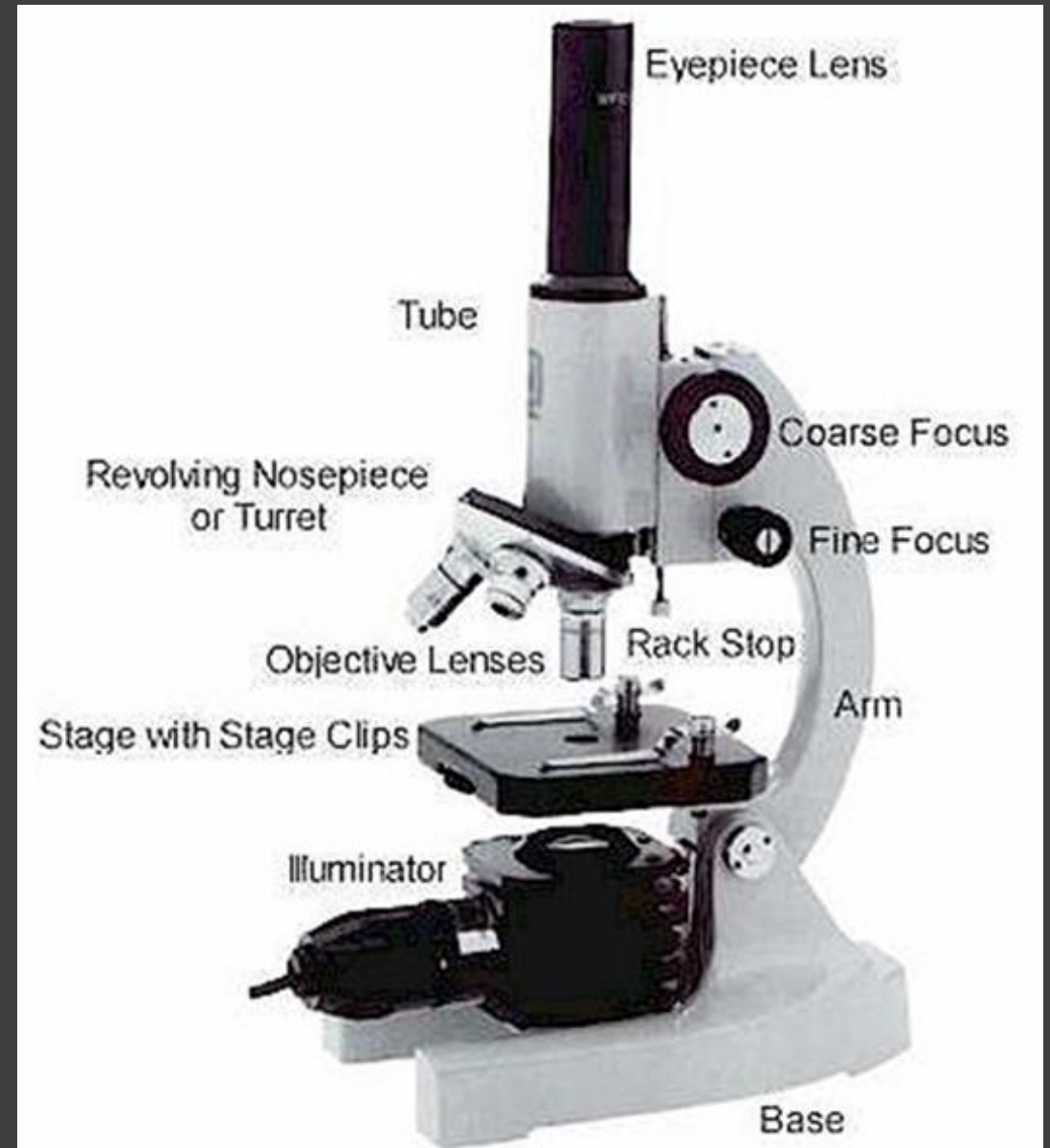
Light Microscope

- A **compound microscope** shines _____ through a _____ and has two lenses to _____
_____.
- The specimen must be thin enough for _____ to pass through it.



Parts of Microscope

1. The **Eyepiece** (_____)
_____ usually
_____ times.
2. The _____ is located right
_____ the specimen. Light
passes through the specimen and
then through the objective lens.
3. The **Stage** is a _____ that
supports a
_____.
4. The **Light Source** is a
_____ that provides light for
_____.





