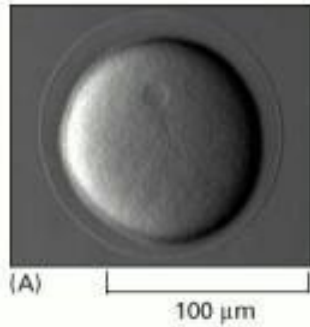


ME 411 / ME 511

# Biological Frameworks for Engineers

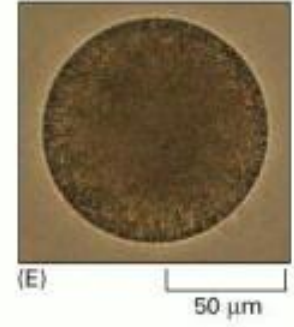
# What are Cells?



(B) Sea Urchin

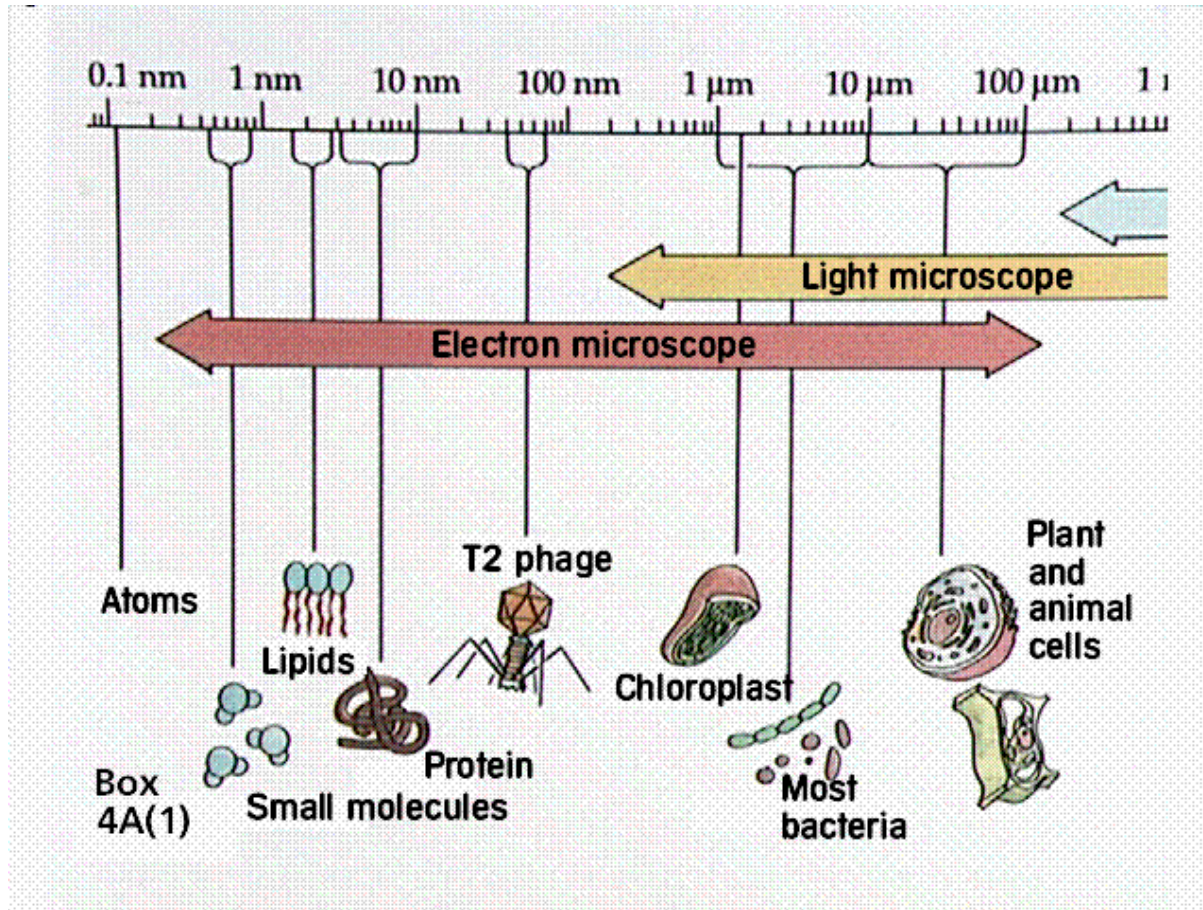


(D) Mouse



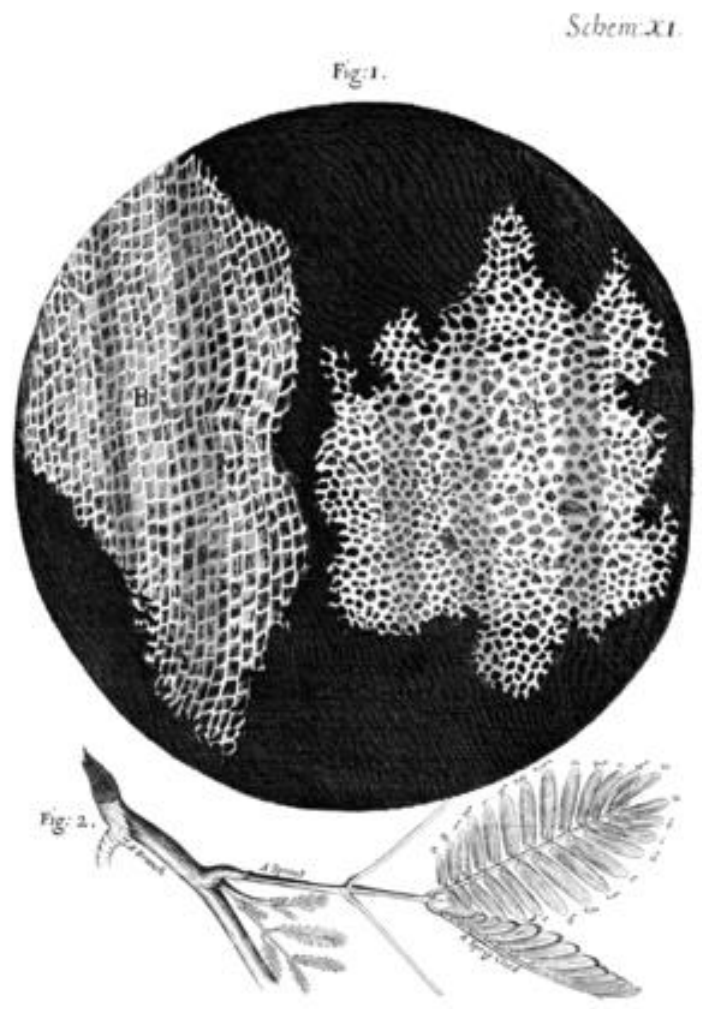
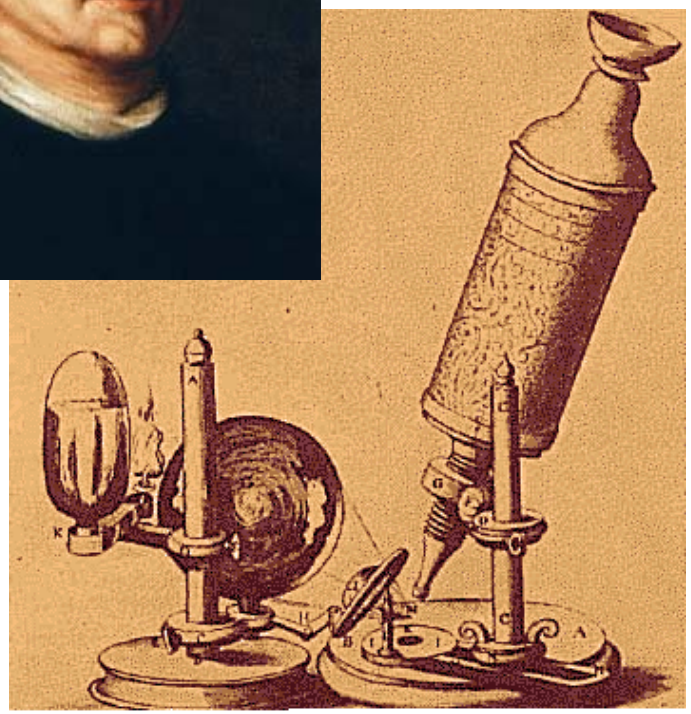
(F) Seaweed

