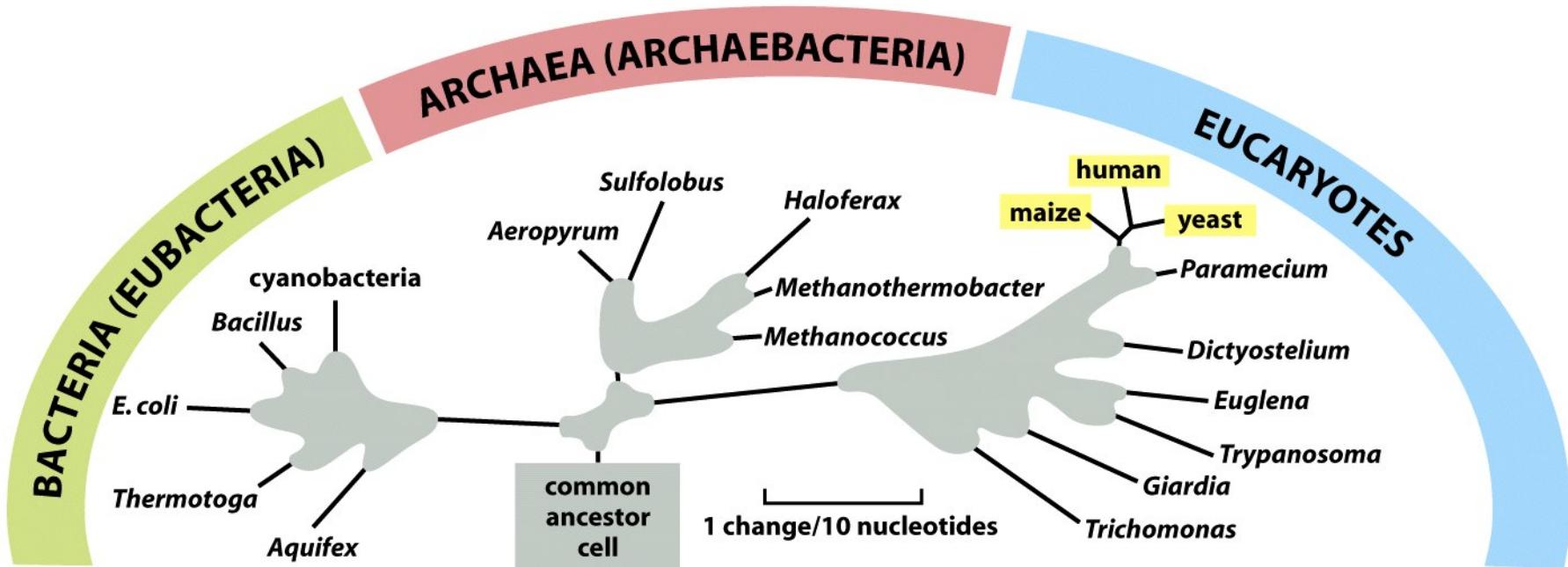


The Phylogeny of Life



```

GTTCCGGGGGGAGTATGGTGCAAAGCTGAAACTTAAAGGAATTGACGGAAGGGCACCACCAAGGAGTGGAGCCTGCGGCTTAATTGACTCAACACGGAAACCTCACCC
GCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTTAAAGGAATTGGCGGGGAGCACTACAACGGGTGGAGCCTGCGGTTAATTGGATTCAACGCCGGCATCTTACCA
ACCGCCTGGGGAGTACGGCCGCAAGGTTAAACTCAAATGAATTGACGGGGCCCCTG . ACAAGCGGTGGAGCATGTGGTTAATTGATGCAACGCGAAGAACCTTACCT
GTTCCGGGGGGAGTATGGTGCAAAGCTGAAACTTAAAGGAATTGACGGAAGGGCACCACCAAGGAGTGGAGCCTGCGGCTTAATTGACTCAACACGGAAACCTCACCC

```

human
Methanococcus
E. coli
human

Figure 1-22 Molecular Biology of the Cell 5/e (© Garland Science 2008)

Figure 1-21/22 Molecular Biology of the Cell, Fifth Edition (© Garland Science 2008)

ARCHAEBACTERIA



Figure 1-1b
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EUBACTERIA

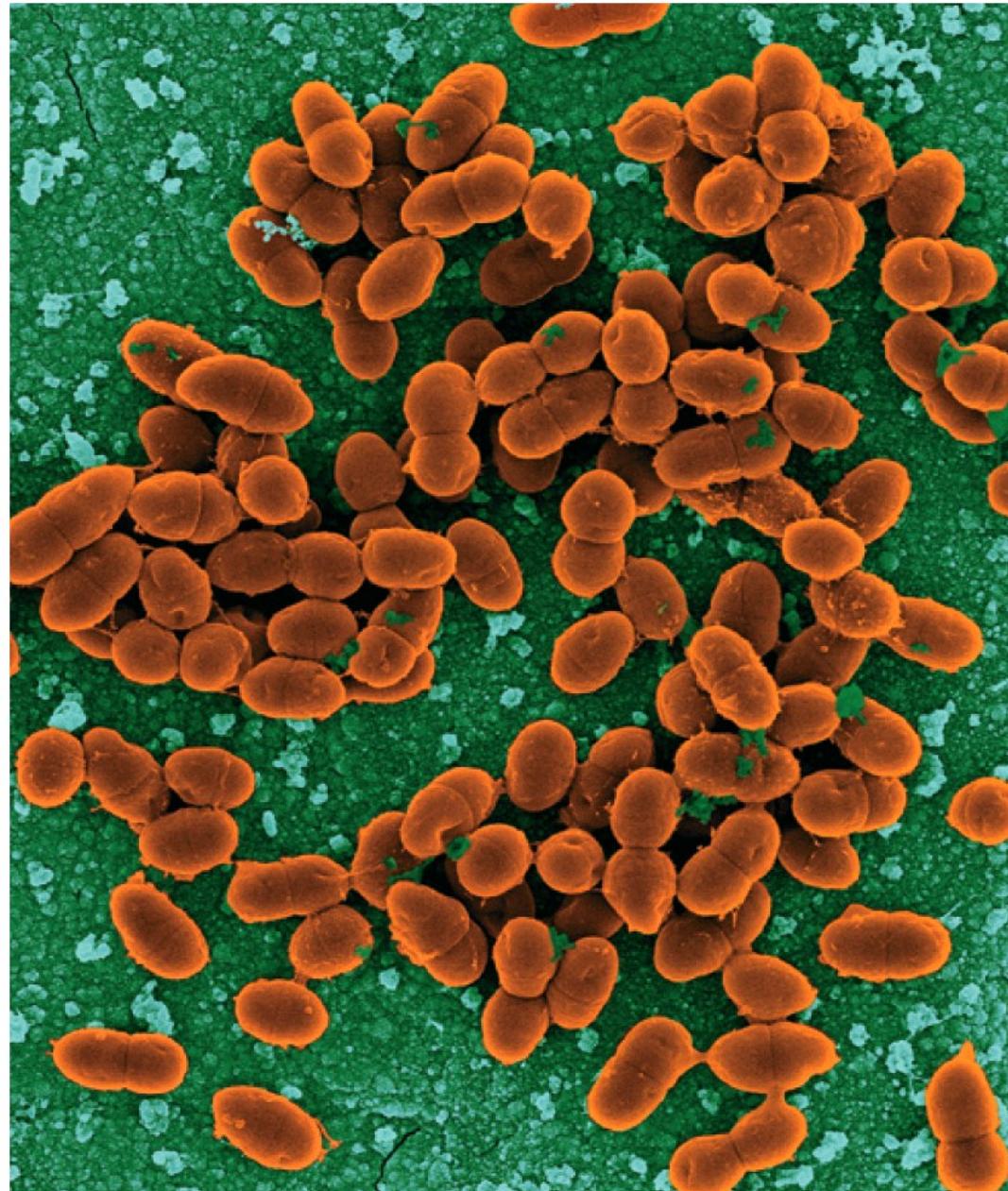


Figure 1-1a
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EUKARYOTES

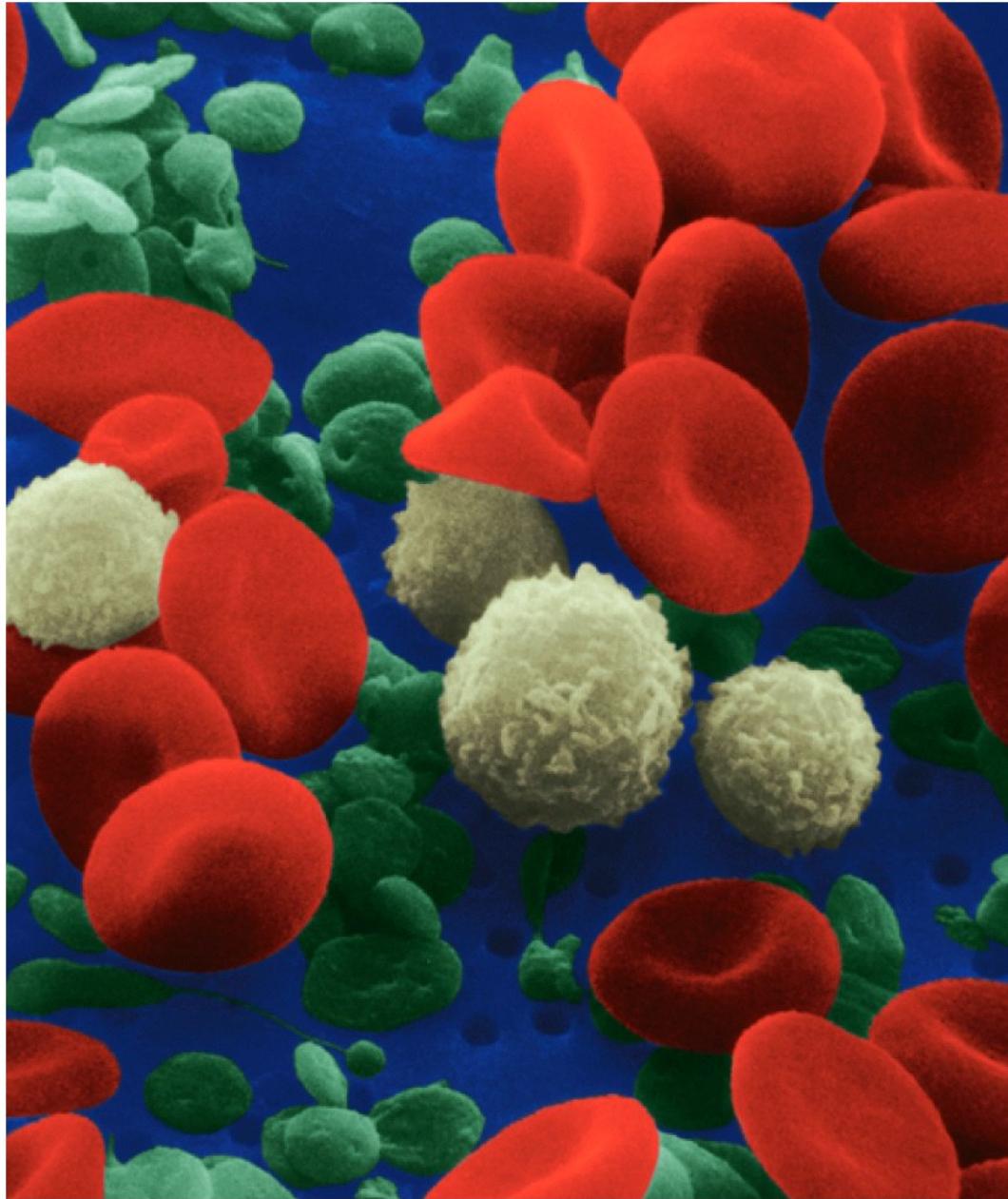


Figure 1-1c
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Size and the Visible Spectrum

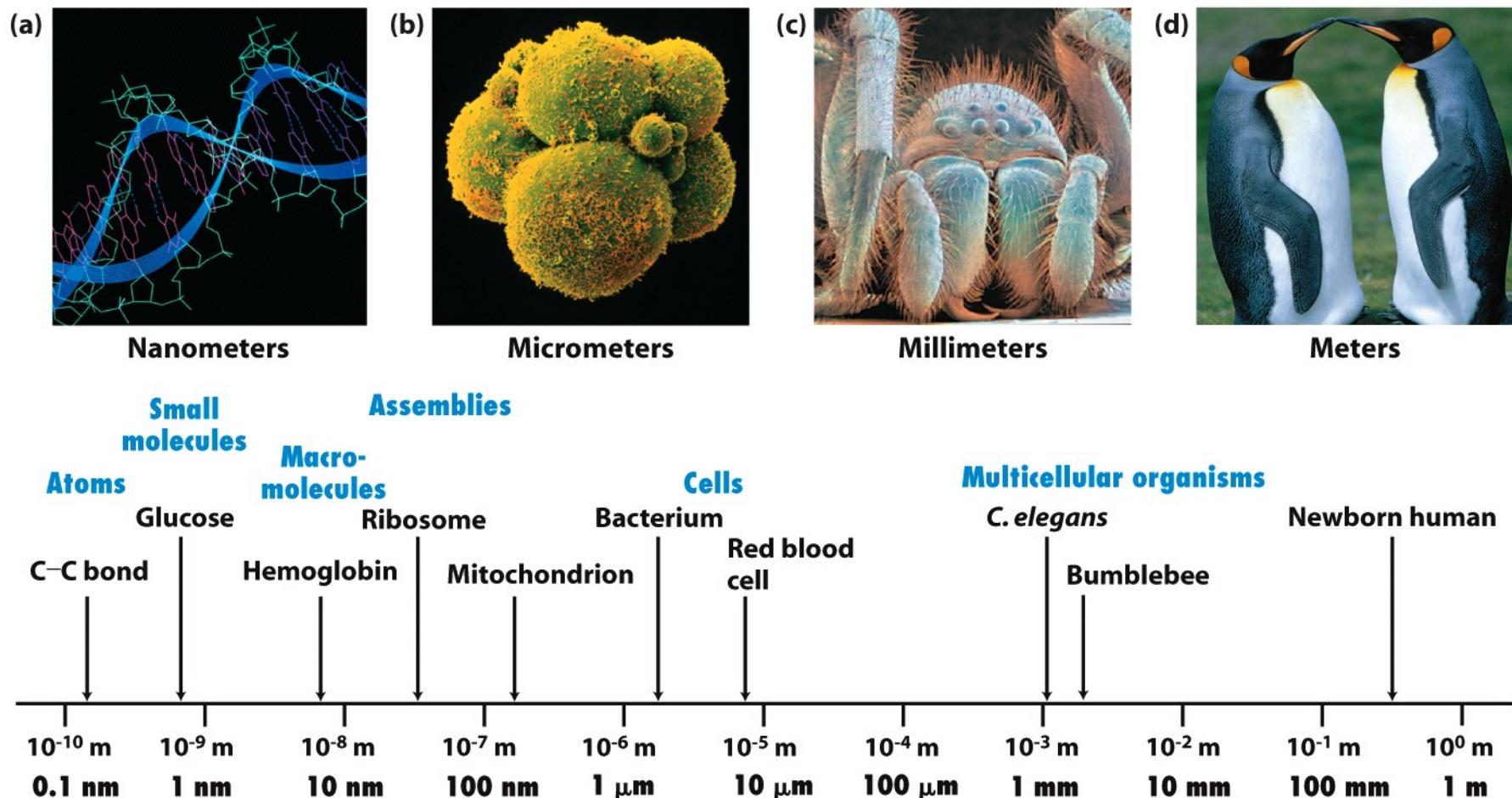
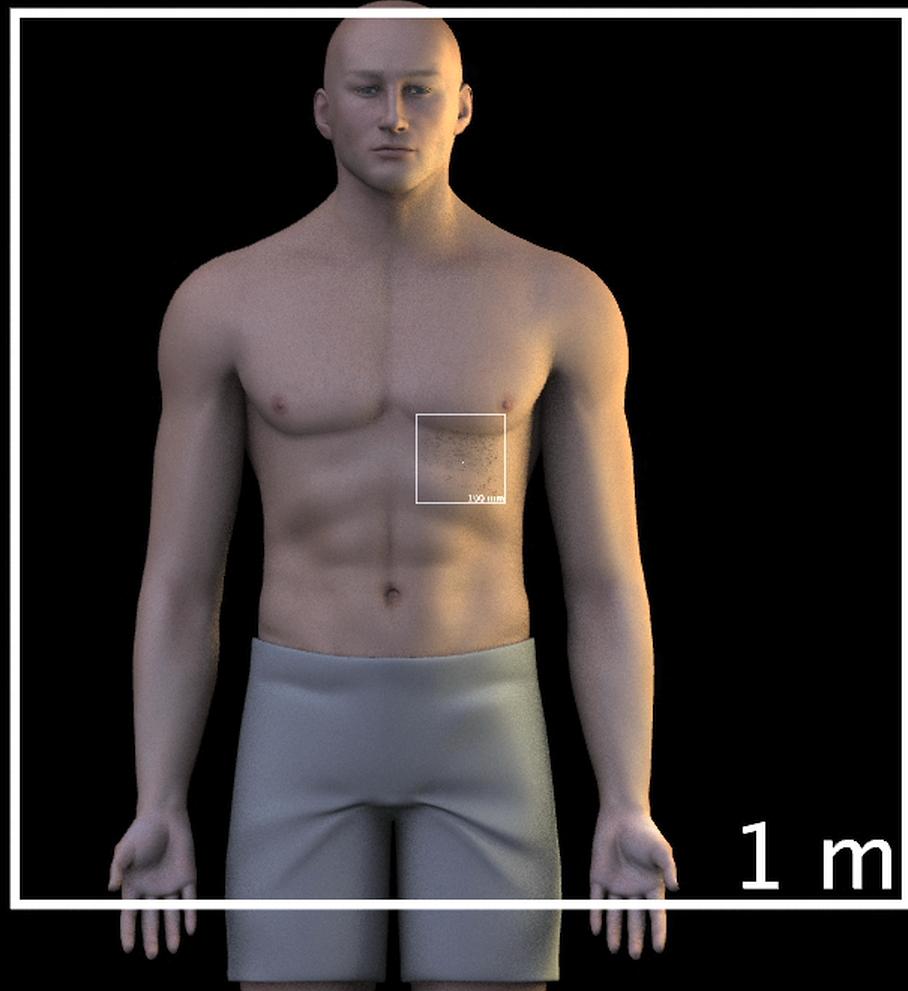


