Welcome to Bio 1030
Biology Today

Second Part of Semester
Feb 27-April 21, 2008

Instructor for Second Part:
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Previous Lecture 1: Nature of Scientific Inquiry

Assigned Readings: Bio 1030 & and link: Hempel: Scientific Inquiry

Both posted at:

www.is.wayne.edu/mnissani/bio1030/

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Lectures will not typically reiterate material from assigned readings. I shall assume that you can master those on your own. Instead, lectures will explain, add to, and amplify key concepts

Many discoveries and breathroughs in science: Extending our senses

Telescope: Moon

Dolphin Conversation.

With instruments, we can really eavesdrop:

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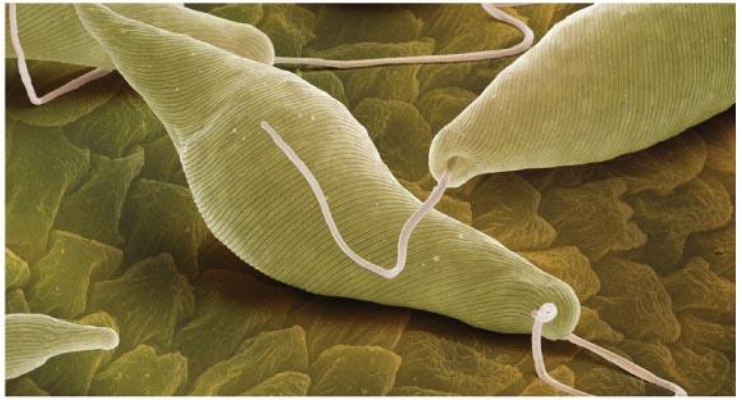
Sonogram: Baby of 20 weeks:

http://youtube.com/watch?v=3bzEXM8c0P4

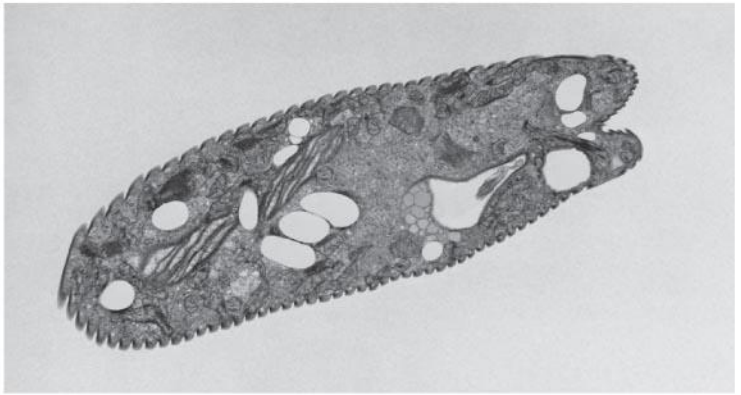
Microscopy is yet another way of expanding our sensory world: There are several types of scopes:

3 Views of Paramecium with 3 Types of Scopes: Light (500X), Scanning Electron (2,000X), and Transmission Electron (2,800X)