# Cellular Dimensions

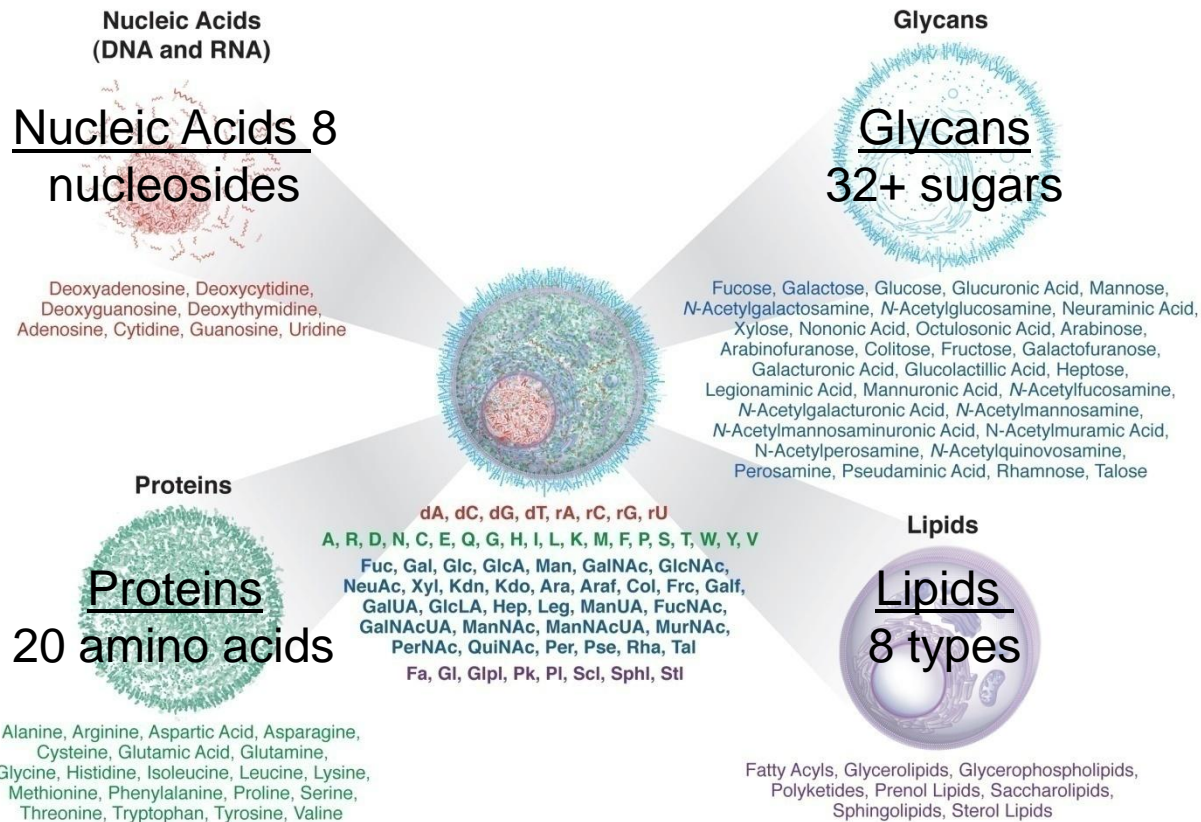




# Robert Hooke



# 68 Basic Building Blocks



“From the construction, modification, and interaction of these components, the cell develops and functions.” –James Marth





Worth1000.com

# Lipid Bilayer



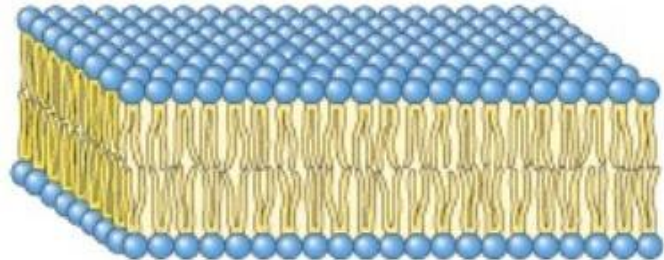
Individual units are wedge-shaped (cross-section of head greater than that of side chain)