Figure 1-20
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— wavelength range of visible light



History of Cell Theory

Crystals (convex) appear to increase small images from early observations.

Glass is invented ~ 3000-2500 BC, during the Bronze age.

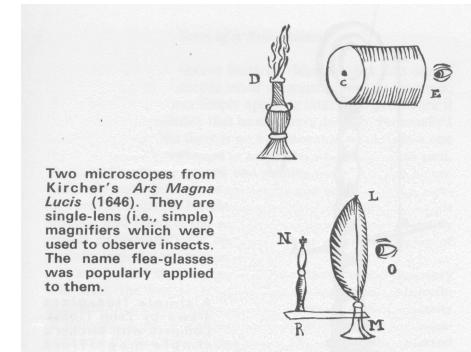
Burning and Magnifying Glasses are present in the writings of Roman philosophers Seneca and Pliny the Elder, in the first century AD.

~1000 AD, first reading aid called a “reading stone”: a glass sphere.

First eyeglasses “spectacles” invented in 1284 by Salvino D’Armata.



Between 13th and 17th centuries, early microscopes called “flea glasses” provide ~2-10X magnification.



History of Cell Theory



Anton van Leeuwenhoek (1632-1723)
The father of microscopy, the first microbiologist.

Learned how to grind and polish lenses to great clarity and curvature, with magnifications of ~300X.

Invented the first practical microscope.

His microscopes were single lenses, technically magnifying glasses and not compound microscopes.

First to observe and describe bacteria, yeast, and blood corpuscles (1674).



History of Cell Theory

~1590 two Dutch spectacle makers Zaccharias and Hans Janssen found that multiple lenses arranged in a tube significantly increased magnification.

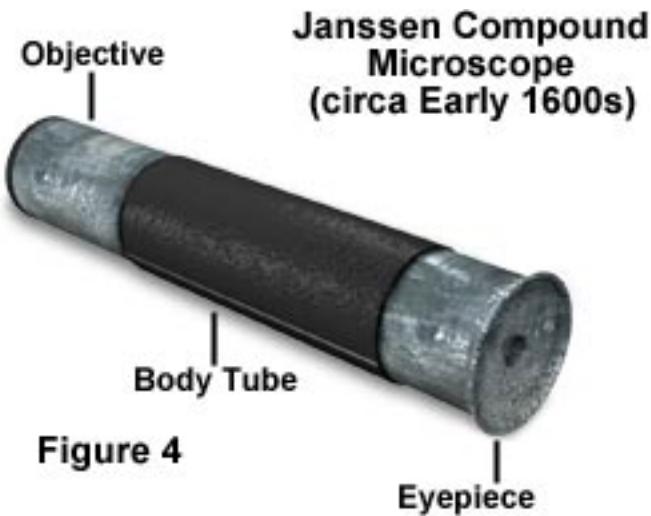


Figure 4

Microscope from Greek words “micron” (meaning “small”) and skopein (meaning to “look at”) was a term first used by Giovanni Faber in 1610 in referring to the early instrument Galileo was using.

History of Cell Theory

1665: Robert Hooke (physician and microscopist) publishes work *Micrographia*, and identifies microscopic units that make up larger organisms, he refers to as cells, from Latin “cella” meaning “small room”.

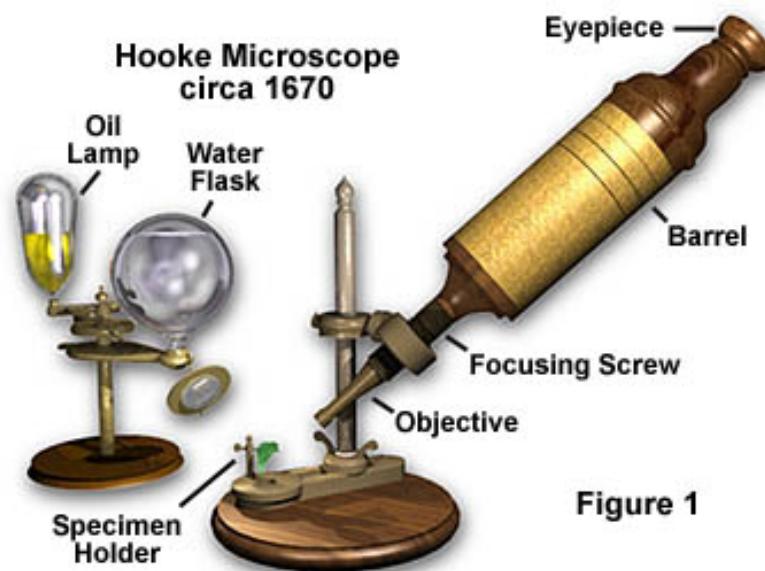
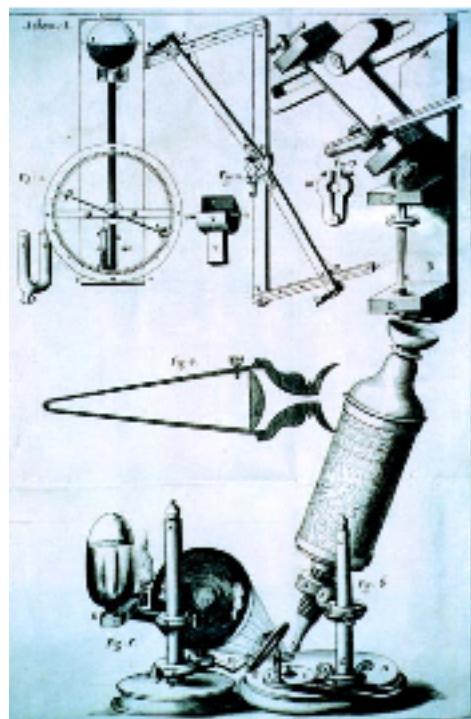


Figure 1



History of Cell Theory

The microscope bridged inanimate matter and living organisms.

Early belief in fibers as basic components, spontaneous generation, and “free cell formation”.

Belief in fundamental units of organism (plant) structure is widespread.

1824: Henry Milne-Edwards proposed that basic structure of all animal tissues is an array of “globules”.

**Henry Dutrochet (1776-1847): Proposed cell as a physiologic unit.
“The cell is the fundamental element of organization.”**

Francois Raspail (1794-1878): “Every cell is derived from another cell.”

Jan Purkyňe (1787–1869): Proposed animals have “basic cellular tissue”.

Theodor Schwann (1810-1882), Mattias Schleiden (1804-1881), and Rudolf Virchow (1821-1902) credited with the development of Cell Theory.

History of Cell Theory

"there is one universal principle of development for the elementary parts of organisms... and this principle is in the formation of cells"

-Theodor Schwann



Mattias Schleiden

Cell Theory developed 1837-1838

An explanation of the relationship between cells and living things.

The three main tenets of Cell Theory:

All living things are made of cells and their products.

Cells are the basic units of life.

All cells arise from pre-existing cells.

Are Viruses Alive?

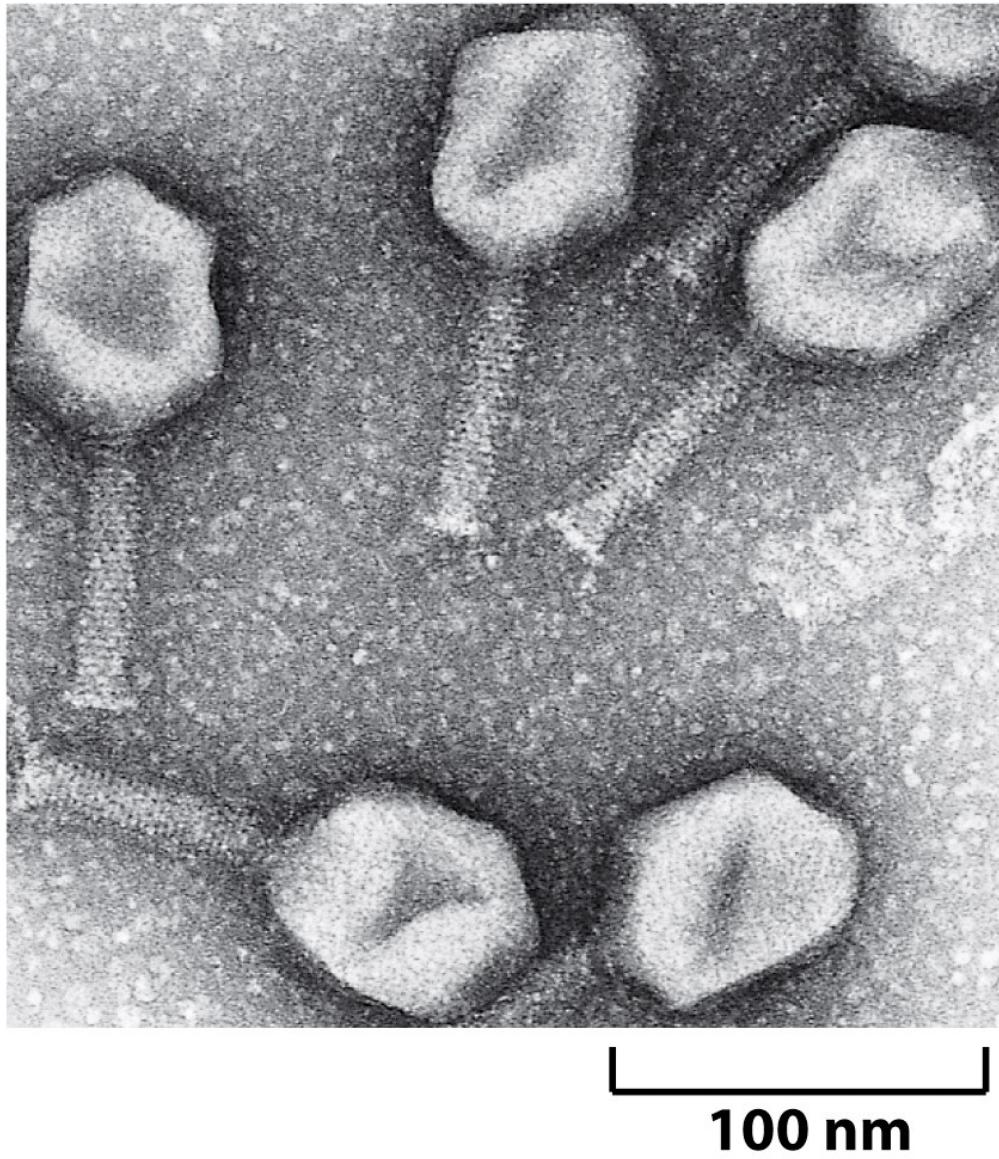


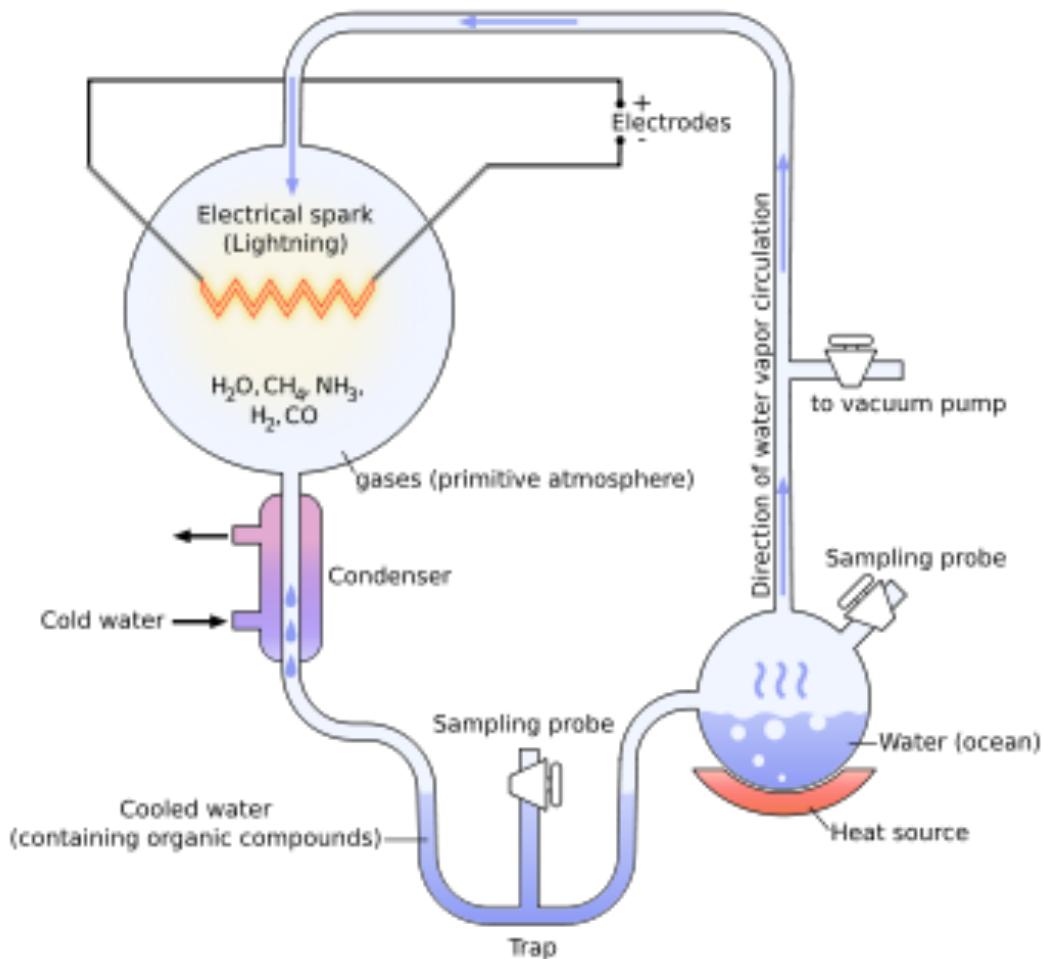
Figure 1-27a *Molecular Biology of the Cell*, Fifth Edition (© Garland Science 2008)

Viruses Need Cells for Reproduction



Figure 1-27b *Molecular Biology of the Cell*, Fifth Edition (© Garland Science 2008)

Beginnings of Life? The Miller–Urey Experiment



At the end of one week of continuous operation, Miller and Urey observed that as much as 10–15% of the carbon within the system was in the form of organic compounds. 2% of the carbon had formed amino acids. Sugars were formed. Nucleic acids were not. The common 20 amino acids were formed in various concentrations.