Magnification and Resolution

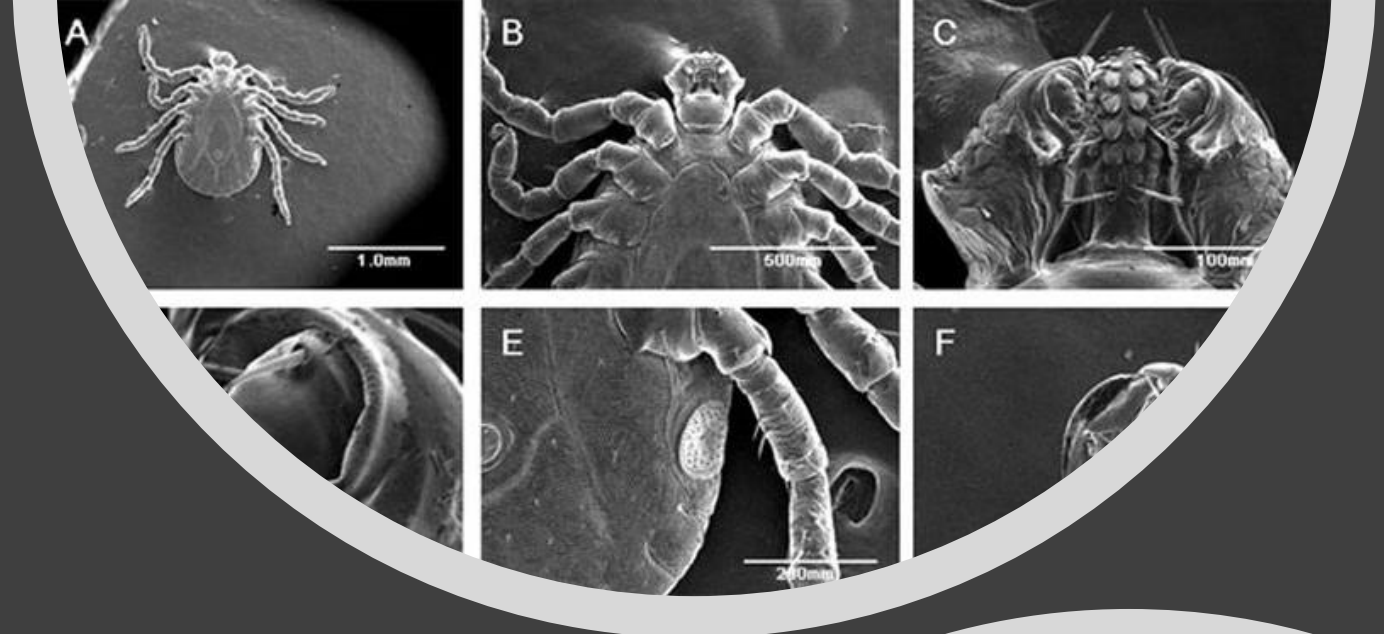
- **Magnification** is the _____
_____.
 - Ocular lens (10X)
 - Objective lens (up to 100X)
- **Resolution** is the _____
_____.