**Micelle**  
(a)

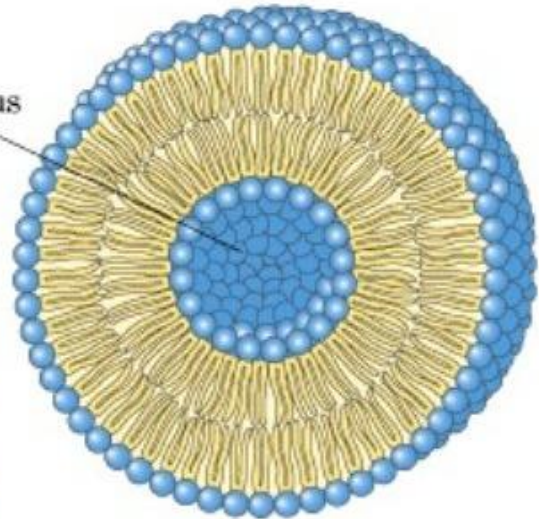


Individual units are cylindrical (cross-section of head equals that of side chain)



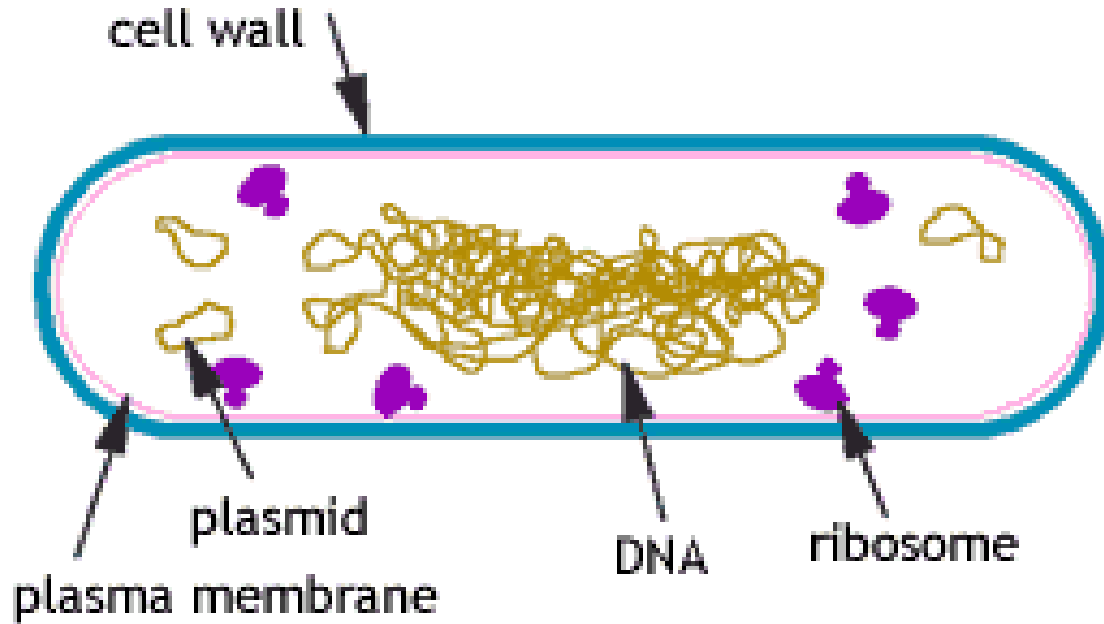
**Bilayer**  
(b)