NEURON

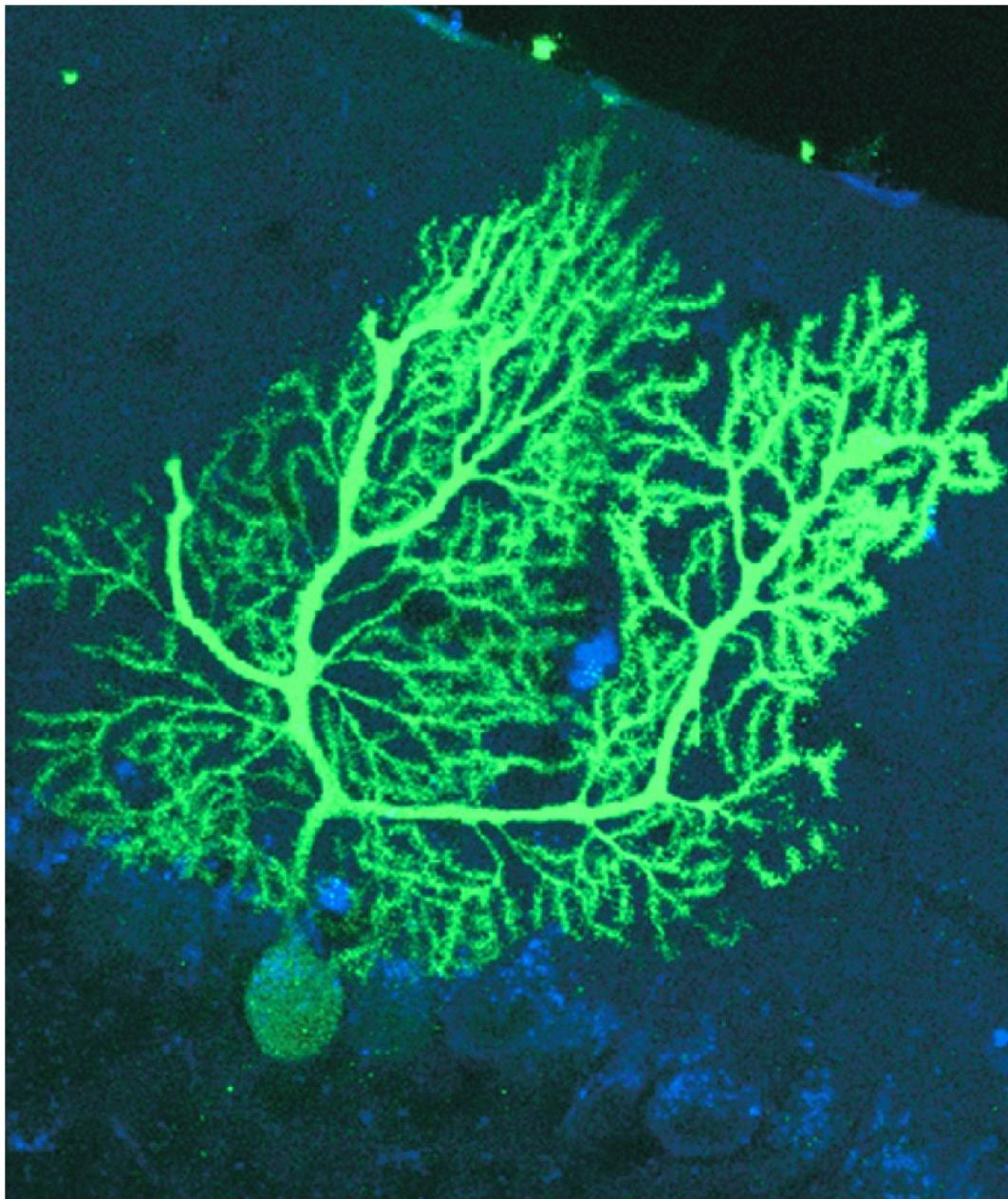


Figure 1-1f
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EPITHELIAL CELLS

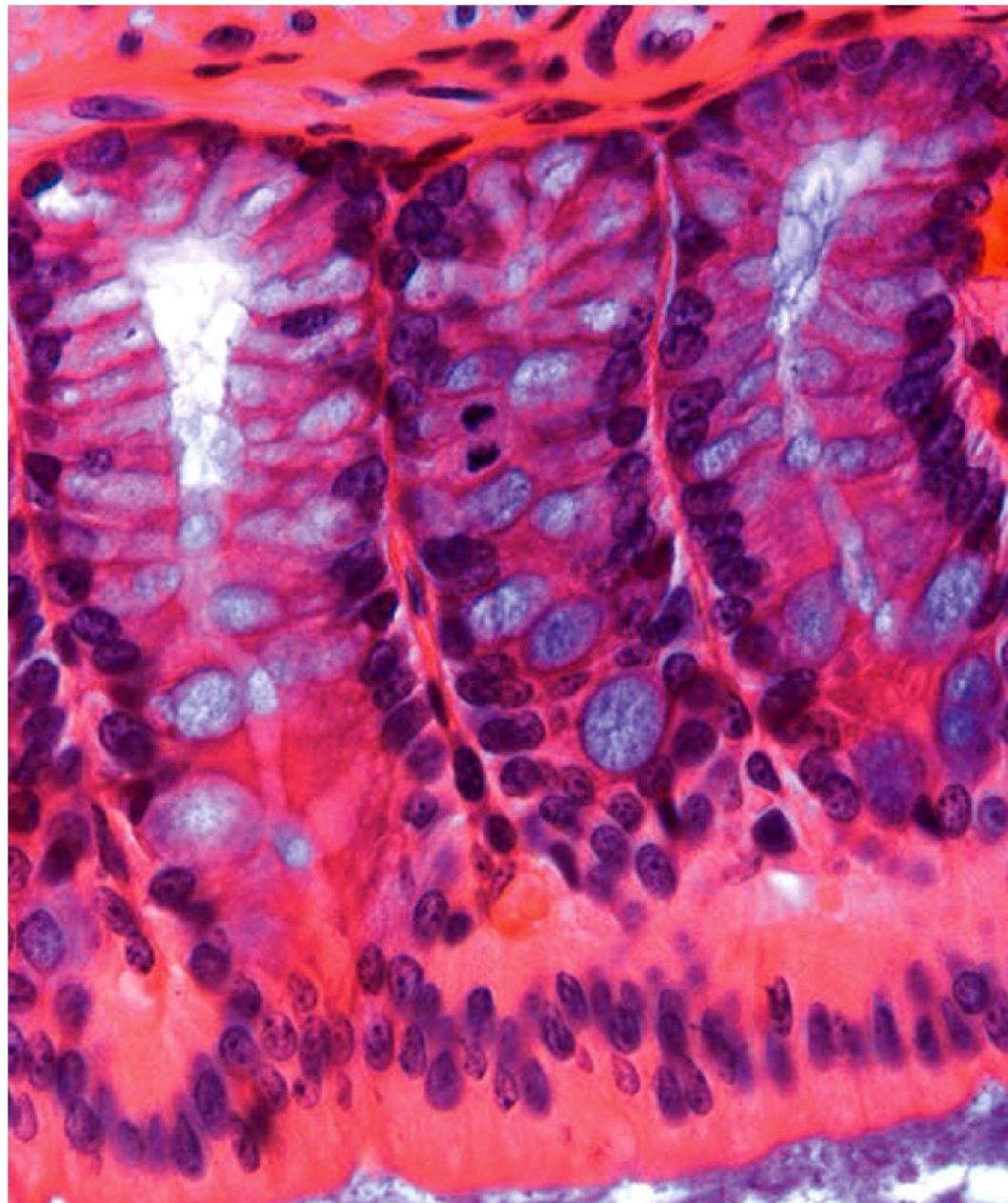


Figure 1-1g
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PLANT CELLS

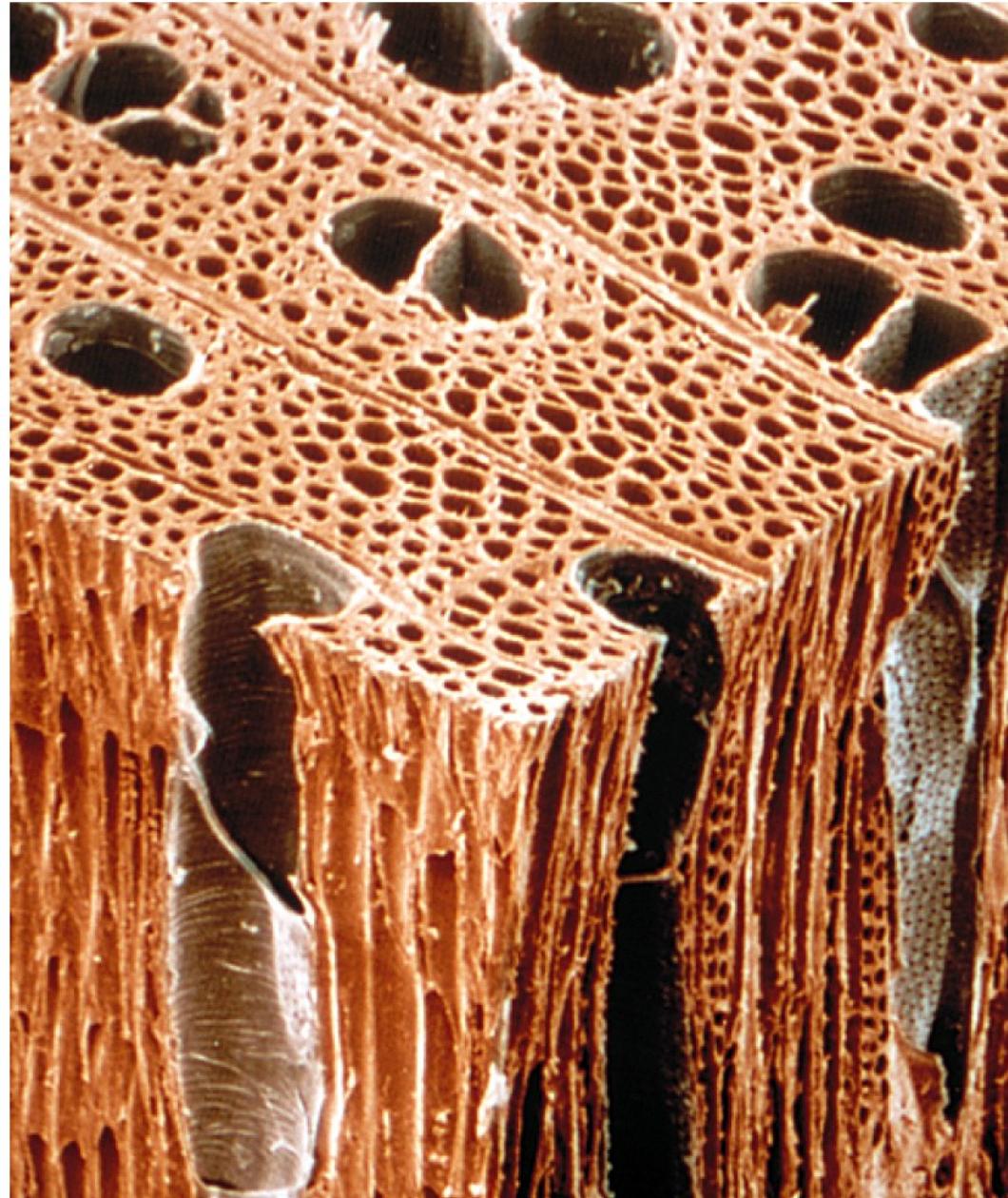
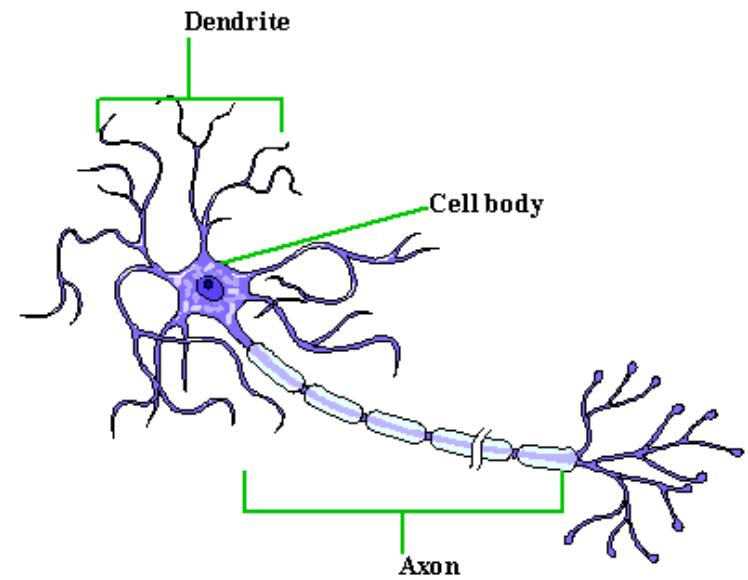
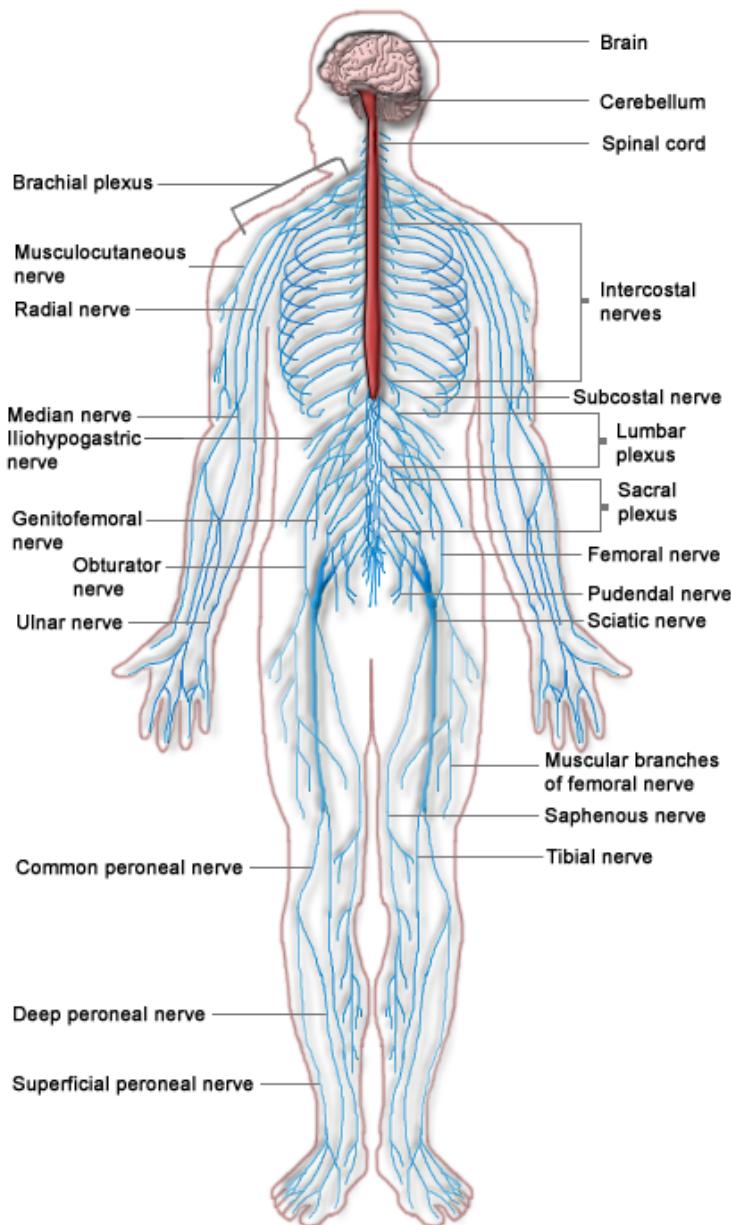


Figure 1-1h
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The Longest Cells are Motor Neurons



~4.5 feet long

Eggs (Ova) are the Largest Cells....or are they?