Electron Microscope

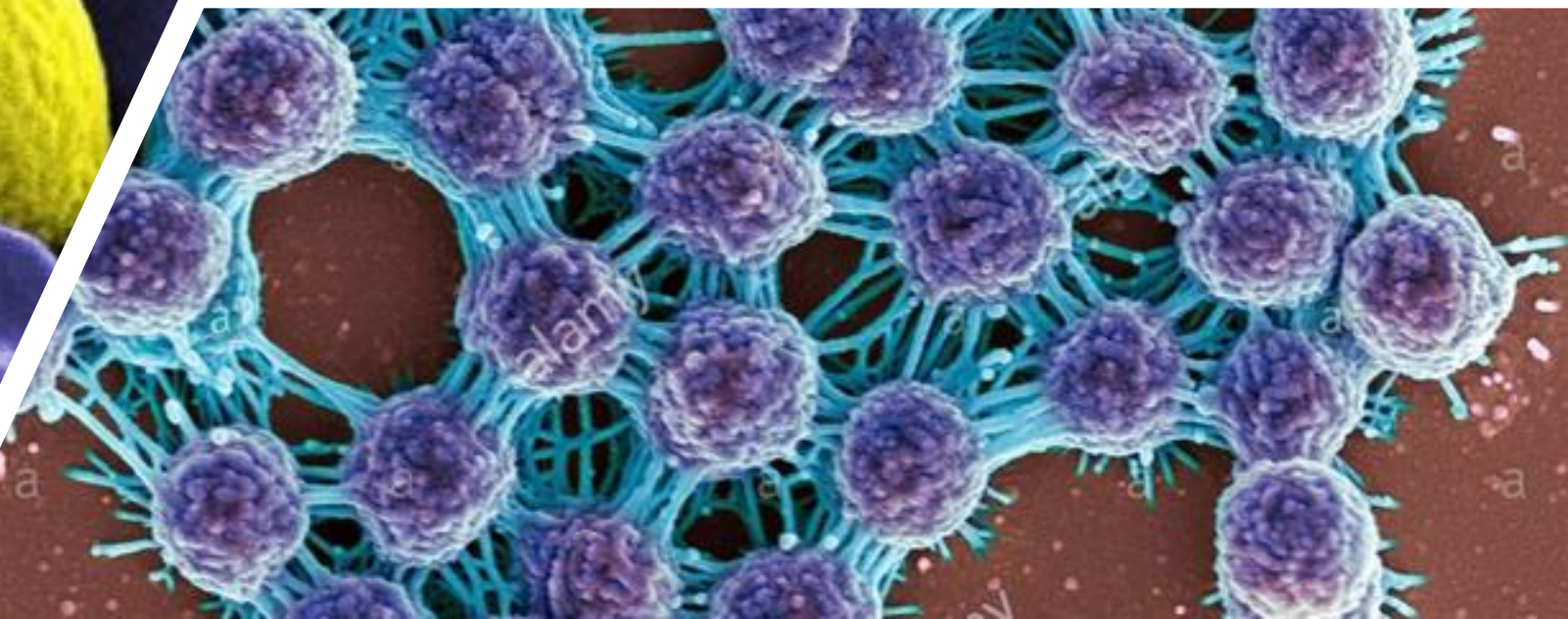
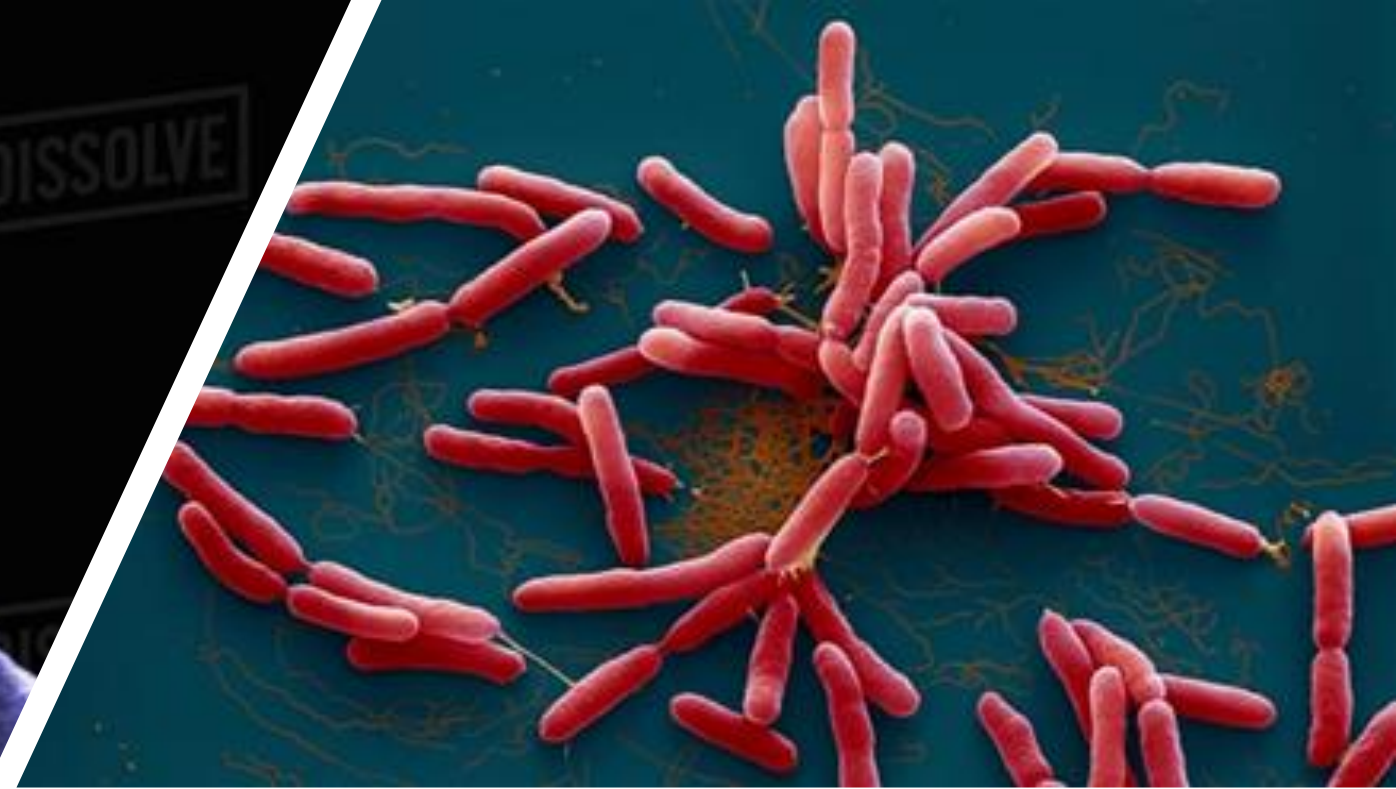
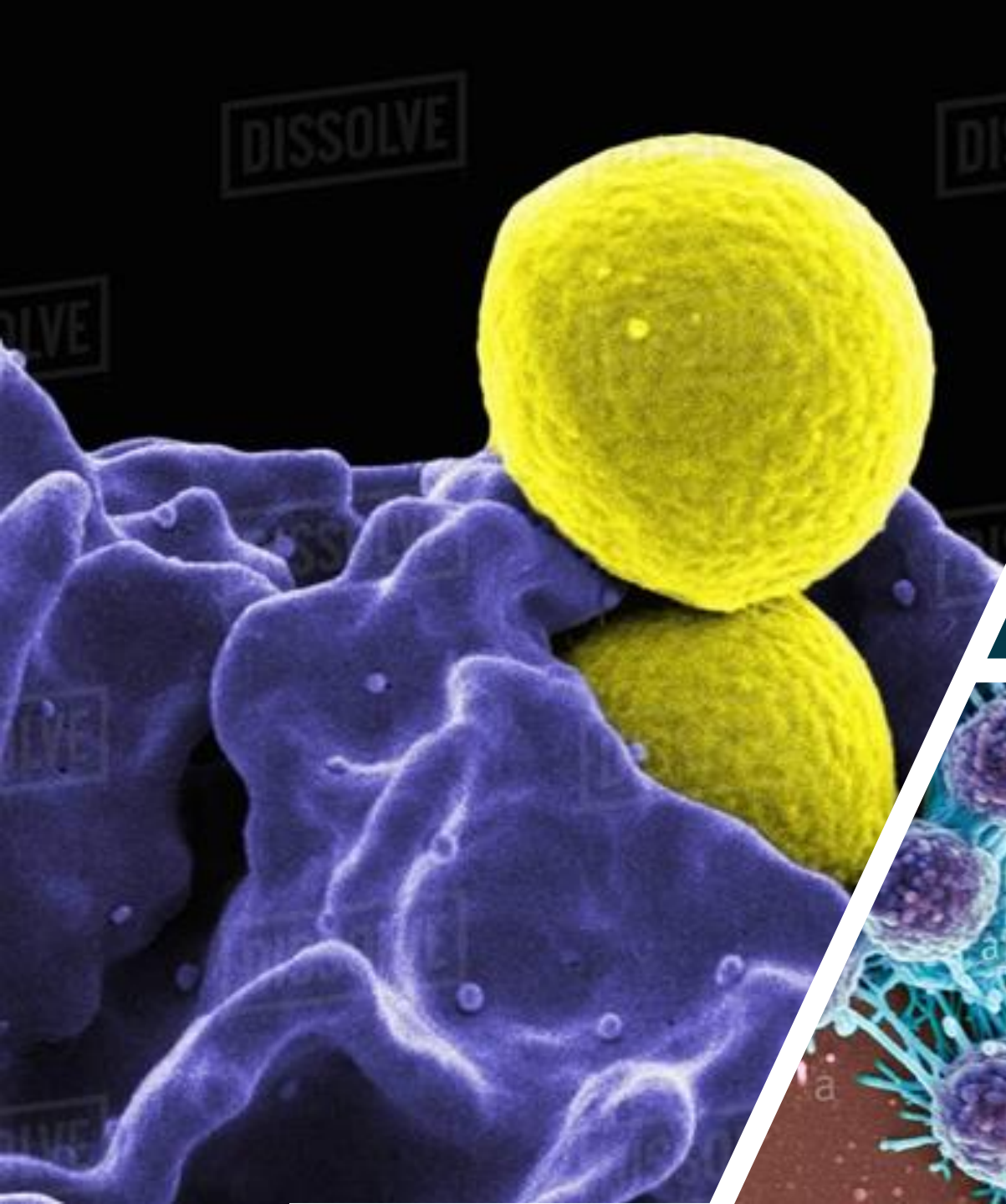
- In an **Electron Microscope**, a beam of _____ produces an _____ of the specimen.
 1. _____
 2. _____
- Images are in black and white, but computers can artificially color the images.
- Specimen is places in vacuum chamber, so living specimens cannot be viewed in Electron microscope.

