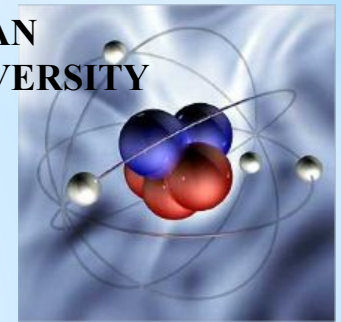




The Ministry of Education and Science of the Republic of KAZAKHSTAN  
KHOJA AKHMET YASSAWI INTERNATIONAL KAZAKH-TURKISH UNIVERSITY  
FACULTY OF NATURAL SCIENCES



DEPARTMENT OF ECOLOGY AND CHEMISTRY

# Topic of the lecture:

# Introduction to Biochemistry

Specialty, Code of specialty : 5B011200 (F) – Chemistry

Discipline Teacher: Sarbayeva M.T

TURKESTAN 2017 y.

# The content of the lecture:

## What is Biochemistry?

- Biochemistry = chemistry of life.
- Biochemists use physical and chemical principles to explain biology at the molecular level.
- Basic principles of biochemistry are common to all living organism

# How does biochemistry impact you?

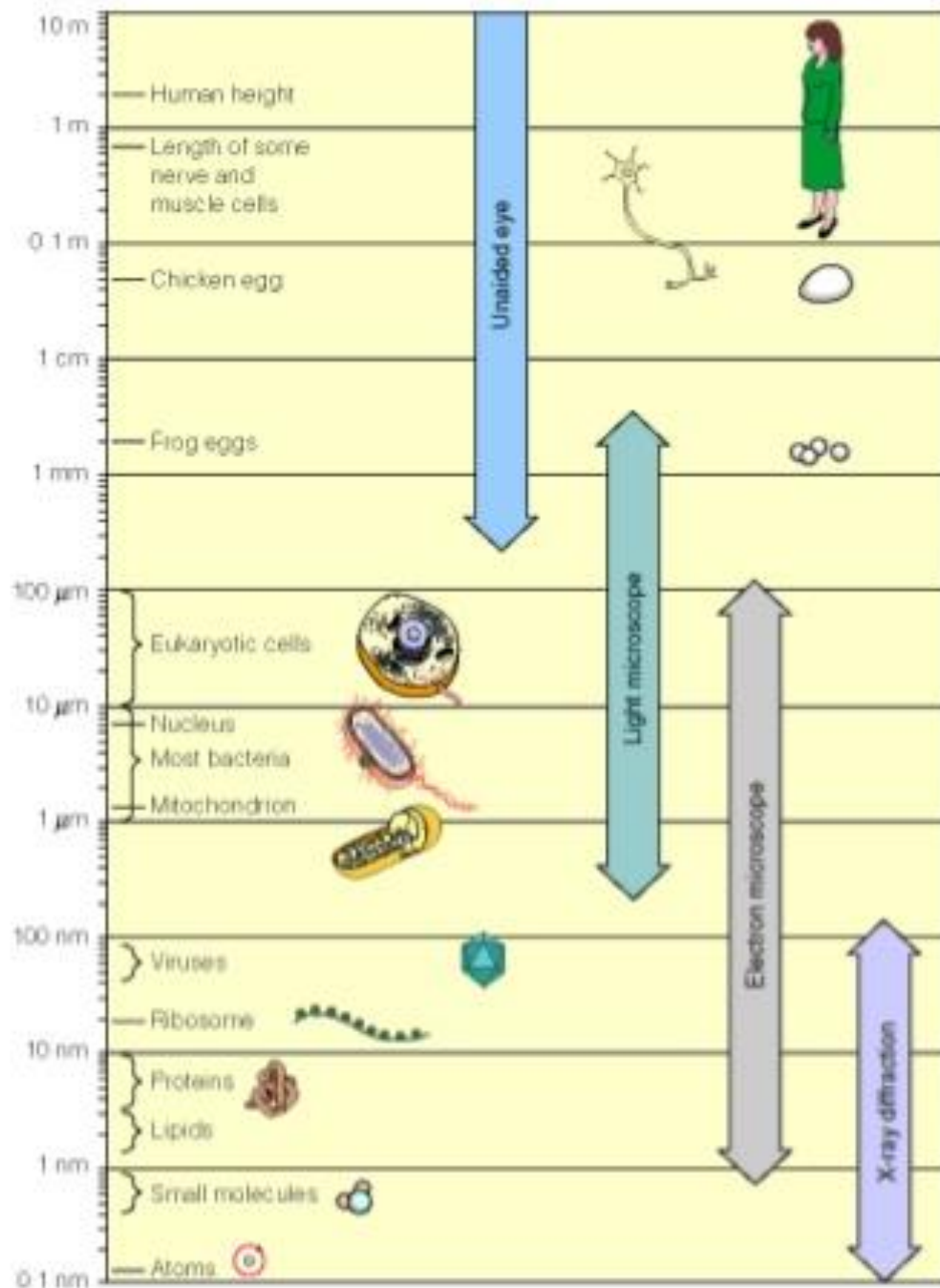
- Medicine
- Agriculture
- Industrial applications
- Environmental applications