(a) Light micrograph (LM) of the protist *Euglena*

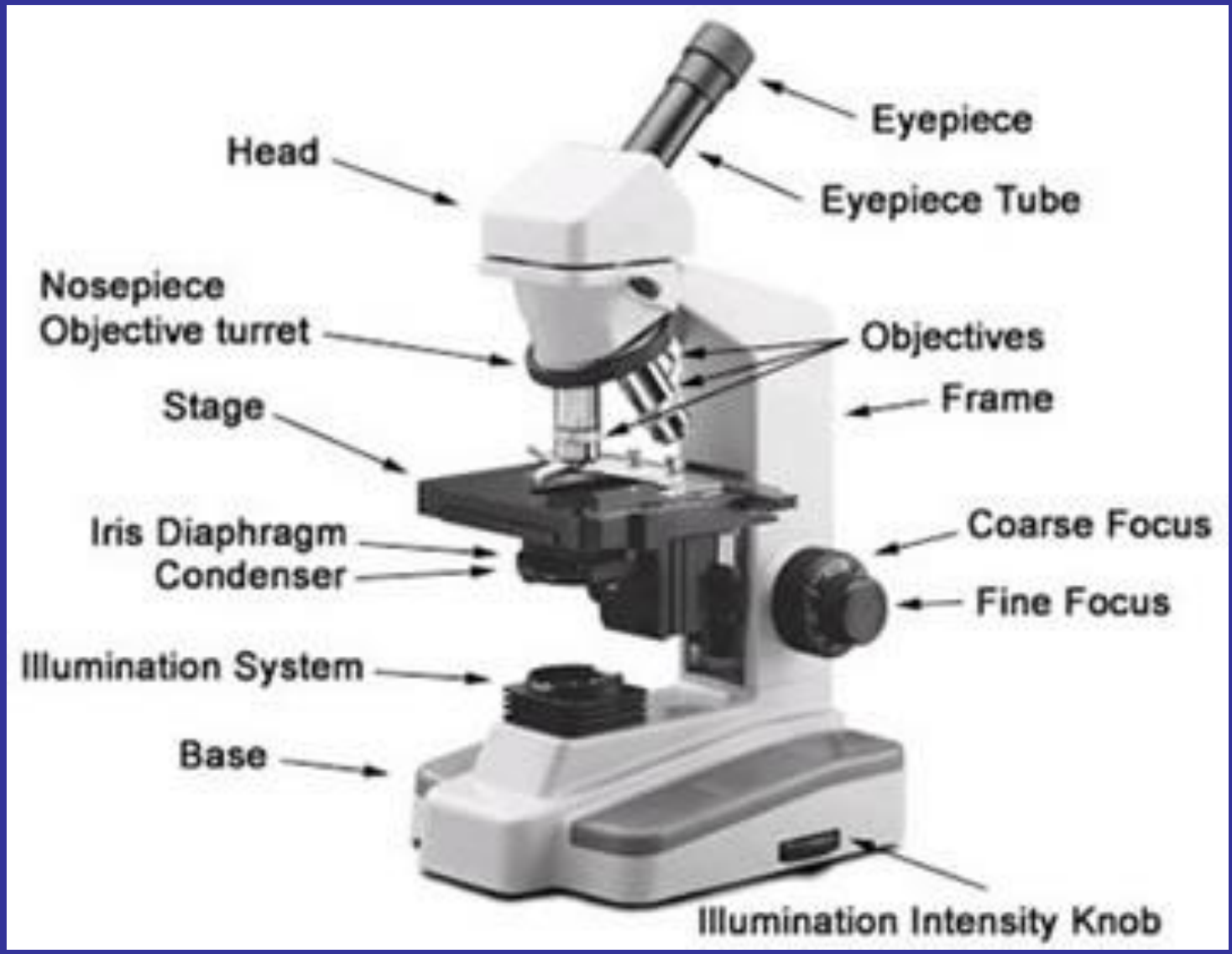


(b) Scanning electron micrograph (SEM) of *Euglena*



(c) Transmission electron micrograph (TEM) of *Euglena*

A Typical Light Microscope



Microscopy: 3 Key Features:

Magnification: ı with scope: I

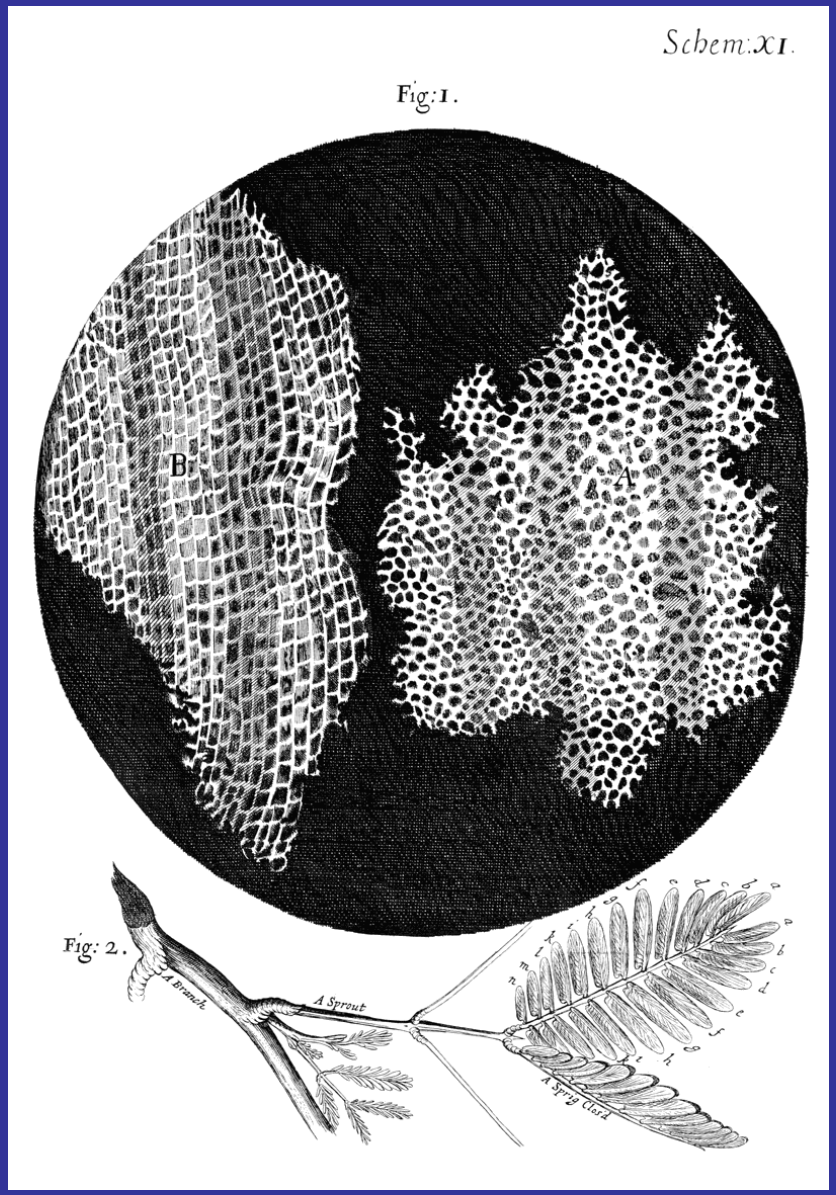
Resolution: II w scope I I

Contrast: I w scope I

The Microscope, in turn, led to the CELL THEORY

Cells: The building blocks of **all** living organisms

Robert Hook's Drawing, Plants, 1665



A Few Years Later, Antonie van Leeuwenhoek Saw Living bacteria, sperm, protozoa

Cell Theory. Cells are a fundamental feature of ALL LIFE (viruses excepted). There are 2 useful classification schemes here:

- unicellular vs. multicellular
- eukaryotes vs. prokaryotes

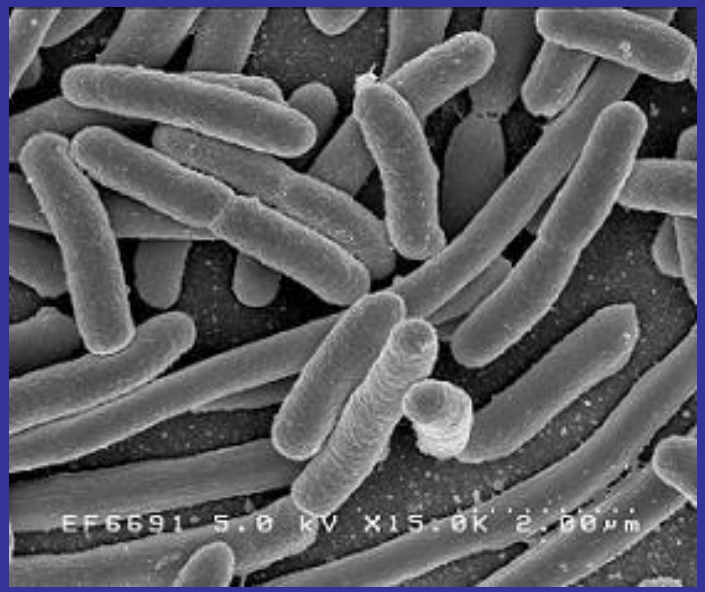
unicellular vs. multicellular

AMEOBA, that's it, that is the entire organism

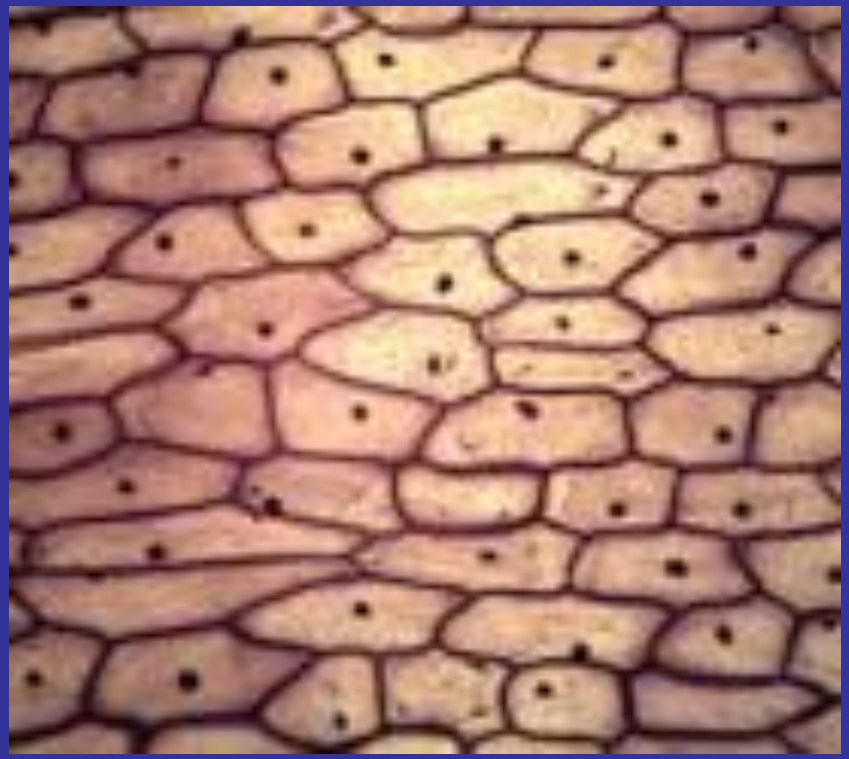
A Paramecium: about 100 µm (0.1ml, 0.0001m)

Here is how a live paramecium looks under the microscope

Some cells, like bactrial cells, are very small, less than 1/10 of each of your trillions of cells: *E. coli*