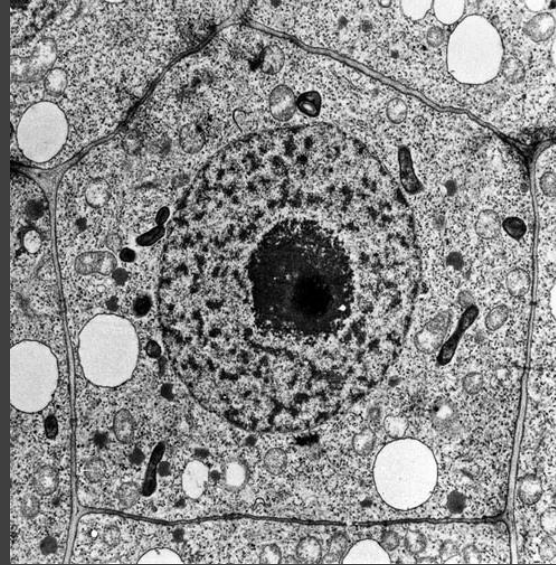
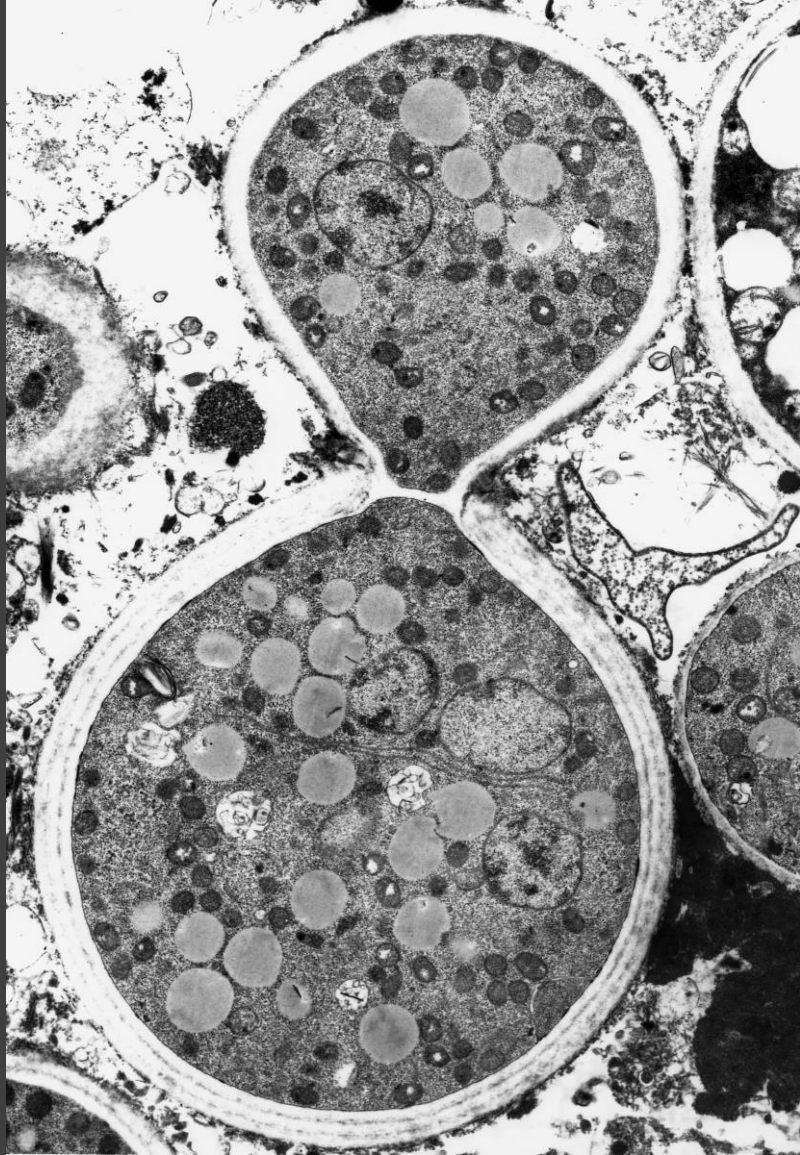
SEM: Scanning Electron Microscope