# Principle Areas of Biochemistry

- Structure and function of biological macromolecules
- Metabolism – anabolic and catabolic processes.
- Molecular Genetics – How life is replicated. Regulation of protein synthesis

# Organization of Life

- elements
- simple organic compounds (monomers) •  
macromolecules (polymers)
- supramolecular structures
- organelles
- cells
- tissues
- organisms



## Range of the sizes of objects studies by Biochemist and Biologist

1 angstrom = 0.1 nm

# Elements of Life

IA																0													
1 <b>H</b> 1.008	IIA										3 <b>B</b> 10.81	4 <b>C</b> 12.01	5 <b>N</b> 14.01	6 <b>O</b> 16.00	7 <b>F</b> 19.00	8 <b>Ne</b> 20.18													
3 <b>Li</b> 6.941	4 <b>Be</b> 9.012											13 <b>Al</b> 26.98	14 <b>Si</b> 28.09	15 <b>P</b> 30.97	16 <b>S</b> 32.07	17 <b>Cl</b> 35.45	18 <b>Ar</b> 39.95												
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.31	III B	IV B	VB	VIB	VII B	VIII B			IB	II B	19 <b>K</b> 39.10	20 <b>Ca</b> 40.08	21 <b>Sc</b> 44.96	22 <b>Ti</b> 47.87	23 <b>V</b> 50.94	24 <b>Cr</b> 52.00	25 <b>Mn</b> 54.94	26 <b>Fe</b> 55.85	27 <b>Co</b> 58.93	28 <b>Ni</b> 58.69	29 <b>Cu</b> 63.55	30 <b>Zn</b> 65.39	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.61	33 <b>As</b> 74.92	34 <b>Se</b> 78.96	35 <b>Br</b> 79.90	36 <b>Kr</b> 83.80
37 <b>Rb</b> 85.47	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.91	40 <b>Zr</b> 91.22	41 <b>Nb</b> 92.91	42 <b>Mo</b> 95.94	43 <b>Tc</b> (98)	44 <b>Ru</b> 101.1	45 <b>Rh</b> 102.9	46 <b>Pd</b> 106.4	47 <b>Ag</b> 107.9	48 <b>Cd</b> 112.4	49 <b>In</b> 114.8	50 <b>Sn</b> 118.7	51 <b>Sb</b> 121.8	52 <b>Te</b> 127.6	53 <b>I</b> 126.9	54 <b>Xe</b> 131.3												
55 <b>Cs</b> 132.9	56 <b>Ba</b> 137.3	57* <b>La</b> 138.9	72 <b>Hf</b> 178.5	73 <b>Ta</b> 180.9	74 <b>W</b> 183.8	75 <b>Re</b> 186.2	76 <b>Os</b> 190.2	77 <b>Ir</b> 192.2	78 <b>Pt</b> 195.1	79 <b>Au</b> 197.0	80 <b>Hg</b> 200.6	81 <b>Tl</b> 204.4	82 <b>Pb</b> 207.2	83 <b>Bi</b> 209.0	84 <b>Po</b> (209)	85 <b>At</b> (210)	86 <b>Rn</b> (222)												
87 <b>Fr</b> (223)	88 <b>Ra</b> (226)	89*** <b>Ac</b> (227)	104 <b>Rf</b> (261)	105 <b>Db</b> (262)	106 <b>Sg</b> (263)	107 <b>Bh</b> (264)	108 <b>Hs</b> (265)	109 <b>Mt</b> (268)	110	111	112	113	114	115	116	117	118 (293)												

58* <b>Ce</b> 140.1	59 <b>Pr</b> 140.9	60 <b>Nd</b> 144.2	61 <b>Pm</b> (145)	62 <b>Sm</b> 150.4	63 <b>Eu</b> 152.0	64 <b>Gd</b> 157.3	65 <b>Tb</b> 158.9	66 <b>Dy</b> 162.5	67 <b>Ho</b> 164.9	68 <b>Er</b> 167.3	69 <b>Tm</b> 168.9	70 <b>Yb</b> 173.0	71 <b>Lu</b> 175.0
90*** <b>Th</b> 232.0	91 <b>Pa</b> 231	92 <b>U</b> 238.0	93 <b>Np</b> (237)	94 <b>Pu</b> (244)	95 <b>Am</b> (243)	96 <b>Cm</b> (247)	97 <b>Bk</b> (247)	98 <b>Cf</b> (251)	99 <b>Es</b> (252)	100 <b>Fm</b> (257)	101 <b>Md</b> (258)	102 <b>No</b> (259)	103 <b>Lr</b> (262)