Aqueous cavity



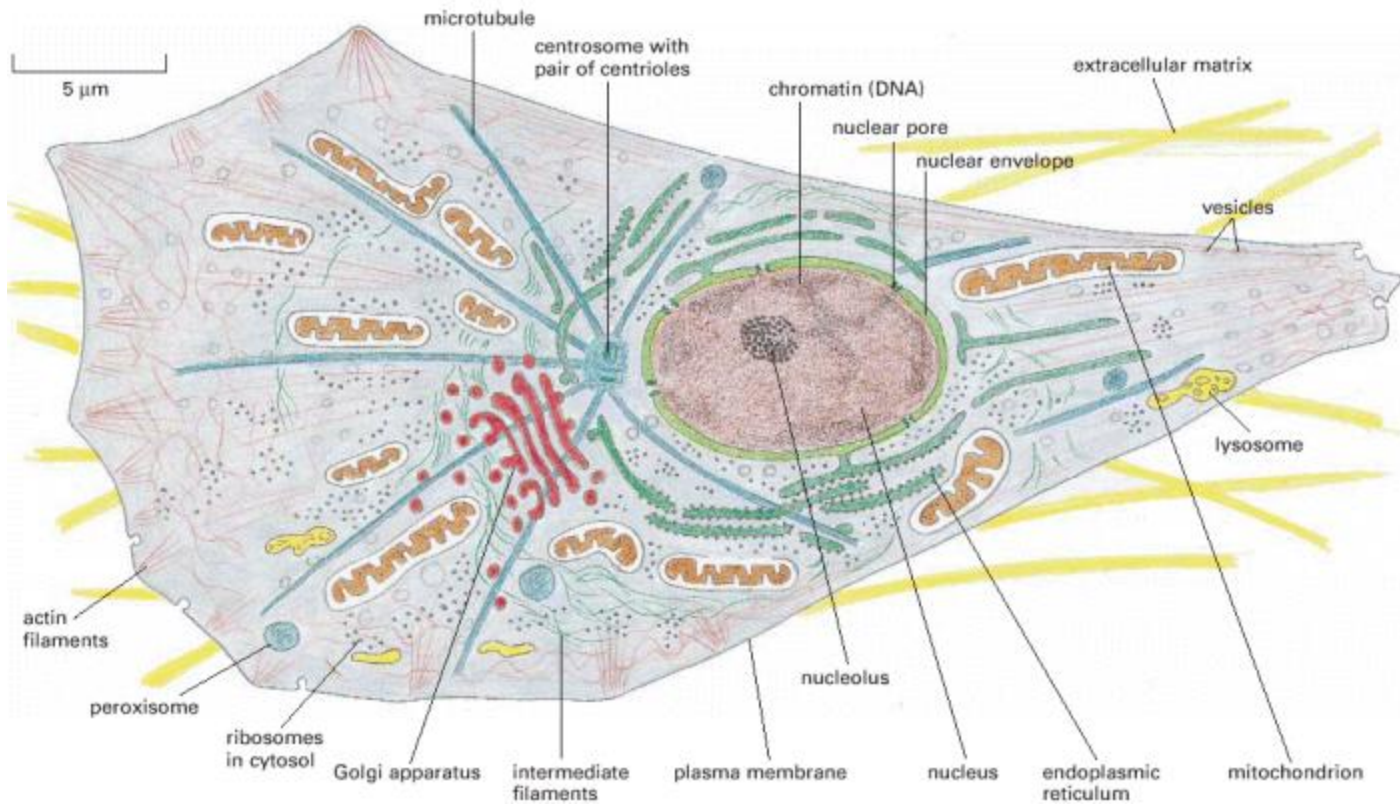
**Liposome**  
(c)