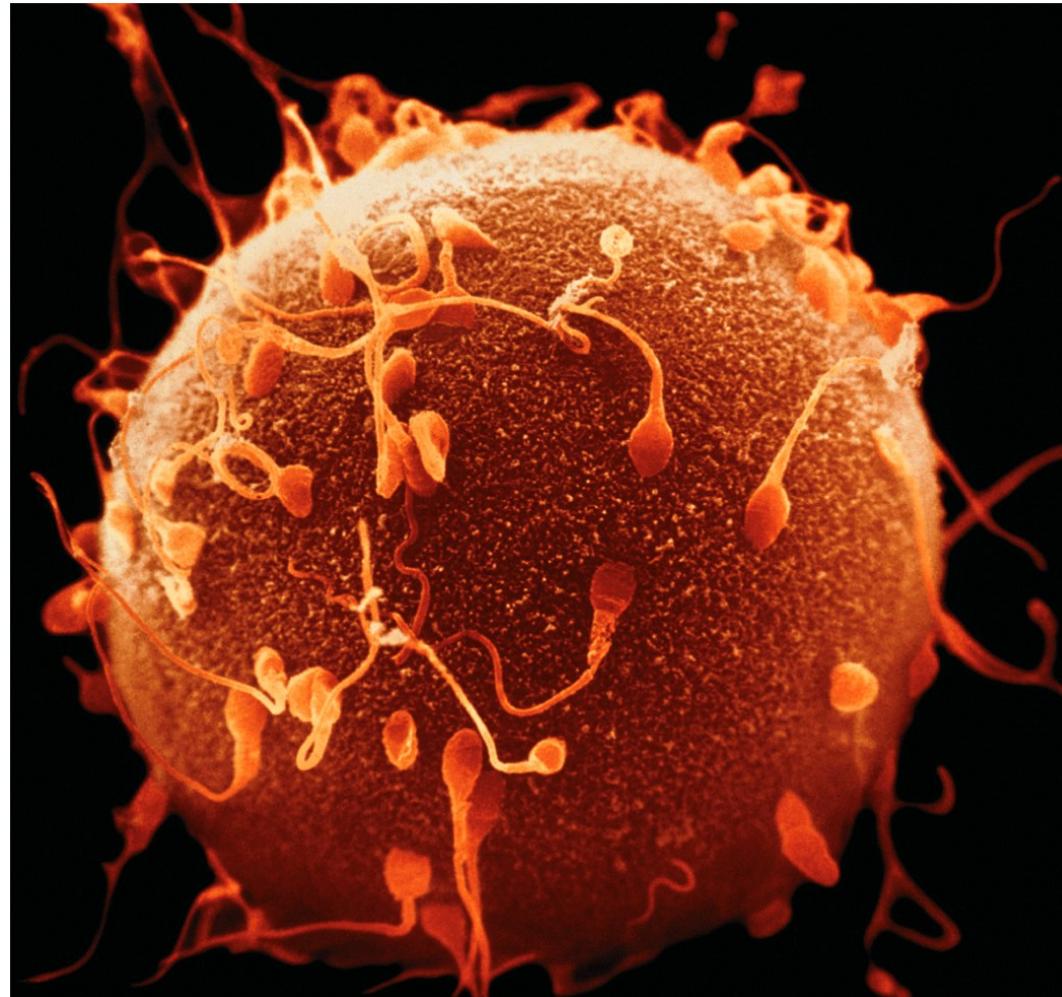
DINOSAUR
EGGS



Figure 1-1d
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Eggs (Ova) are the Largest Cells....or are they?

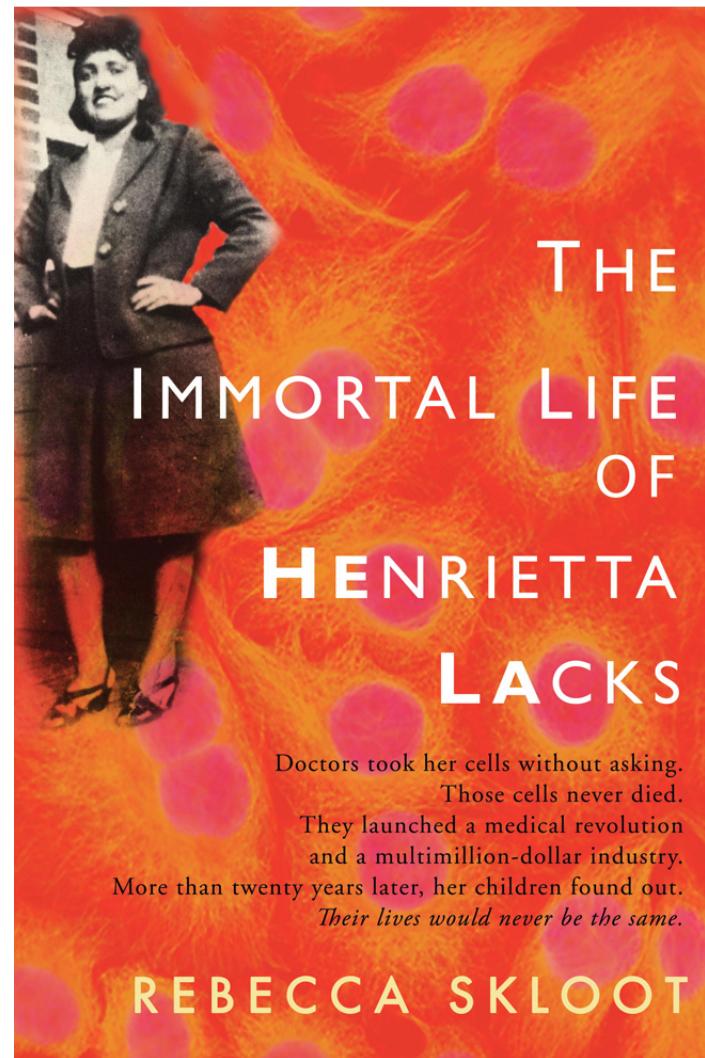
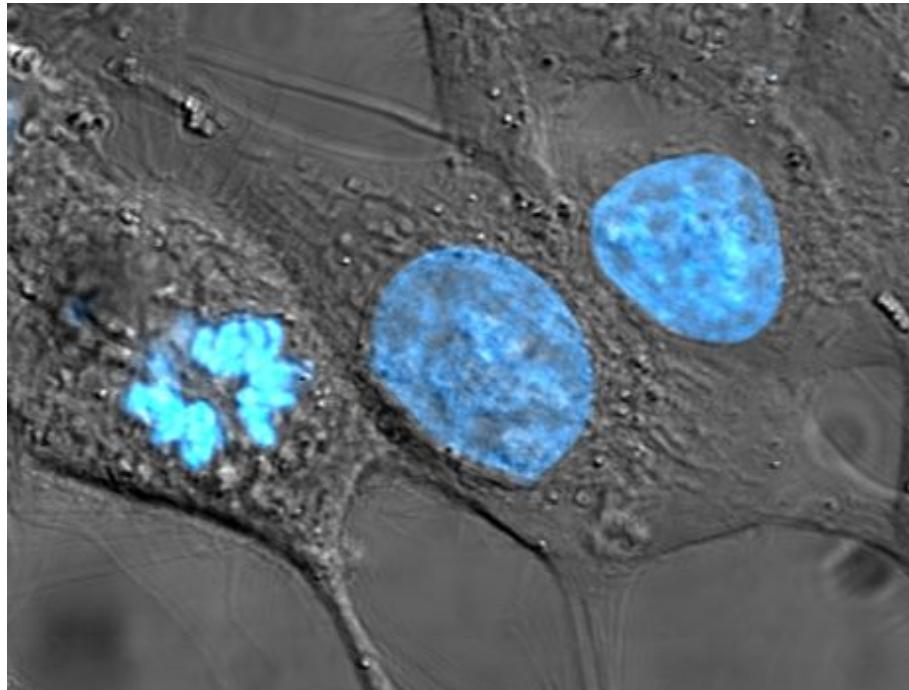
HUMAN
EGG
& SPERM



Chapter 1 Opener
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The Longest Lived Cells are Cancer Cells: They are Immortal

HELA CELLS



ALGAE

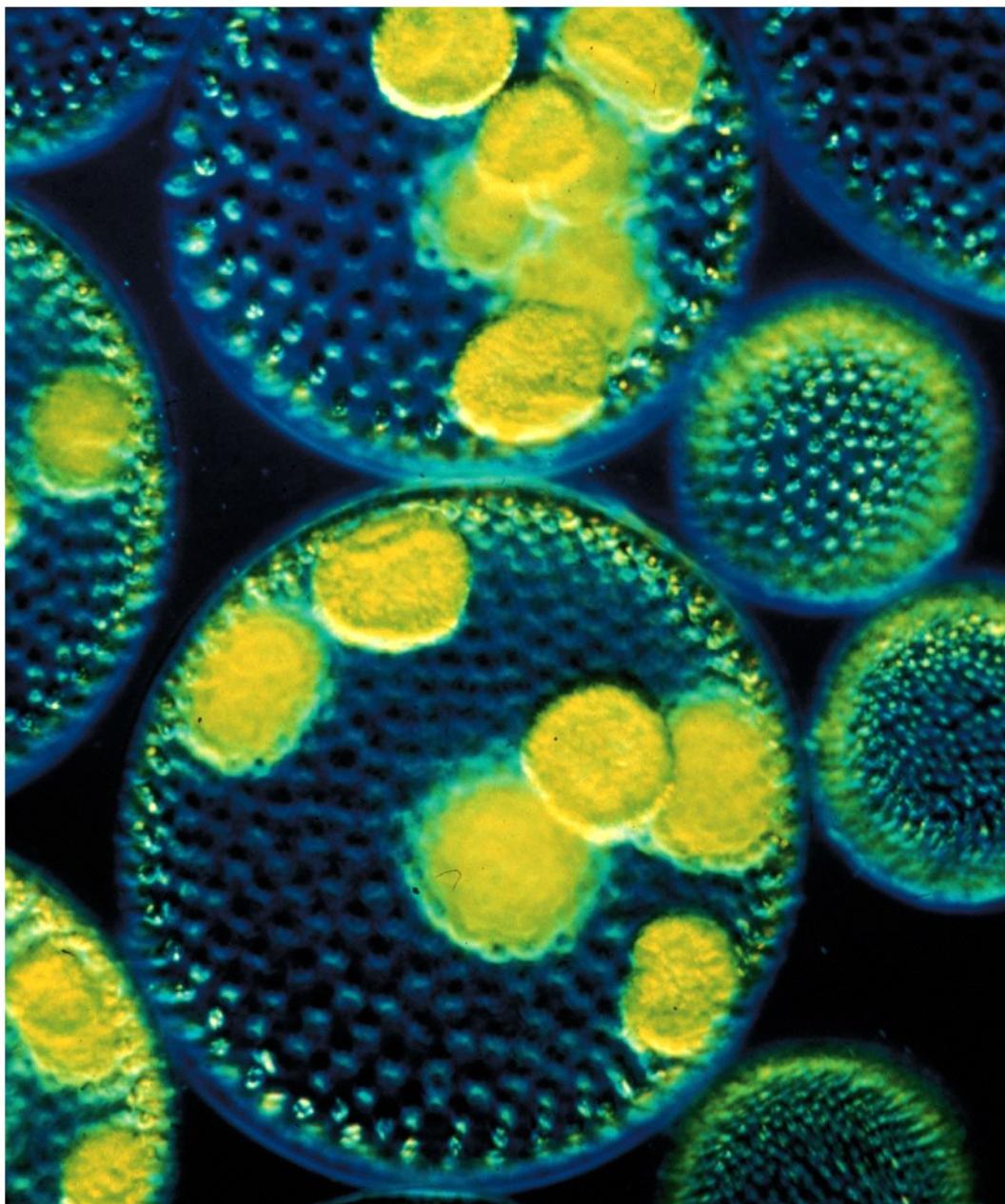


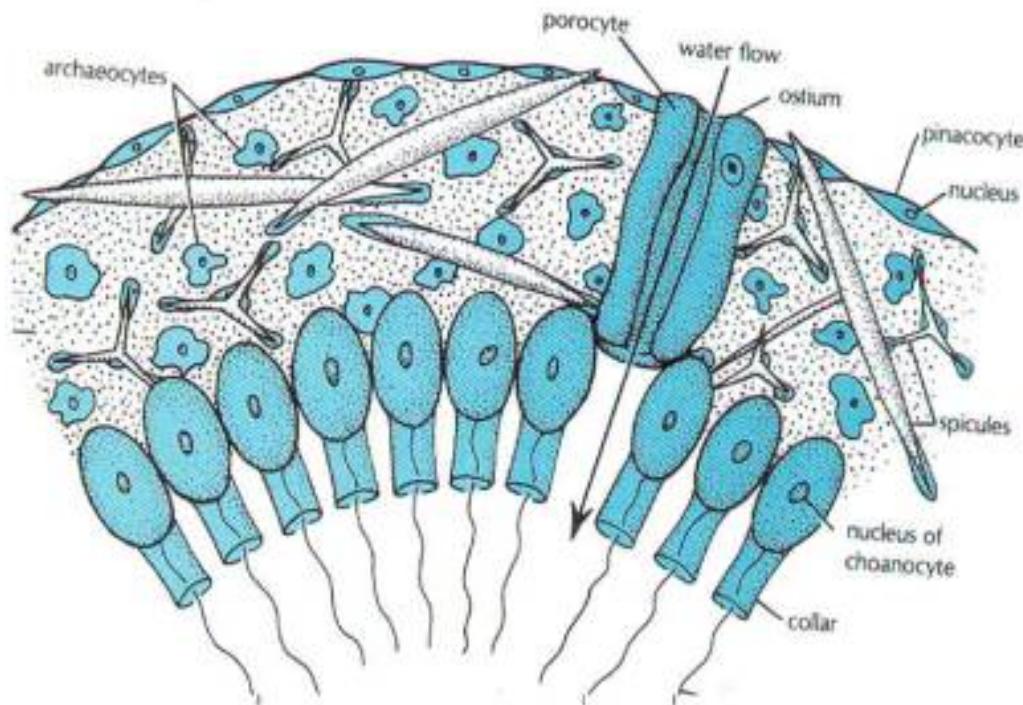
Figure 1-1e
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The Sponge is a Multicellular Organism (Perhaps the Most Primitive)



