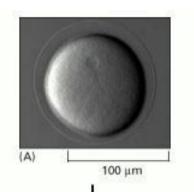
#### ME 498 / ME 599

## Biological Frameworks for Engineers

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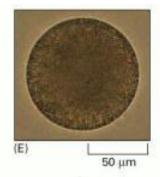


#### What are Cells?



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(C) 50 μm





Sea Urchin



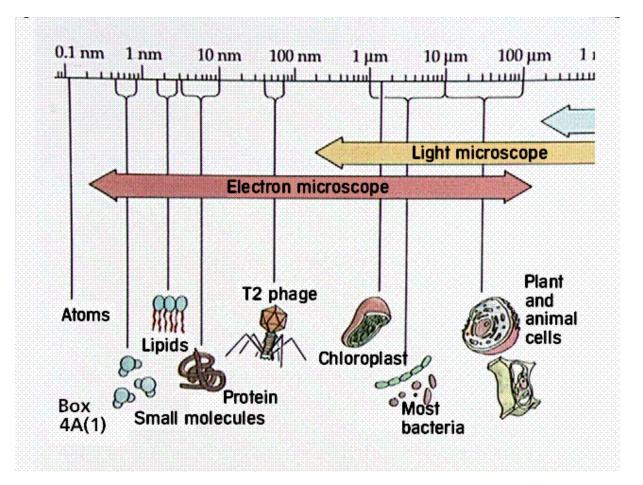
Mouse



Seaweed WASHINGTON

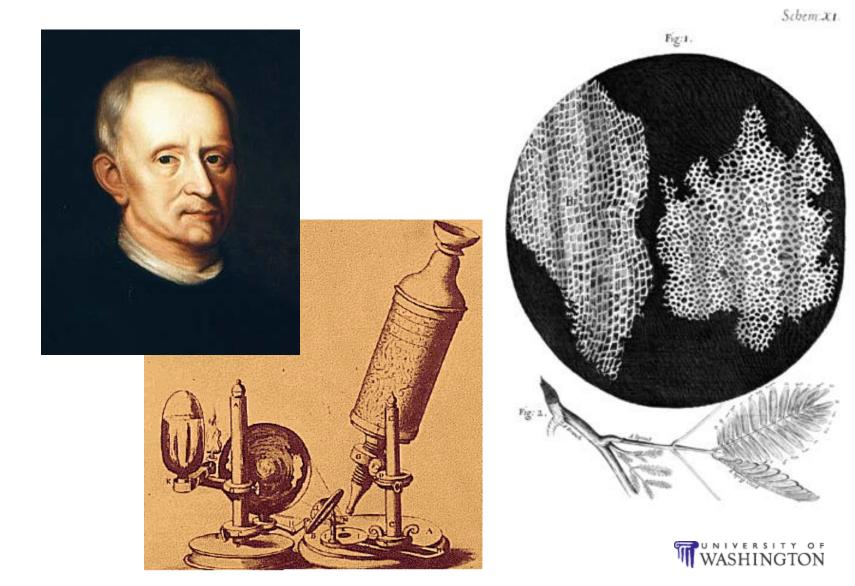


## **Cellular** Dimensions





#### Robert Hooke



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## 68 Basic Building Blocks

Nucleic Acids (DNA and RNA)



Deoxyadenosine, Deoxycytidine, Deoxyguanosine, Deoxythymidine, Adenosine, Cytidine, Guanosine, Uridine



Fucose, Galactose, Glucose, Glucuronic Acid, Mannose,
N-Acetylgalactosamine, N-Acetylglucosamine, Neuraminic Acid,
Xylose, Nononic Acid, Octulosonic Acid, Arabinose,
Arabinofuranose, Colitose, Fructose, Galactofuranose,
Galacturonic Acid, Glucolactillic Acid, Heptose,
Legionaminic Acid, Mannuronic Acid, N-Acetylfucosamine,
N-Acetylgalacturonic Acid, N-Acetylmuramic Acid,
N-Acetylperosamine, N-Acetylquinovosamine,
Perosamine, Pseudaminic Acid, Rhamnose, Talose