# Prokaryotic Cells



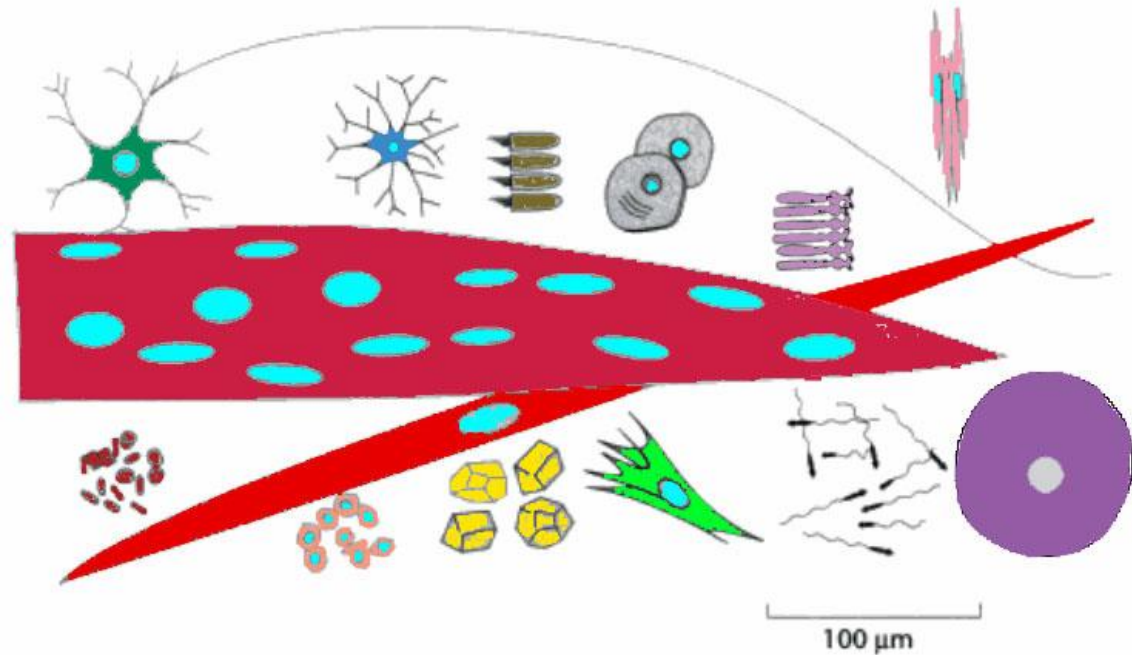


# Eukaryotic Cells



# Cell Function Follows Form

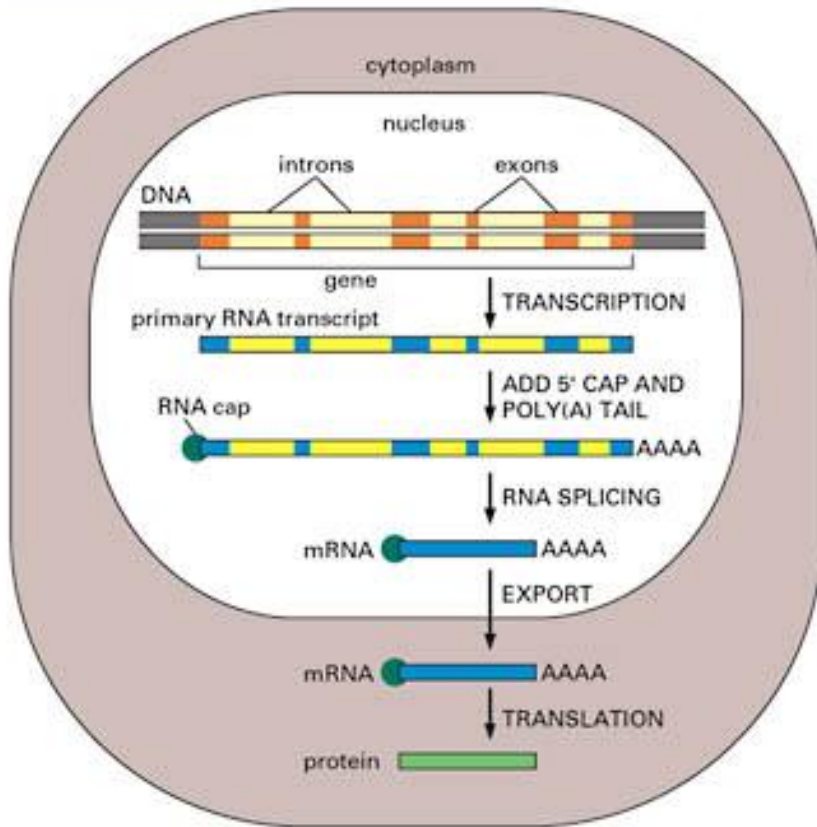
- Cell types:
  - motor neuron
  - osteocyte
  - hair cell
  - adipocyte
  - rods and cones
  - endothelials
  - skeletal muscle
  - smooth muscle
  - RBC
  - lymphocyte
  - epithelial (separated)
  - fibroblasts
  - sperm and egg cells