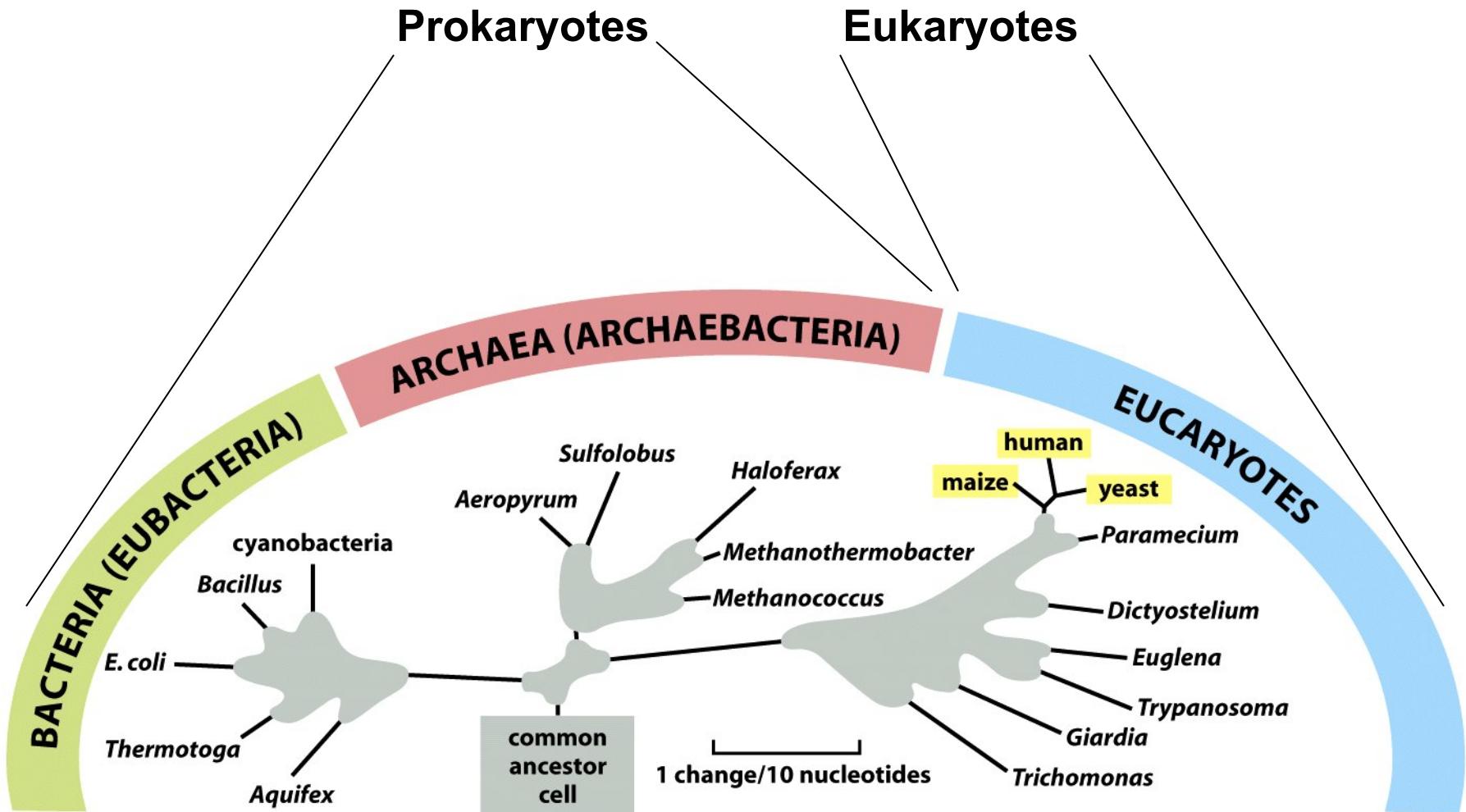
Marine sponges are multicellular animals that can regenerate from single cells. The cells of a sponge rely on the processes of intercellular recognition and cellular adhesion to form aggregates of cells of the same species that eventually develop into an adult sponge.

The Sponge is a Multicellular Organism (Perhaps the Most Primitive)

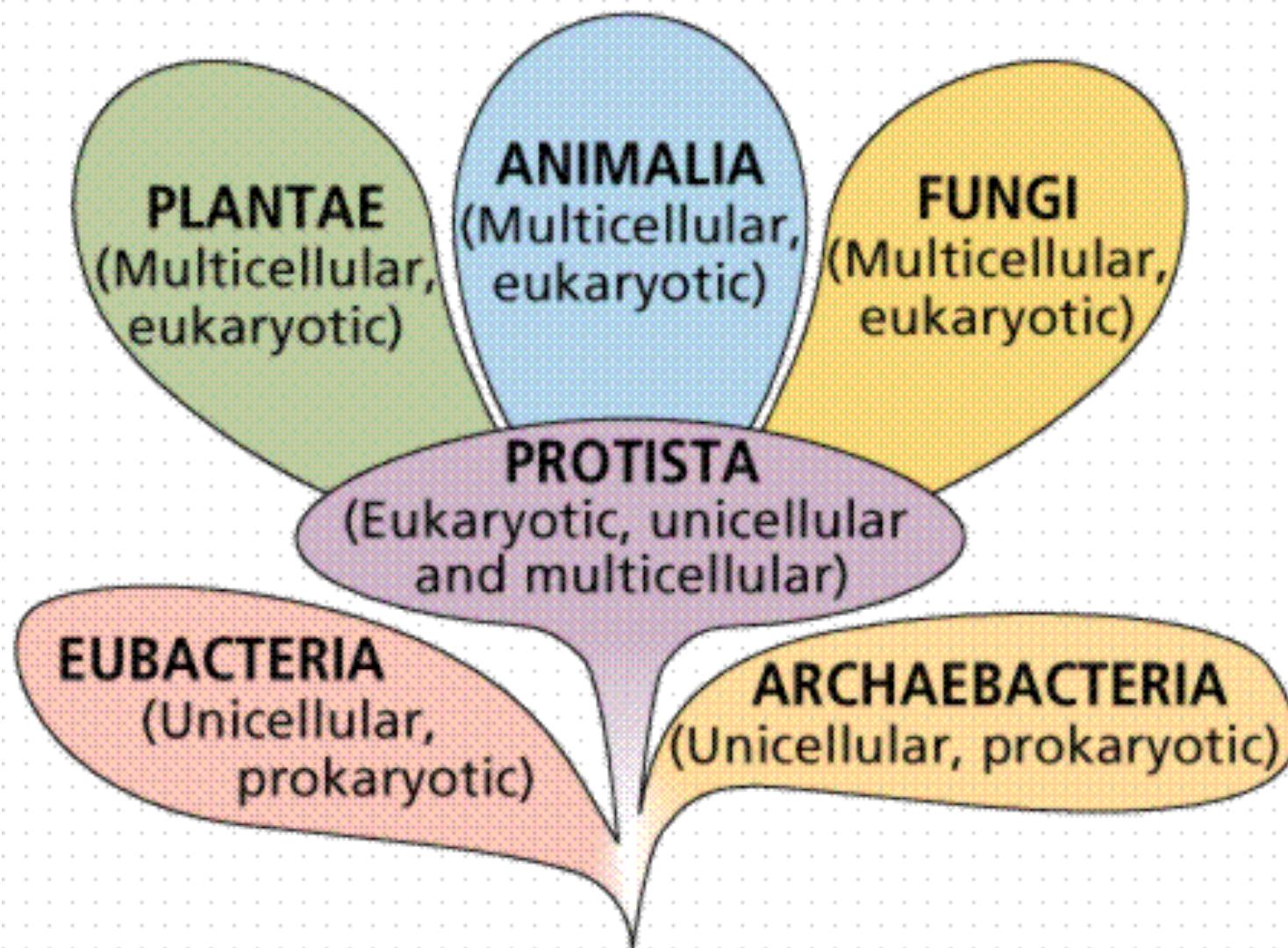


There are Two Types of Cells: Prokaryotes and Eukaryotes

Each Type has Distinguishing Features



Protists are Likely the Ancestors of All Eukaryotes



The Protists

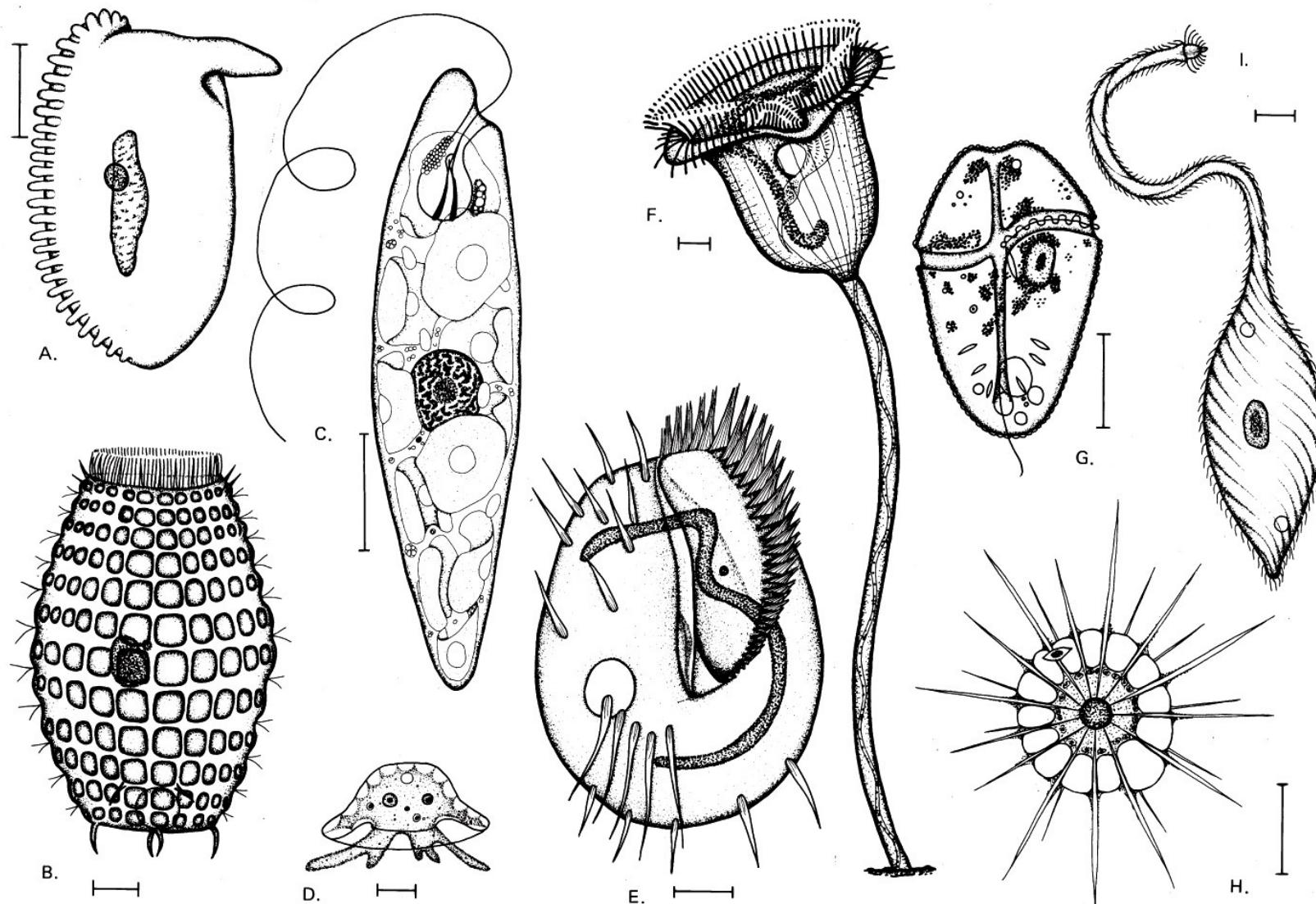


Figure 1-41 *Molecular Biology of the Cell*, Fifth Edition (© Garland Science 2008)

Prokaryotic cell

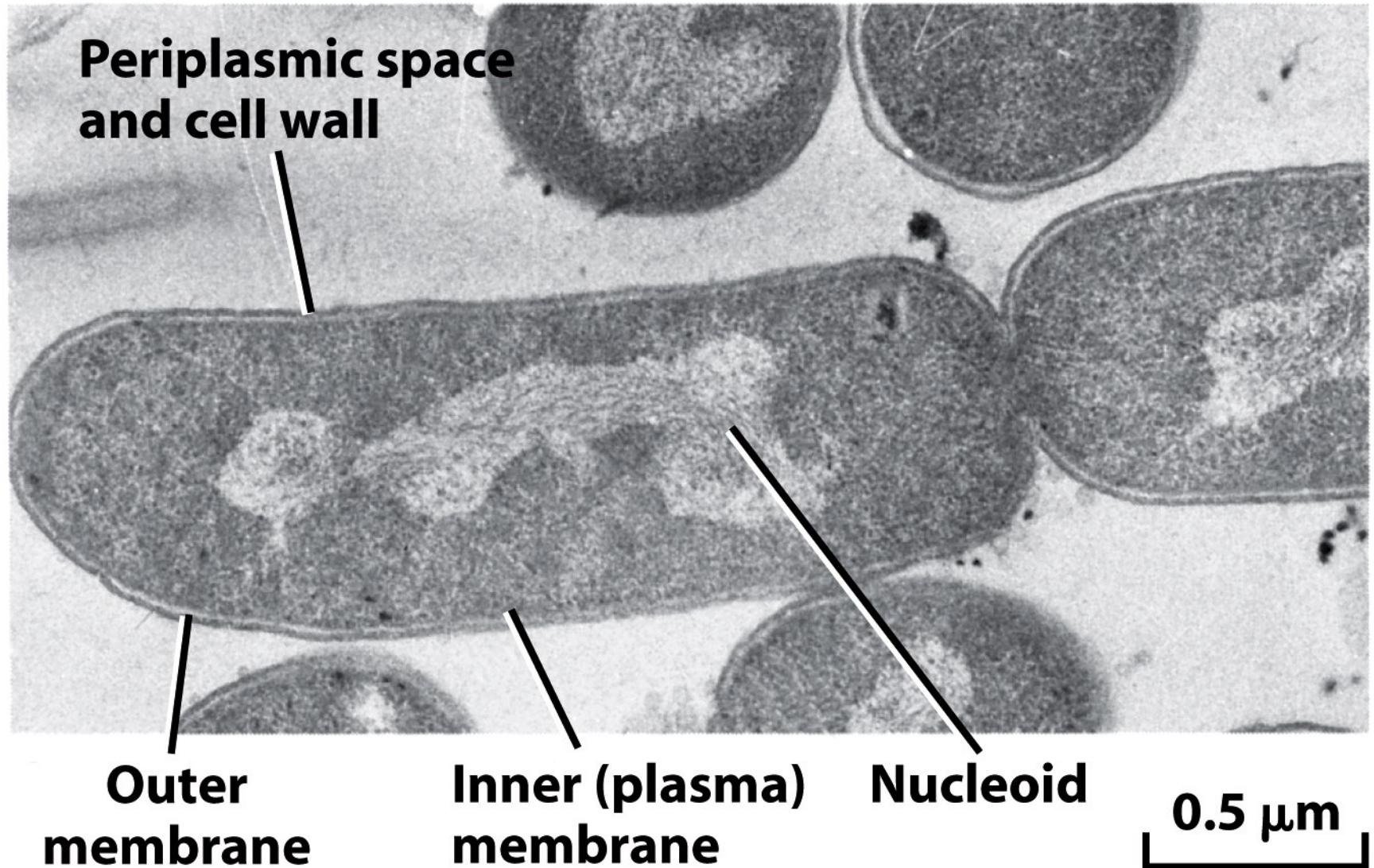


Figure 1-2a part 1
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Prokaryotic cell