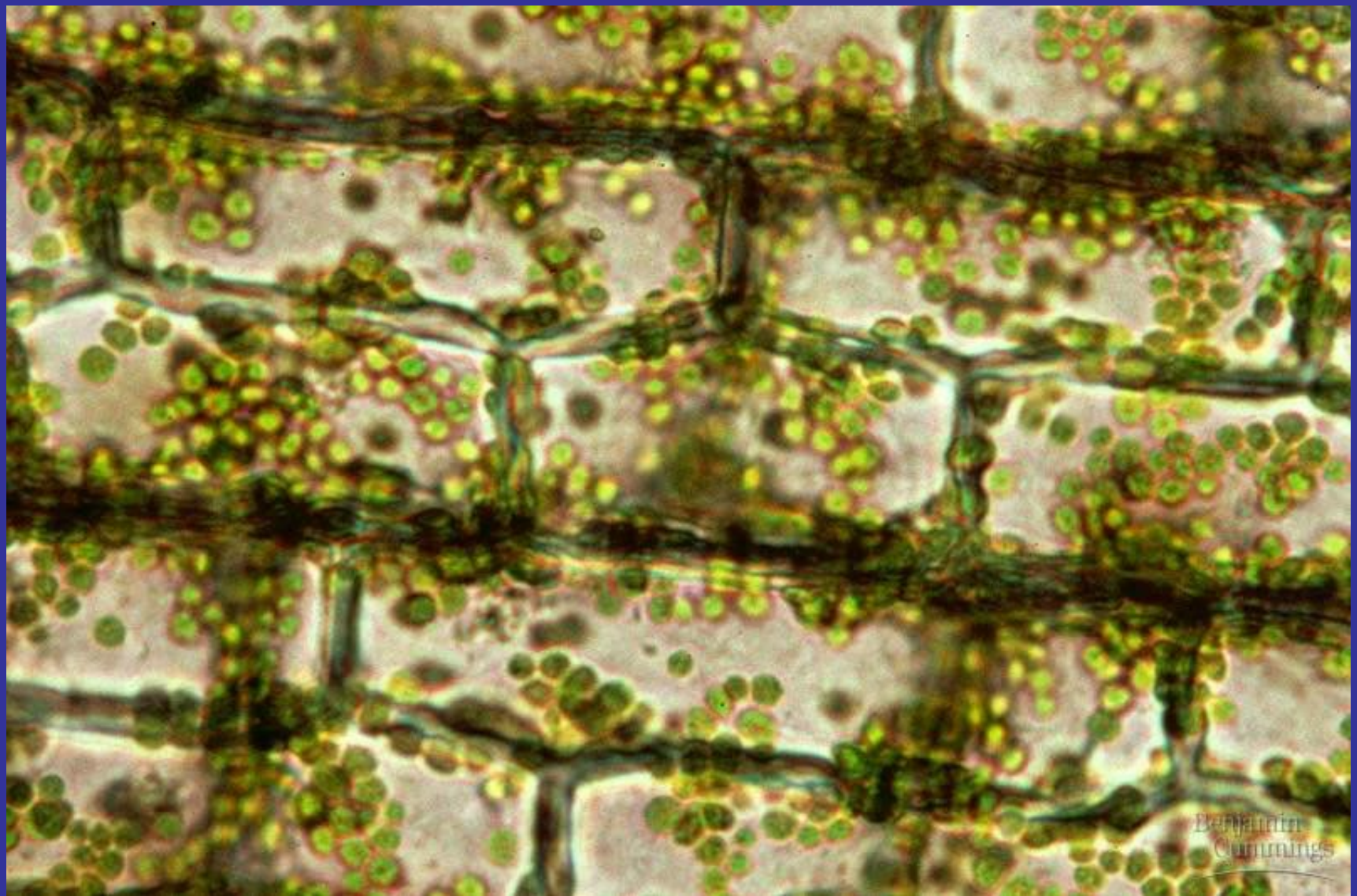


And here is an example of an organism that is made of MANY CELLS

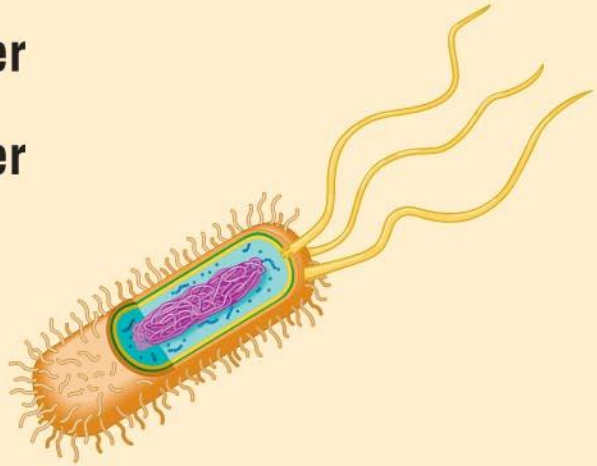
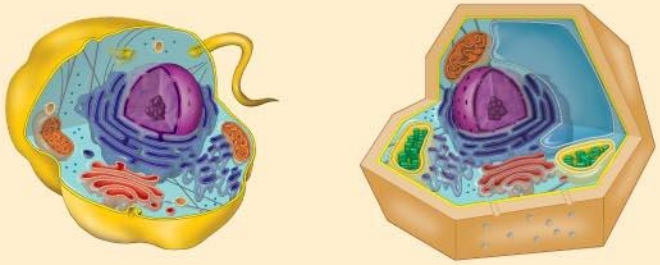


Here is another: If you scrape your cheek, stain, and place under the scope:

Cellular Organization of Higher Plants



A Second classification scheme: Eukaryotes vs. Prokaryotes

Prokaryotes	Eukaryotes
• Smaller • Simpler  • Most do not have membrane-enclosed organelles • Bacteria and archaea	• Larger • More complex  • Membrane-enclosed organelles • Protists, plants, fungi, animals

The cells of a whale are about **the same size** as the cells of a mouse.

Every second, your body produces about 2 million red blood cells.

Scientific Notation: Powers:

$2^3 = 2X2X2=8$

$2^4 = 2X2X2X2=16$

$10^1 = 10$

10^3 m= 10X10X10=1,000 m = 1 kilometer

$10^6 = 10X10X10X10X10X10=1,000,000$ (1 million)

Try to solve: What is 10^9 ?

Scientific Notation: Negative Powers

10^{-1} m = 1/10=0.1 m

10^{-3} m = 1/1000=0.001 m = 1 ml

10^{-6} m = 1/1,000,000=0.000001 m = 1**µm**
=1 micrometer

Try to solve: What is 10^{-2} ?

So, if I had microscopic vision and could see air, I would see zillions of dancing atoms. Likewise, if I could magnify any living thing, I would see:

- Single cells or clumps, simple, small: prokayotes (e.g., *E. coli*)
- Single cells, large, complex: Single-Celled Eukaryotes (e.g., paramecium, amoeba)
- Complex, many cells: Eukaryotes (maple trees, dogs, fleas)

Another way of visualizing this, from small to big:

Viruses: 0.0000001 meter: Life forms?