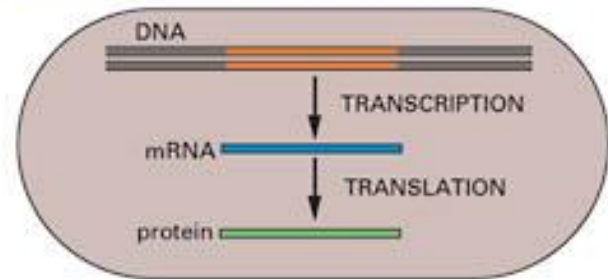
(Drawn to scale)

# Central Dogma

(A) EUCARYOTES



(B) PROCARYOTES





# Cells

## Factory Parallels with Cells

- a. The building framework
- b. Doors
- c. Internal walls
- d. The machines that make products
- e. The central computer
- f. The central computer room (eukaryotic cells only)
- g. The combustion engine
- h. The solar cell (photosynthetic organisms)

# Cells

## Factory Parallels with Cells

- a. The building framework *cell wall, cytoskeleton, cell membrane*
- b. Doors
- c. Internal walls
- d. The machines that make products
- e. The central computer
- f. The central computer room (eukaryotic cells only)
- g. The combustion engine
- h. The solar cell (photosynthetic organisms)

# Cells

## Factory Parallels with Cells

- a. The building framework *cell wall, cytoskeleton, cell membrane*
- b. Doors *pumps, transporters, vesicles, pores*
- c. Internal walls
- d. The machines that make products
- e. The central computer
- f. The central computer room (eukaryotic cells only)
- g. The combustion engine
- h. The solar cell (photosynthetic organisms)



# Cells

## Factory Parallels with Cells

- a. The building framework *cell wall, cytoskeleton, cell membrane*
- b. Doors *pumps, transporters, vesicles, pores*
- c. Internal walls *cell membrane, organelle membranes*
- d. The machines that make products
- e. The central computer
- f. The central computer room (eukaryotic cells only)
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- h. The solar cell (photosynthetic organisms)

# Cells

## Factory Parallels with Cells

- a. The building framework *cell wall, cytoskeleton, cell membrane*
- b. Doors *pumps, transporters, vesicles, pores*
- c. Internal walls *cell membrane, organelle membranes*
- d. The machines that make products *enzymes, ribosomes*
- e. The central computer
- f. The central computer room (eukaryotic cells only)
- g. The combustion engine
- h. The solar cell (photosynthetic organisms)

# Cells

## Factory Parallels with Cells

- a. The building framework *cell wall, cytoskeleton, cell membrane*
- b. Doors *pumps, transporters, vesicles, pores*
- c. Internal walls *cell membrane, organelle membranes*
- d. The machines that make products *enzymes, ribosomes*
- e. The central computer *DNA/chromosomes/genome*
- f. The central computer room (eukaryotic cells only)
- g. The combustion engine
- h. The solar cell (photosynthetic organisms)



# Cells

## Factory Parallels with Cells

- a. The building framework *cell wall, cytoskeleton, cell membrane*
- b. Doors *pumps, transporters, vesicles, pores*
- c. Internal walls *cell membrane, organelle membranes*
- d. The machines that make products *enzymes, ribosomes*
- e. The central computer *DNA/chromosomes/genome*
- f. The central computer room (eukaryotic cells only) *nucleus*
- g. The combustion engine
- h. The solar cell (photosynthetic organisms)

# Cells

## Factory Parallels with Cells

- a. The building framework *cell wall, cytoskeleton, cell membrane*
- b. Doors *pumps, transporters, vesicles, pores*
- c. Internal walls *cell membrane, organelle membranes*
- d. The machines that make products *enzymes, ribosomes*
- e. The central computer *DNA/chromosomes/genome*
- f. The central computer room (eukaryotic cells only) *nucleus*
- g. The combustion engine *mitochondria (cell membrane)*
- h. The solar cell (photosynthetic organisms)

# Cells

## Factory Parallels with Cells

- a. The building framework *cell wall, cytoskeleton, cell membrane*
- b. Doors *pumps, transporters, vesicles, pores*
- c. Internal walls *cell membrane, organelle membranes*
- d. The machines that make products *enzymes, ribosomes*
- e. The central computer *DNA/chromosomes/genome*
- f. The central computer room (eukaryotic cells only) *nucleus*
- g. The combustion engine *mitochondria (cell membrane)*
- h. The solar cell (photosynthetic organisms) *chloroplasts*



Questions ?