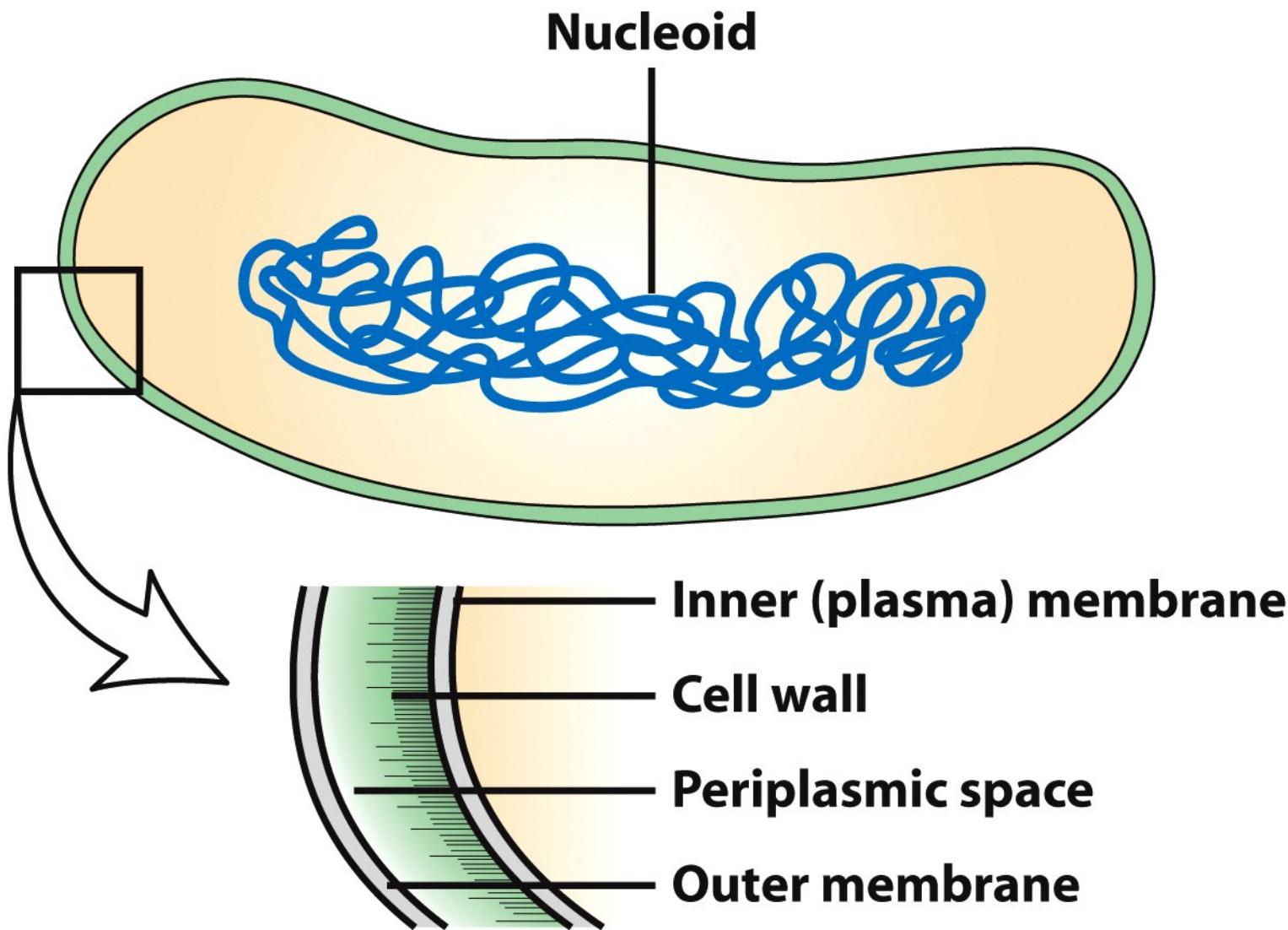


Figure 1-2a part 2
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Eukaryotic cell

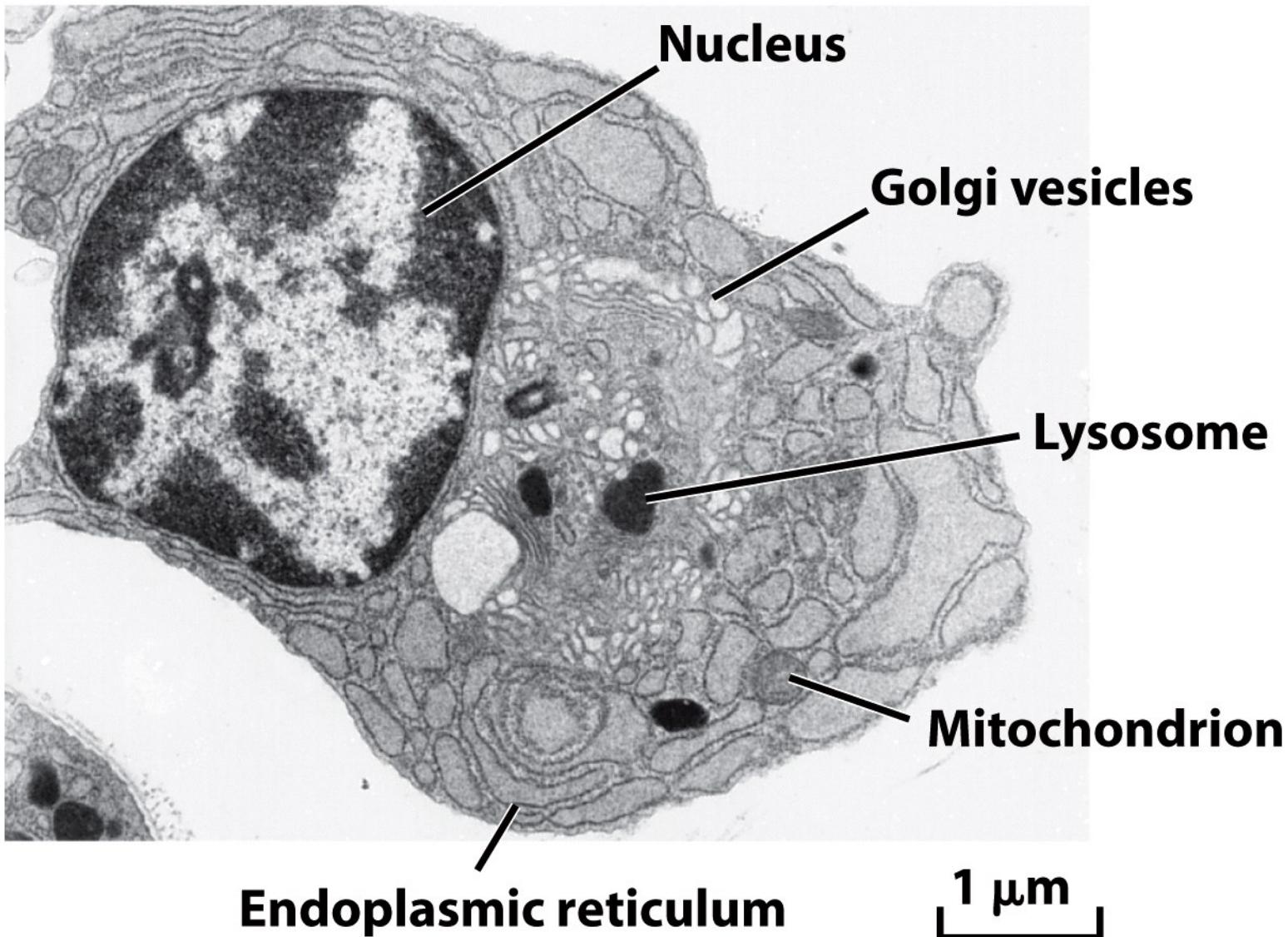


Figure 1-2b part 1
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Eukaryotic cell

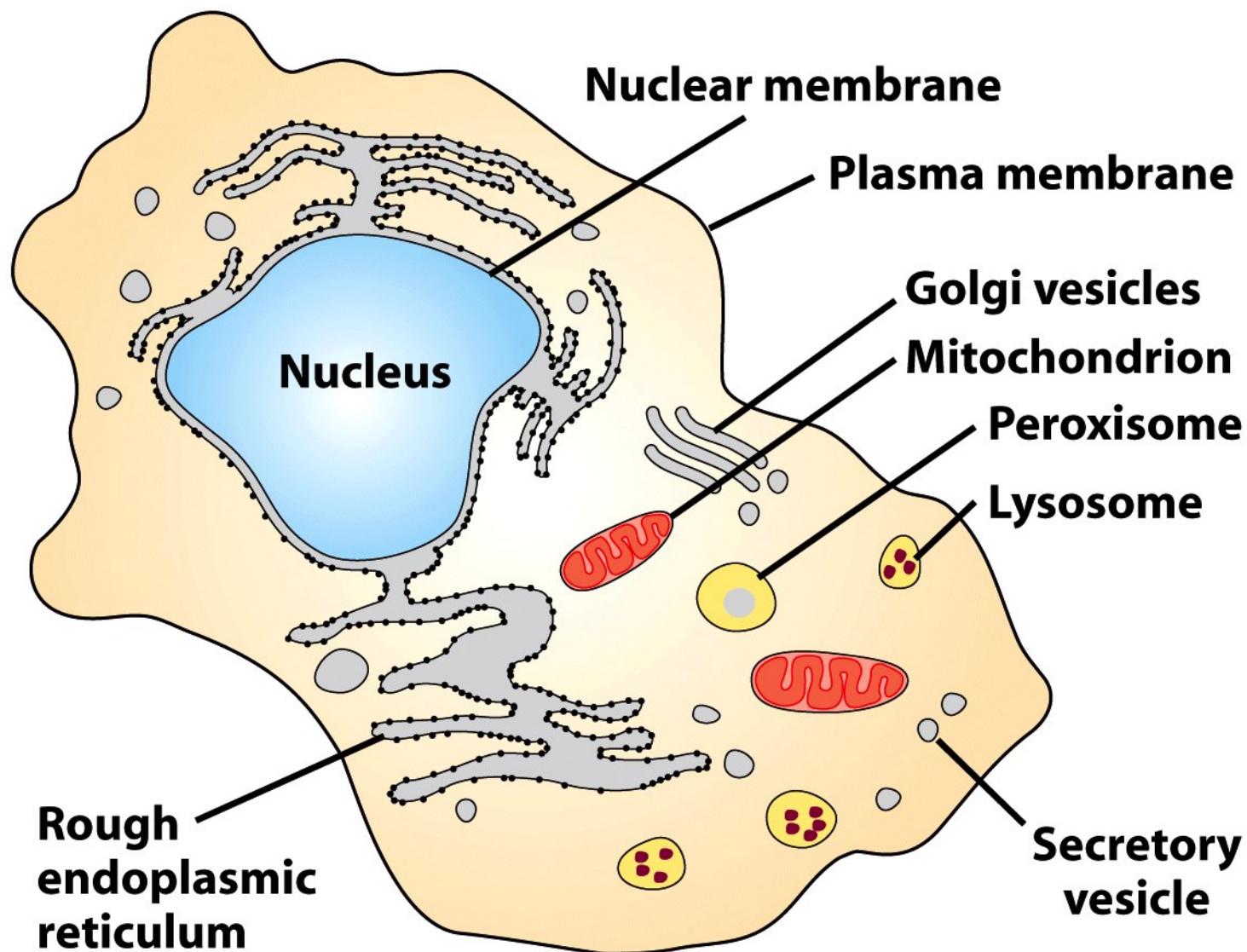
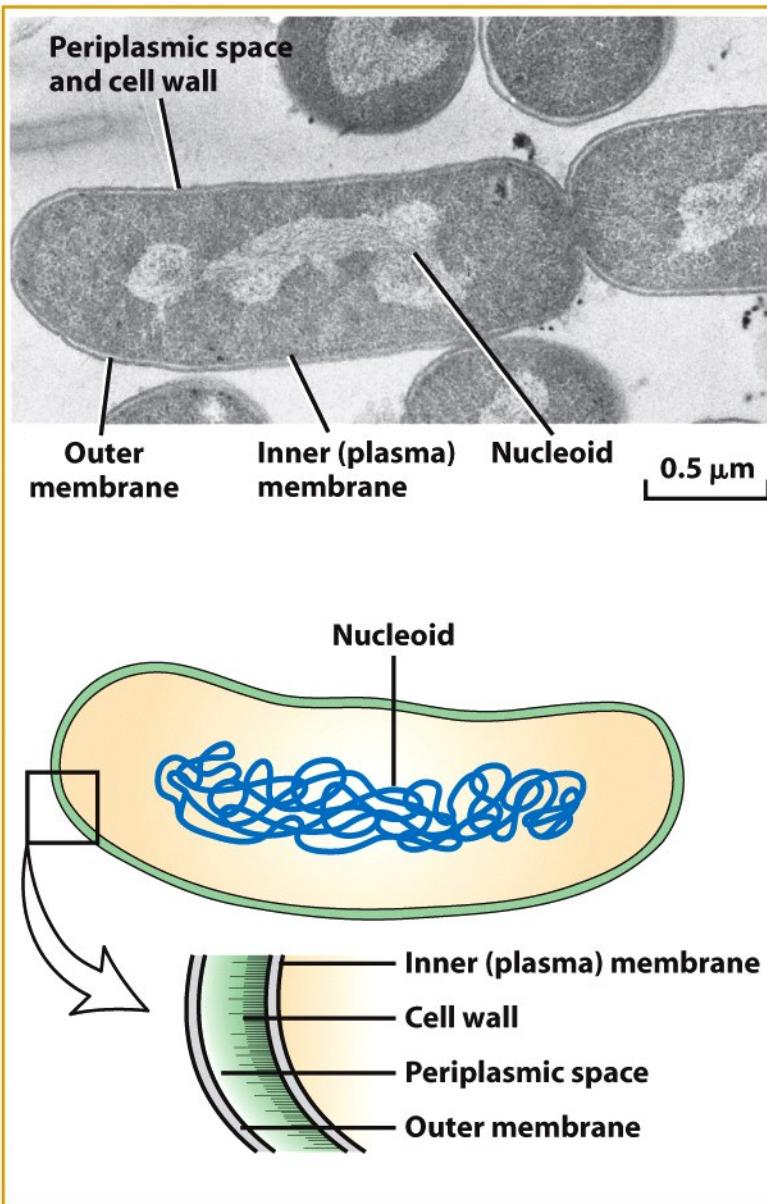


Figure 1-2b part 2
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(a) Prokaryotic cell