- The **SEM** passes a beam of electrons over the specimen's surface.
- SEMs provide a _____ of the specimens surface.
- The specimen is sprayed with a fine _____ and a _____ is aimed at it.
- SEMs can magnify up to _____.







TEM: Transmission Electron Microscope

- The TEM _____

_____.
- _____ enlarge the image and focus it on a screen.
- The TEM is great to view an internal structure.
- TEM can magnify _____
_____.

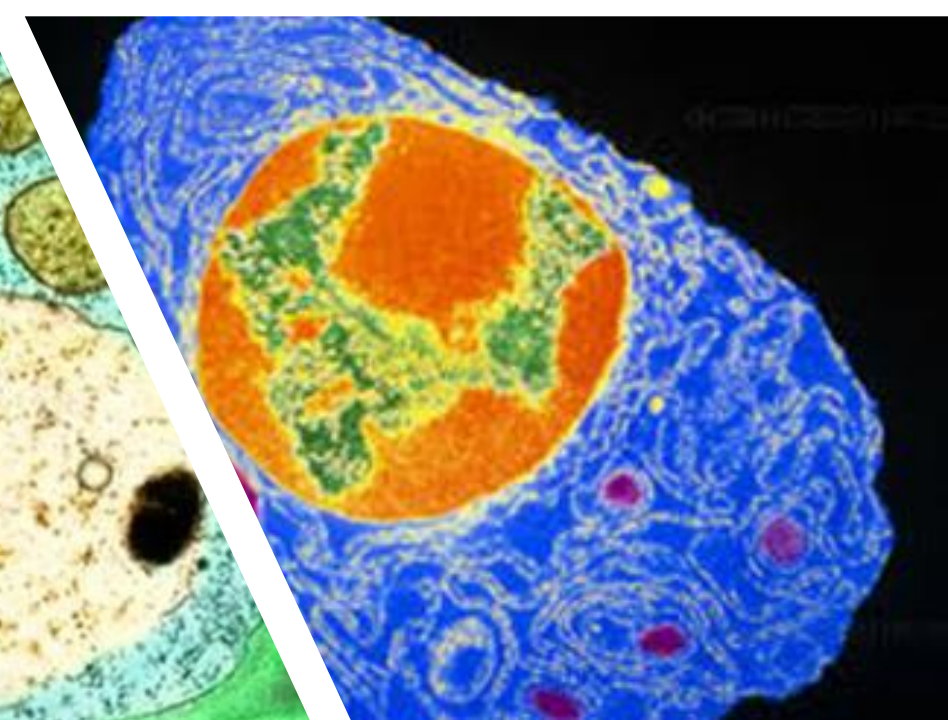
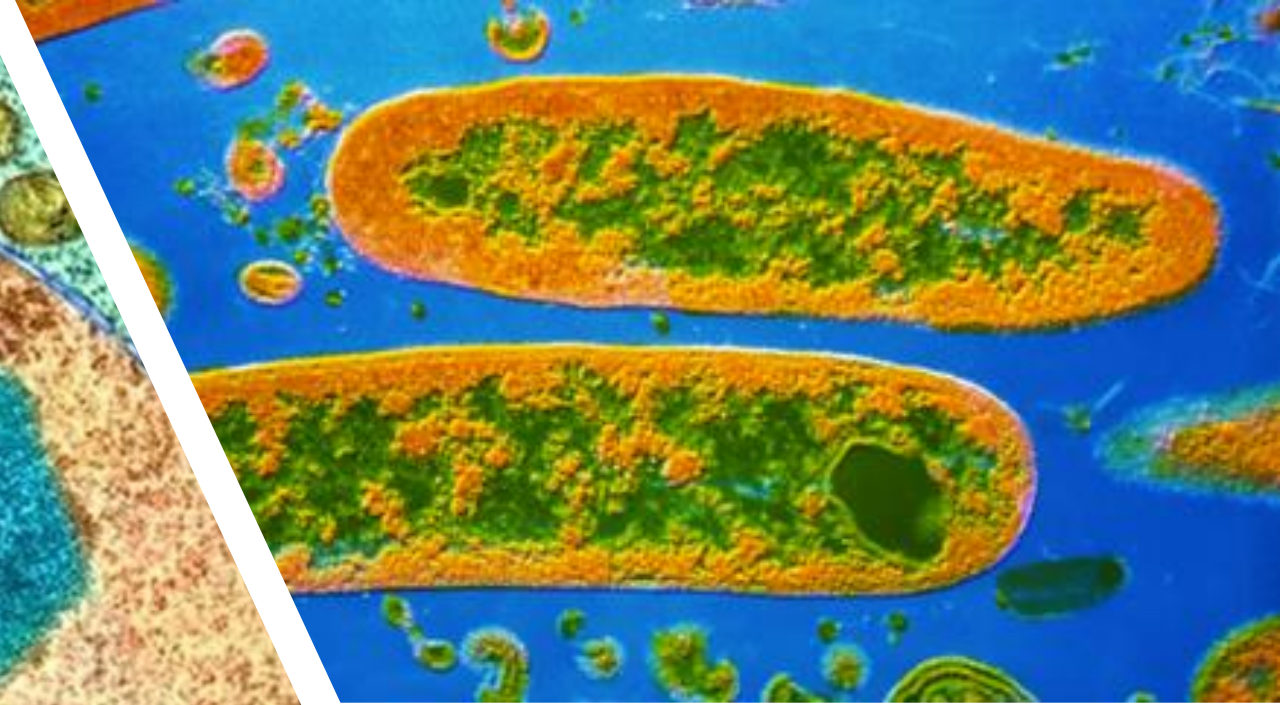
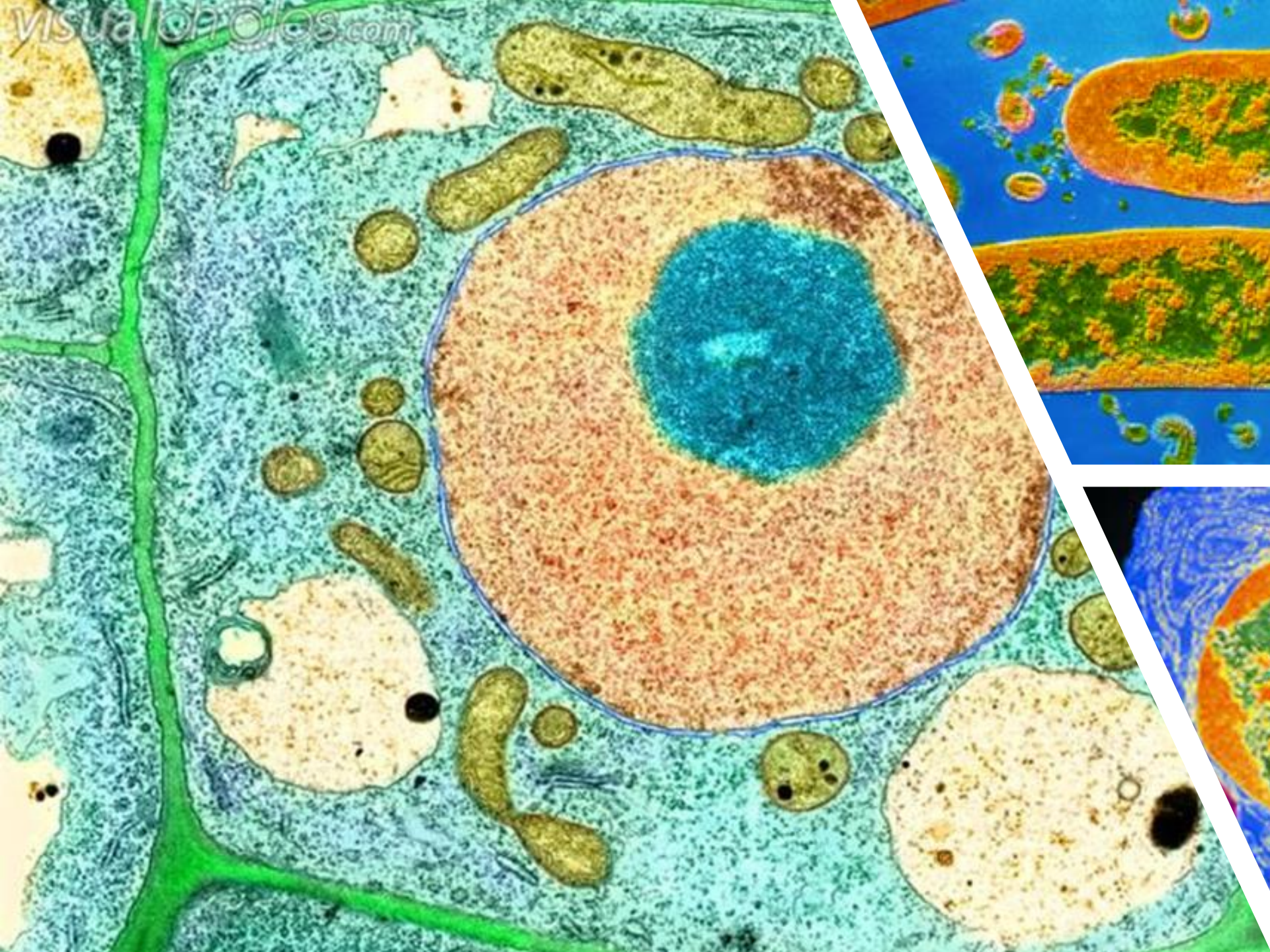