Bacteria: 0.000001 m, prokaryotes

Euglena, amoeba (single-cell organisms), human heart cells (building blocks of a larger organism): 0.00001 m

A human child: 1 m

Distance to alpha-centauri: 4.3 light years, or 40,000,000,000,000,000 m

Measurement Equivalents

1 meter (m) = 100 cm = 1,000 mm = about 39.4 inches

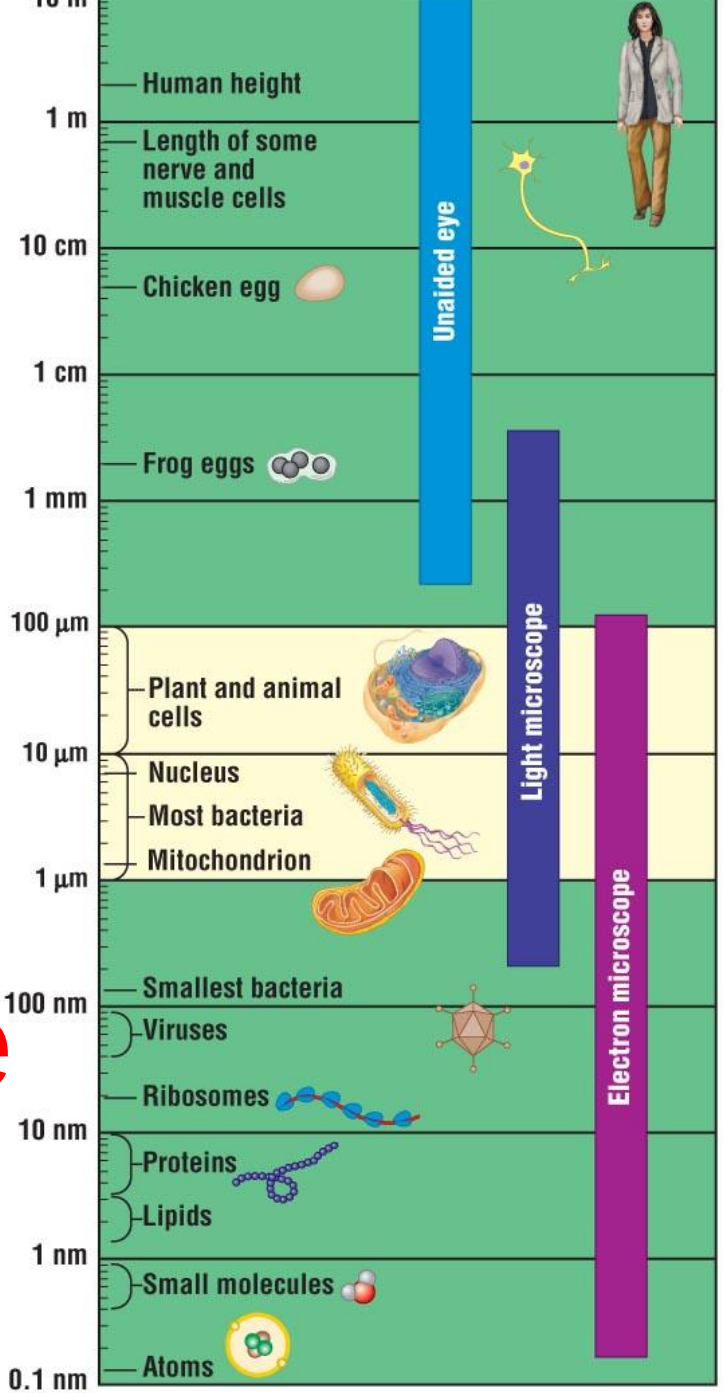
1 centimeter (cm) = 10^{-2} ($\frac{1}{100}$) meter (m) = about 0.4 inch

1 millimeter (mm) = 10^{-3} ($\frac{1}{1,000}$) m = $\frac{1}{10}$ cm

1 micrometer (μm) = 10^{-6} m = 10^{-3} mm

1 nanometer (nm) = 10^{-9} m = 10^{-3} μm

Orders of Magnitude



OK, Let's see if I have been just talking to myself. Try to Answer:

$3^5 =$

1. Cell theory states that . . .
2. Organisms can be classified, based on their number of cells into: _____ and _____ organisms

1. Based on complexity, size, and structures of their cells, organisms can be divided into which two major groups? _____ _____
2. Instruments that expand our sensory world are:

1. Explain: Magnificaiton, resolution, contrastWhat does $1X10^{-3}$ mean?
2. What does $1X10^{3}$ mean?
3. What does $1X10^{-3}$ mean?

1. What's our class website?
2. Instructor's e-mail?

We mentioned that the cell of a mouse is about the same size as the cell a whale.

- So, cell-wise, what's the difference between these 2 mammals?
- What about the cells of whales and bacteria? Whales and euglena?