Proteins



Alanine, Arginine, Aspartic Acid, Asparagine, Cysteine, Glutamic Acid, Glutamine, Glycine, Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Proline, Serine, Threonine, Tryptophan, Tyrosine, Valine

dA, dC, dG, dT, rA, rC, rG, rU A, R, D, N, C, E, Q, G, H, I, L, K, M, F, P, S, T, W, Y, V

Fuc, Gal, Gic, GicA, Man, GalNAc, GicNAc, NeuAc, Xyl, Kdn, Kdo, Ara, Araf, Col, Frc, Galf, GalUA, GicLA, Hep, Leg, ManUA, FucNAc, GaiNAcUA, ManNAc, ManNAcUA, MurNAc, PerNAc, QuiNAc, Per, Pse, Rha, Tal

Fa, Gl, Glpl, Pk, Pl, Scl, Sphl, Stl

Lipids

Lipids 8 types

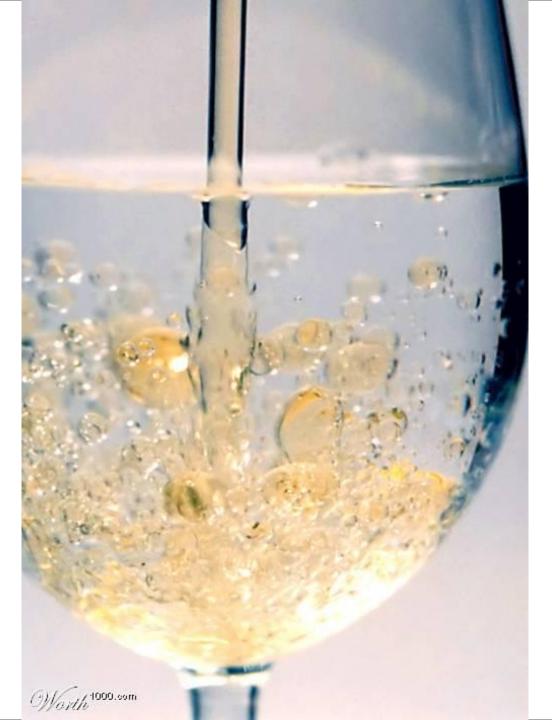
Fatty Acyls, Glycerolipids, Glycerophospholipids, Polyketides, Prenol Lipids, Saccharolipids, Sphingolipids, Sterol Lipids