TABLE 1-1 SI Base Units

<u>Base quantity</u>	<u>Name</u>	<u>Abbreviation</u>
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous (light) intensity	candela	cd

TABLE 1-2 Some SI prefixes

<u>Prefix</u>	<u>Abbreviation</u>	<u>Factor of base unit</u>
giga	G	1,000,000,000 (10^9)
mega	M	1,000,000 (10^6)
kilo	k	1,000 (10^3)
hecto	h	100 (10^2)
deka	da	10 (10^1)
base unit		1
deci	d	0.1 (10^{-1})
centi	c	0.01 (10^{-2})
milli	m	0.001 (10^{-3})
micro	μ	0.000001 (10^{-6})
nano	n	0.000000001 (10^{-9})
pico	p	0.000000000001 (10^{-12})

Units of Measurement

- Scientists use a _____ so that they can compare their results.
- The **Metric System** is _____.
- *System International d'Unites* (SI) is the _____.
- Biologists use SI while making measurements in the laboratory.

TABLE 1-3 Some Derived and Other Units

<u>Quantity</u>	<u>Name</u>	<u>Abbreviation</u>
Area	square meter	m ²
Volume	cubic meter	m ³
Density	kilogram per cubic meter	kg/m ³
Specific volume	cubic meter per kilogram	m ³ /kg
Celsius temperature	degree Celsius	°C
Time	minute	1 min = 60 s
Time	hour	1 h = 60 min
Time	day	1 d = 24 h
Volume	liter	1 L = 1,000 cm ³
Mass	kilogram metric ton	1,000 g = 1 kg 1 t = 1,000 kg

Base and Other Units

- The 7 **Base Units** describe _____, _____, _____, and other quantities.
- *Derived units* are produced by _____ relationship between two base units or between derived units.
- Additional units of measurements can be used with SI units, such as units of _____, _____, and _____.



Safety

• Hazards vary between the lab and the field:

- _____
- _____
- _____
- _____

Good Laboratory Practice

- _____ arises from establishing safe, common-sense habits.
- Never work _____ in the lab or without proper supervision.
- Always ask a supervisor before using any equipment.



Eye Safety



Hand Safety



Safety with Gases



Sharp-Object Safety



Clothing Protection



Animal Care and Safety



Heating Safety



Hygienic Care



Glassware Safety



Proper Waste Disposal



Electrical Safety



Plant Safety



Chemical Safety



Review Questions

1. List the four major parts of a compound microscope.
2. What is the difference between the magnification and resolution of an image under a microscope?
3. Compare the function of a transmission electron microscope with that of a scanning electron microscope.
4. What is the importance of using a common SI system of measurements?
5. How could you convert kilometers to millimeters?
6. Draw the safety symbol for 'Hand Safety'.