(b) Eukaryotic cell

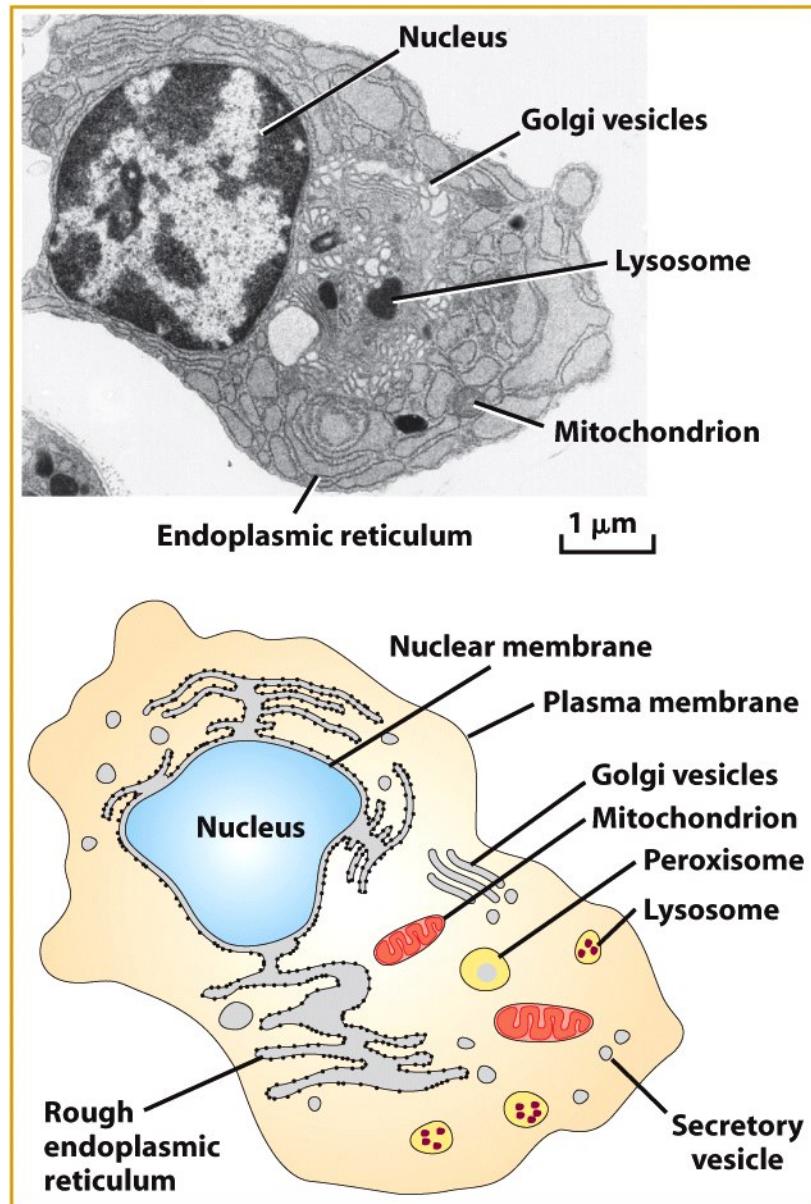


Figure 1-2

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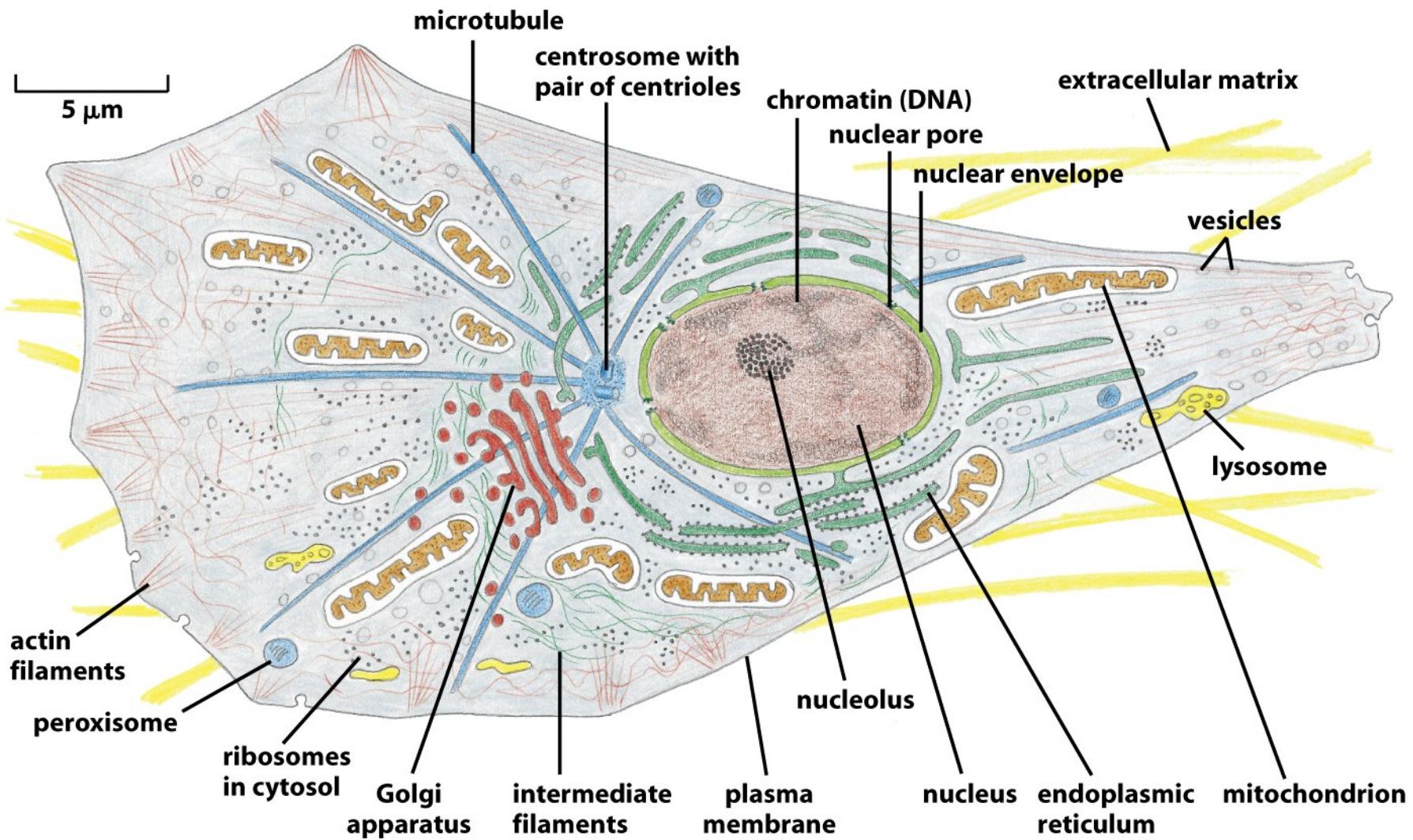
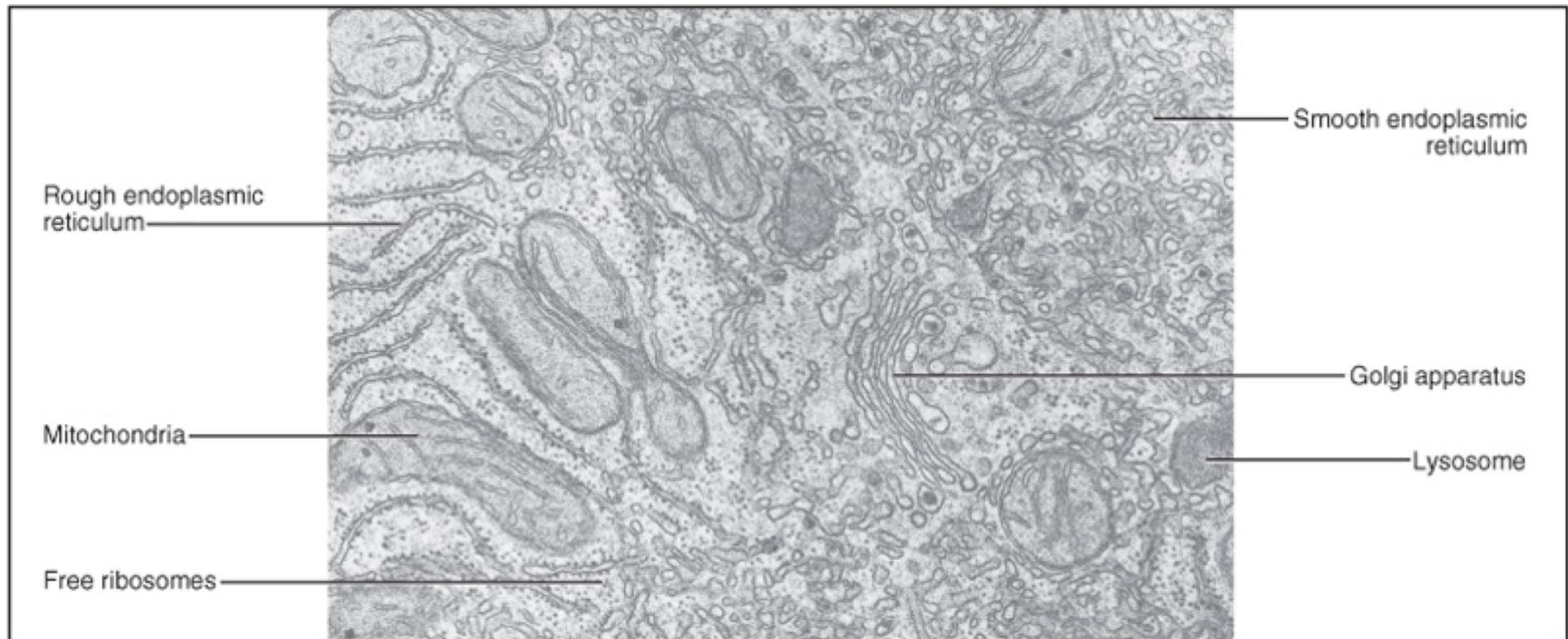


Figure 1-30 *Molecular Biology of the Cell*, Fifth Edition (© Garland Science 2008)

Electron Micrograph of a Eukaryotic Cell

Actually, it is Crowded in the Cytoplasm



Mitochondria power Eukaryotic Cells: Where Did They Come From?

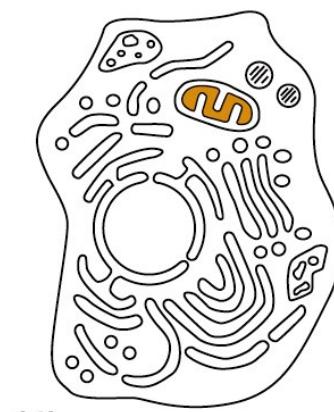
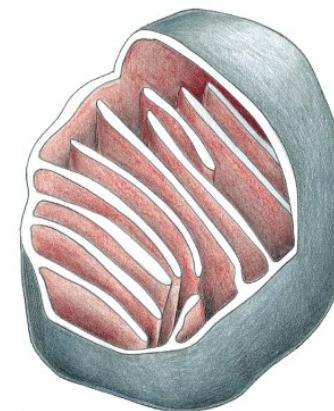
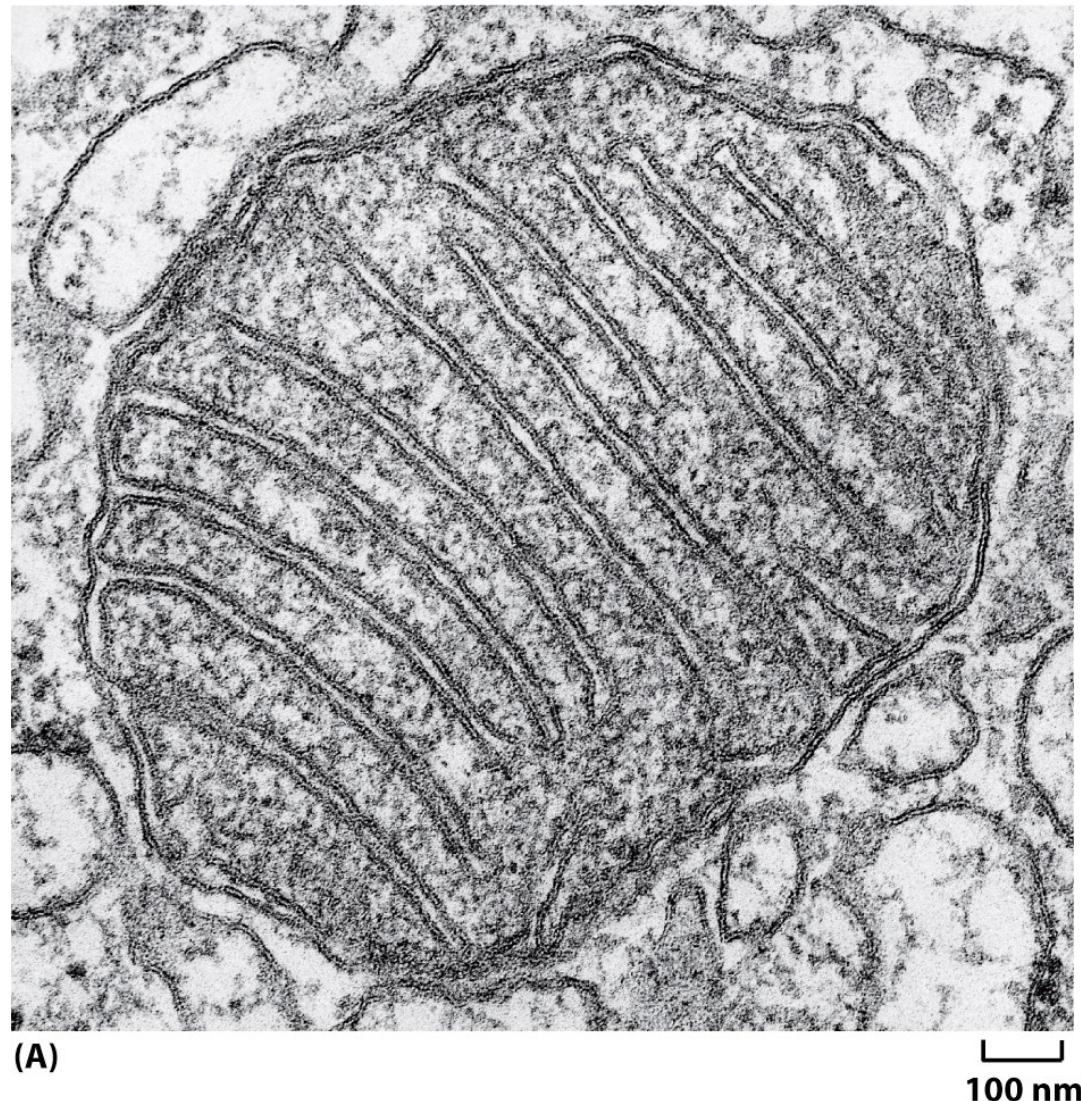


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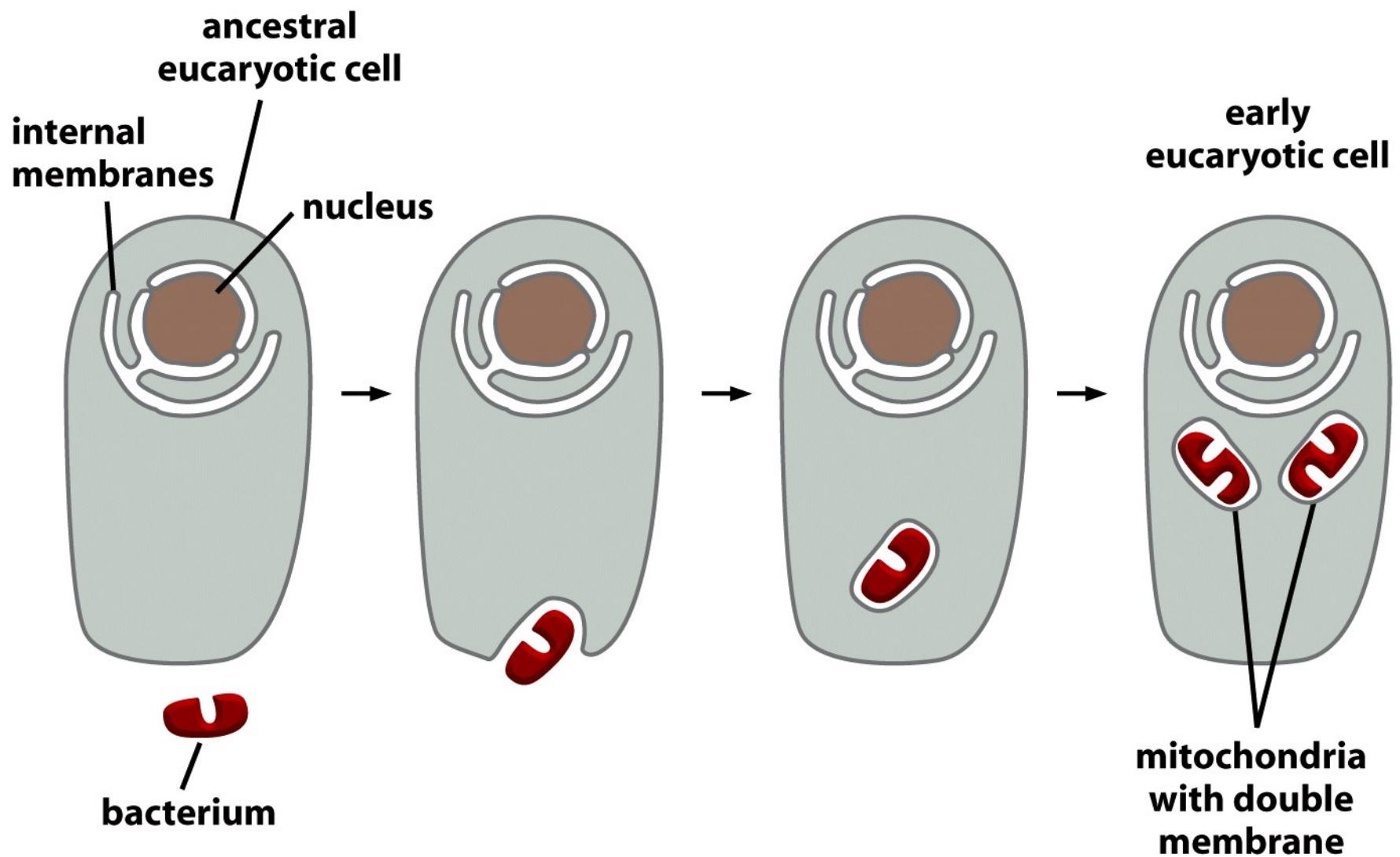