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

J. Marth Nature Cell Biology, 2008,10(9):1015-16

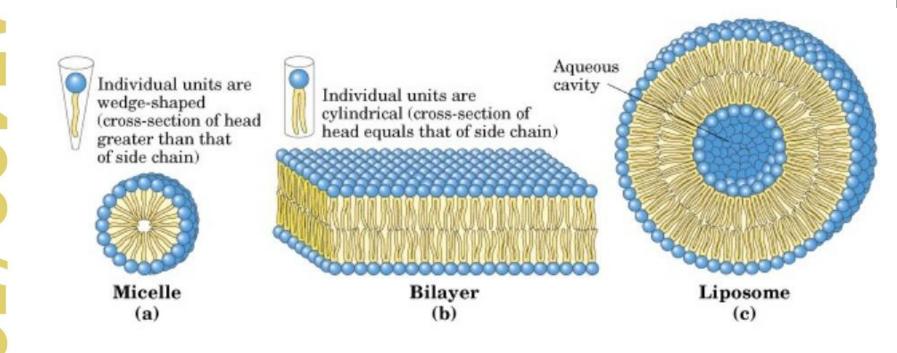








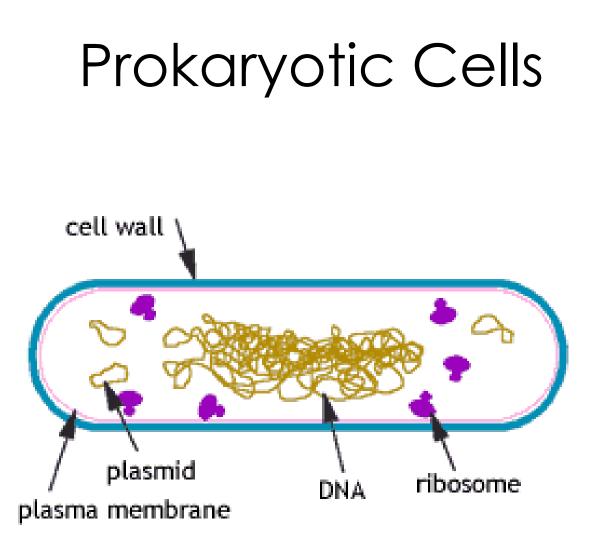
#### Lipid Bilayer



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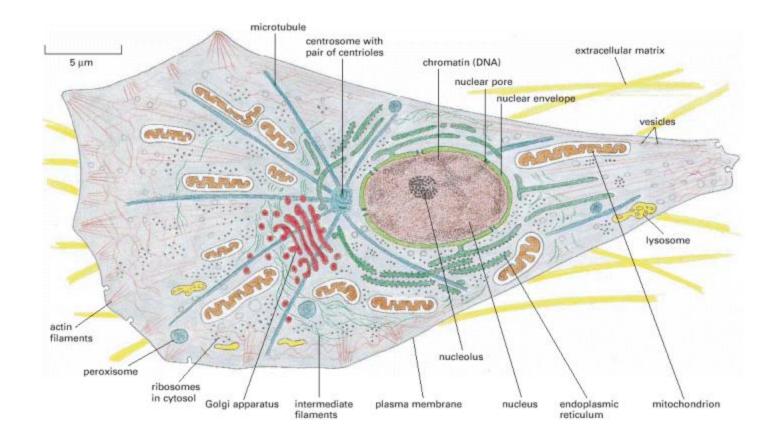








### Eukaryotic Cells



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# Cell Function Follows Form

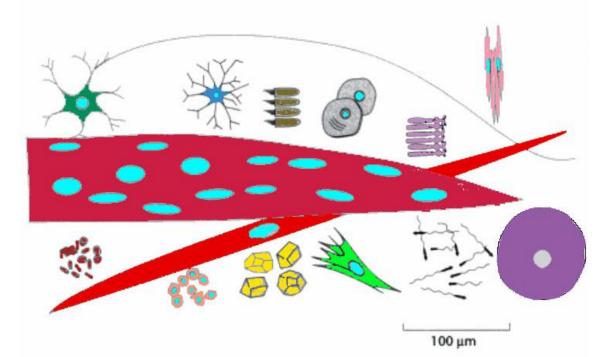
#### Cell types:

- motor neuron
- osteocyte
- hair cell

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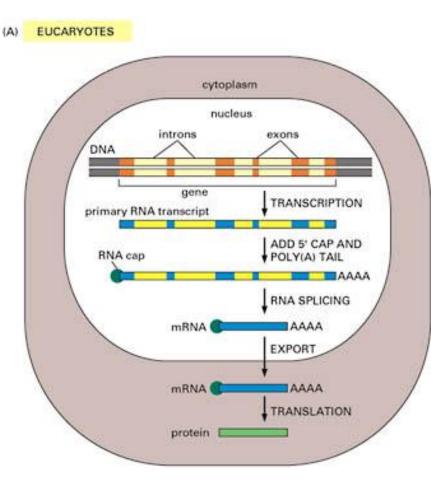
- adipocyte
- rods and cones
- endothelials
- skeletal muscle
- smooth muscle
- RBC
- lymphocyte
- epithelial (separated)
- fibroblasts
- sperm and egg cells



(Drawn to scale)

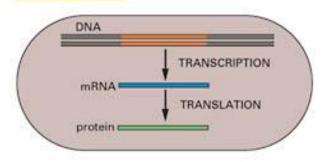


### Central Dogma



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(B) PROCARYOTES





#### Cells

#### Factory Parallels with Cells

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- 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 ?