Figure 1-34 *Molecular Biology of the Cell*, Fifth Edition (© Garland Science 2008)

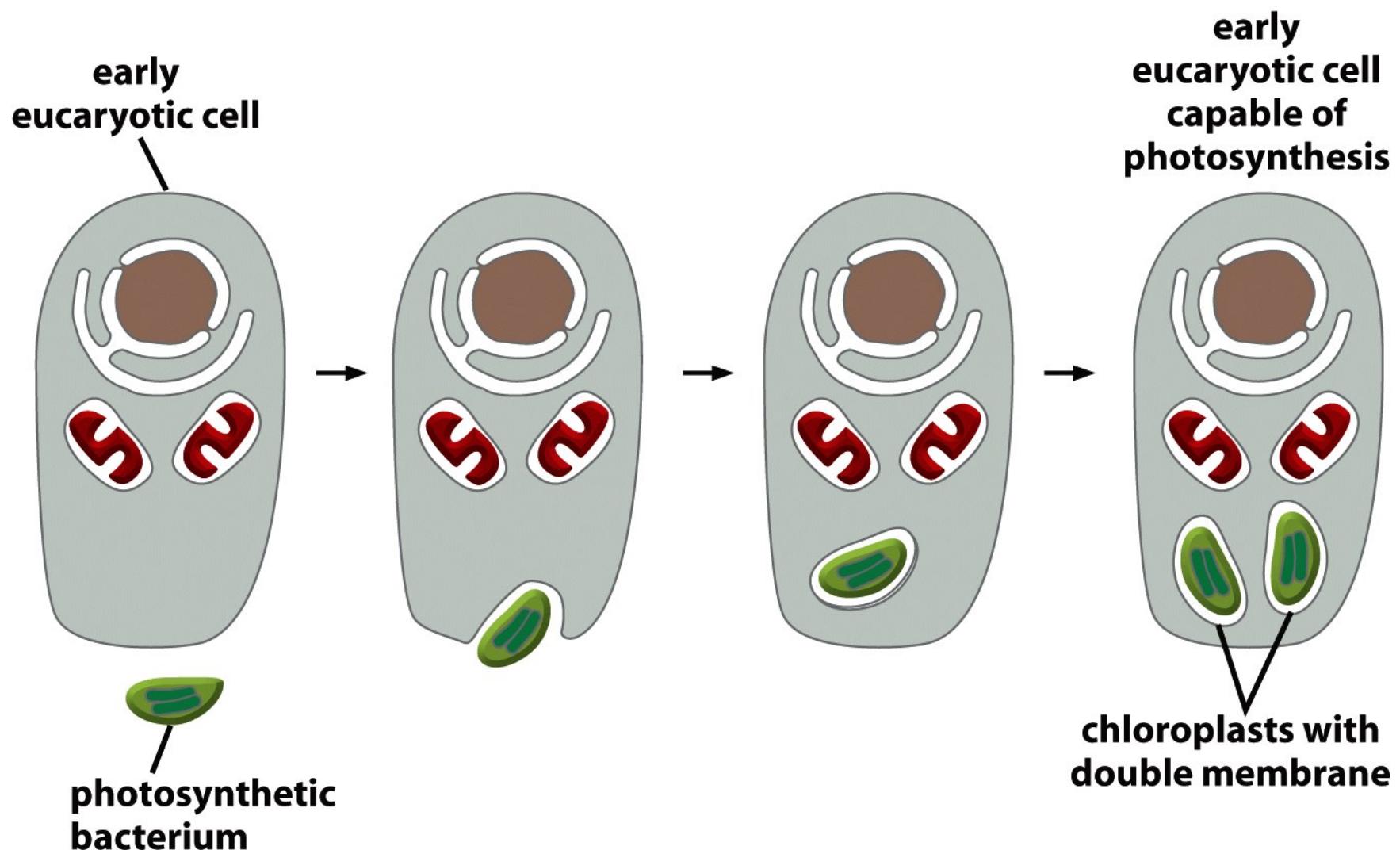
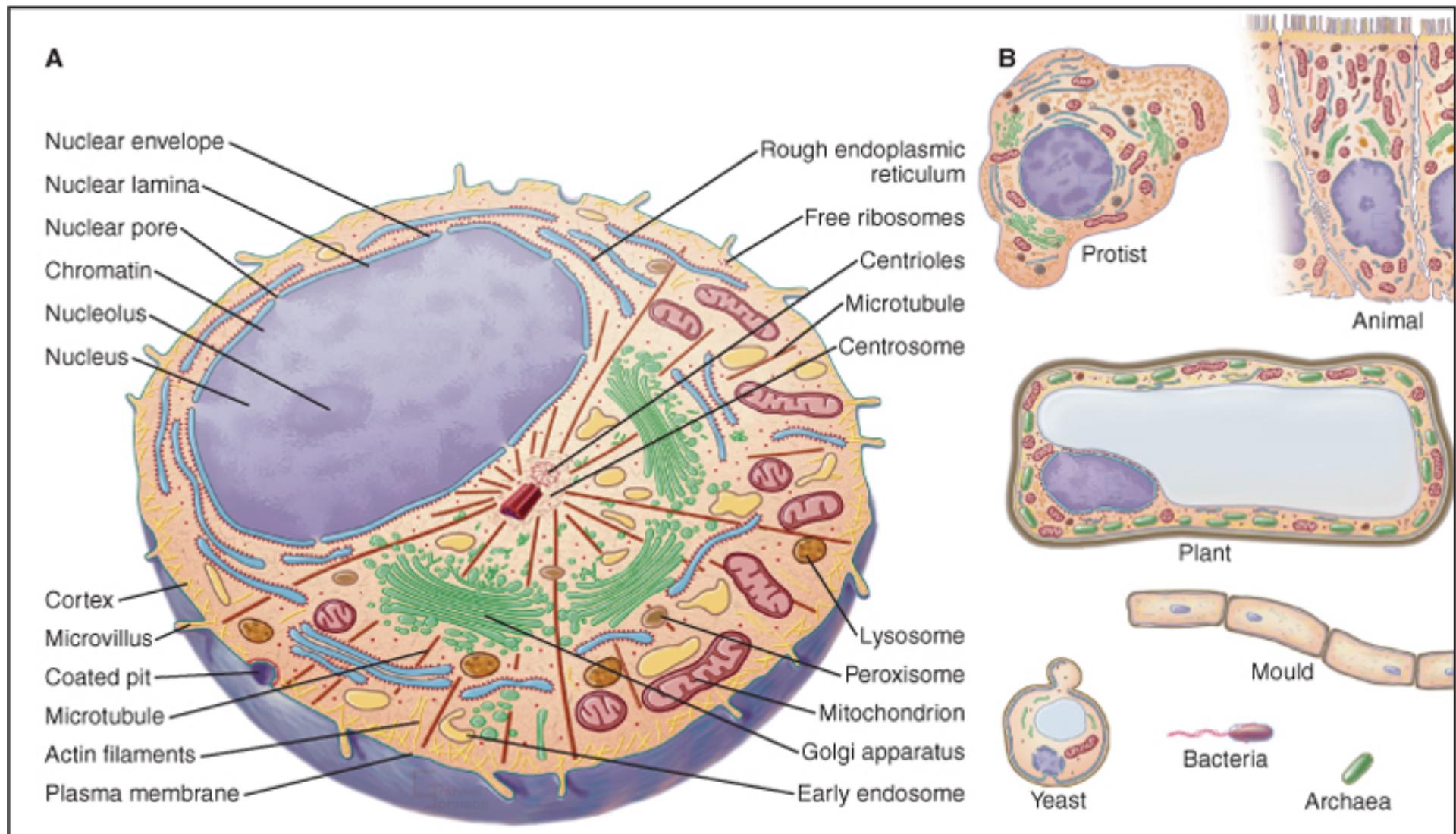
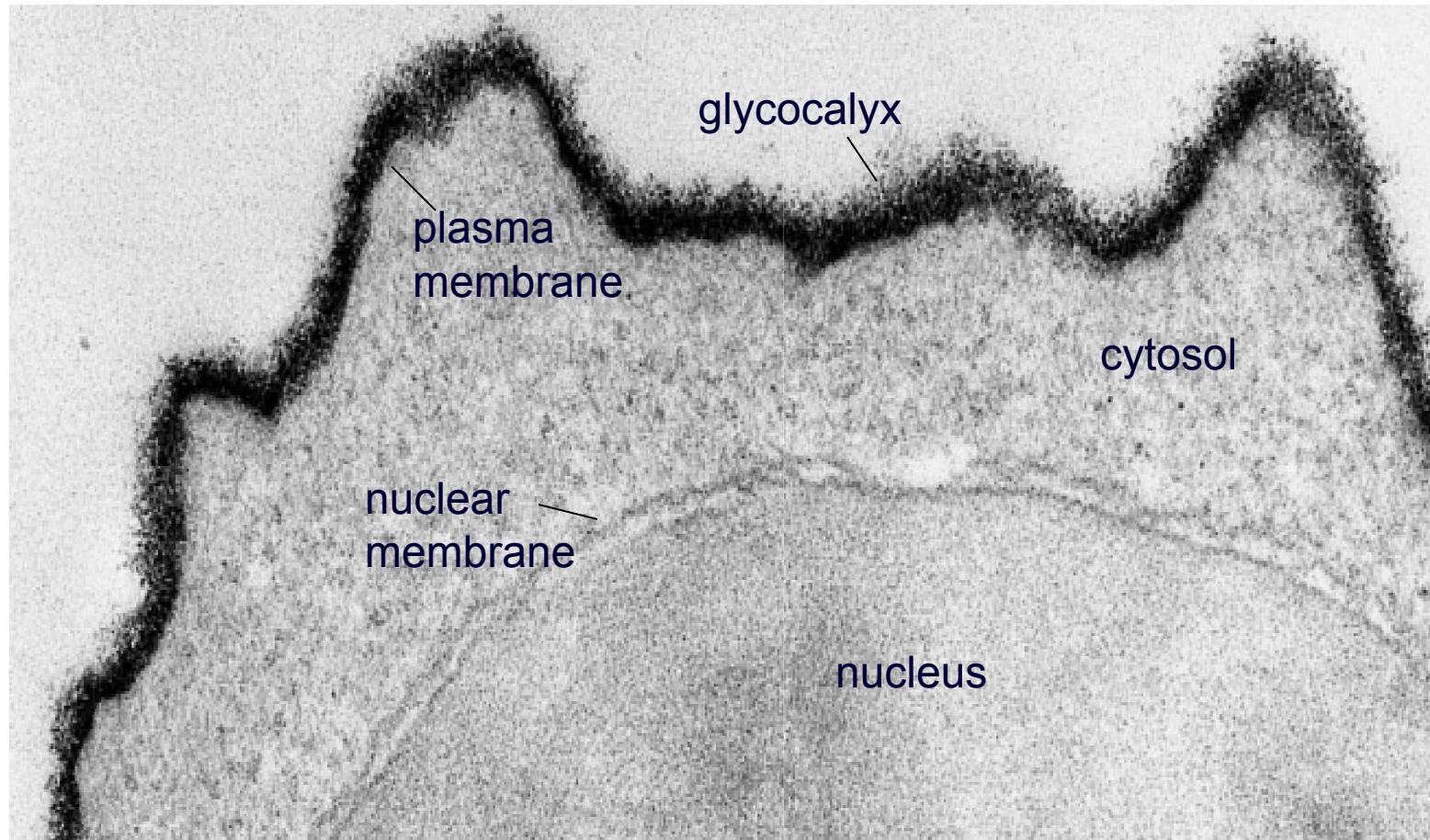


Figure 1-36 Molecular Biology of the Cell 5/e (© Garland Science 2008)

Cells Compared Among All Forms of Life



All Cells Have an Outer (Extracellular) Glycocalyx



Composite Including Electron Micrograph of a Lymphocyte Stained wth Ruthenium Red
(modified from *Molecular Biology of the Cell*)

Cells can be Motile and Predatory

A Neutrophil engulfing a red blood cell by the process of Phagocytosis

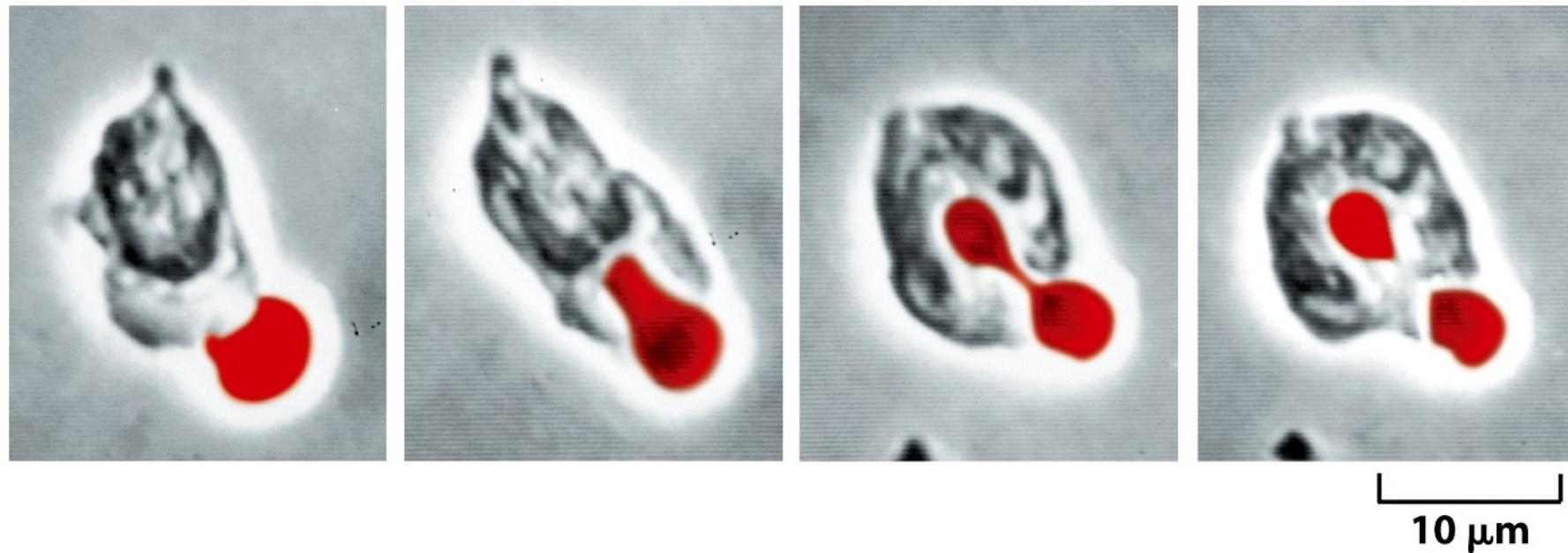


Figure 1-31 Molecular Biology of the Cell 5/e (© Garland Science 2008)

Cells can be Motile and Predatory