Most abundant, essential for all organisms: C, N, O, P, S, H

Less abundant, essential for all organisms : Na, Mg, K, Ca, Cl

Trace levels, essential for all organism: Mn, Fe, Co, Cu, Zn

Trace levels, essential for some organisms: V, Cr, Mo, B, Al, Ga, Sn, Si, As, Se, I,

-macro biogen

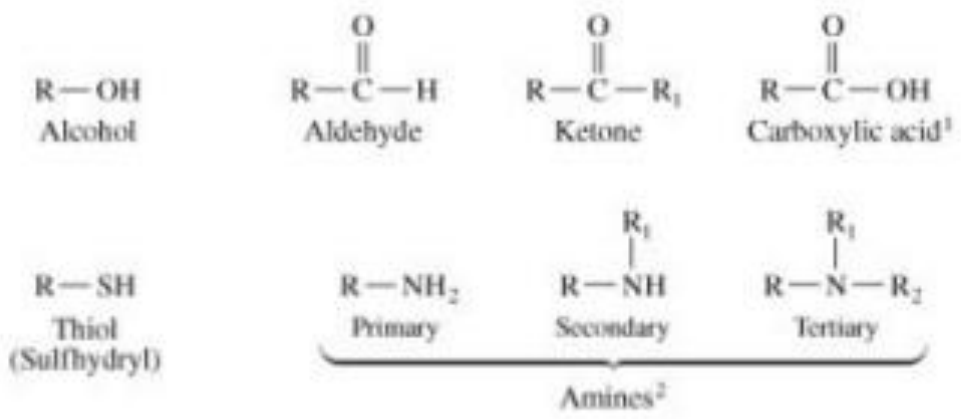
-oligo

-micro

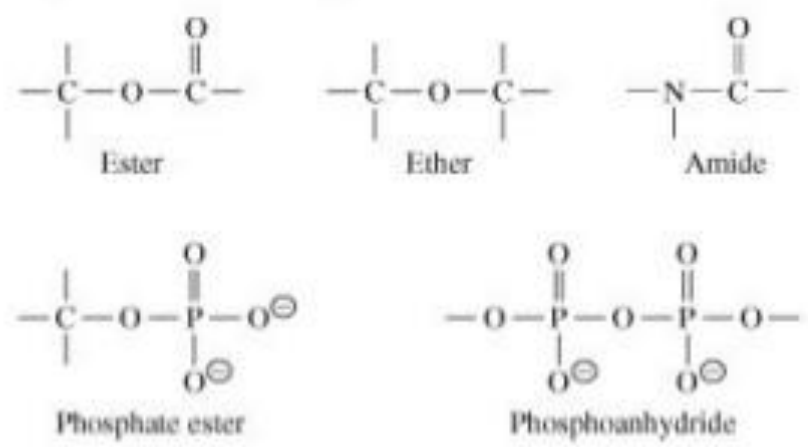
-ultra

# Important compounds, functional groups

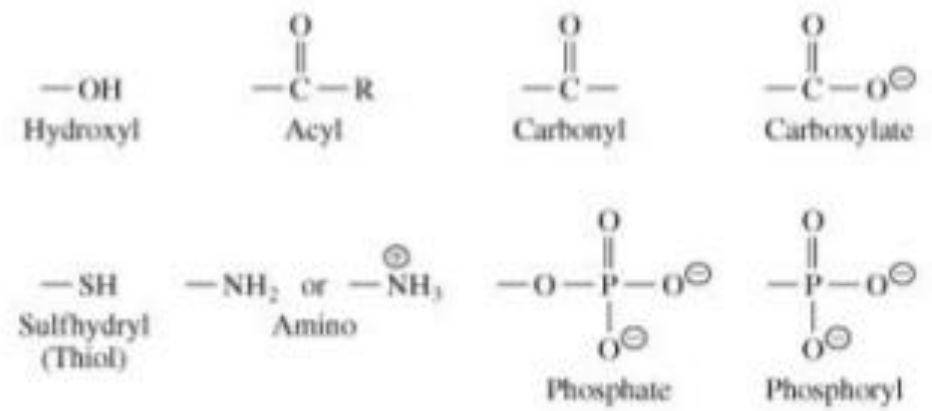
(a) Organic compounds



(c) Linkages in biochemical compounds



(b) Functional groups



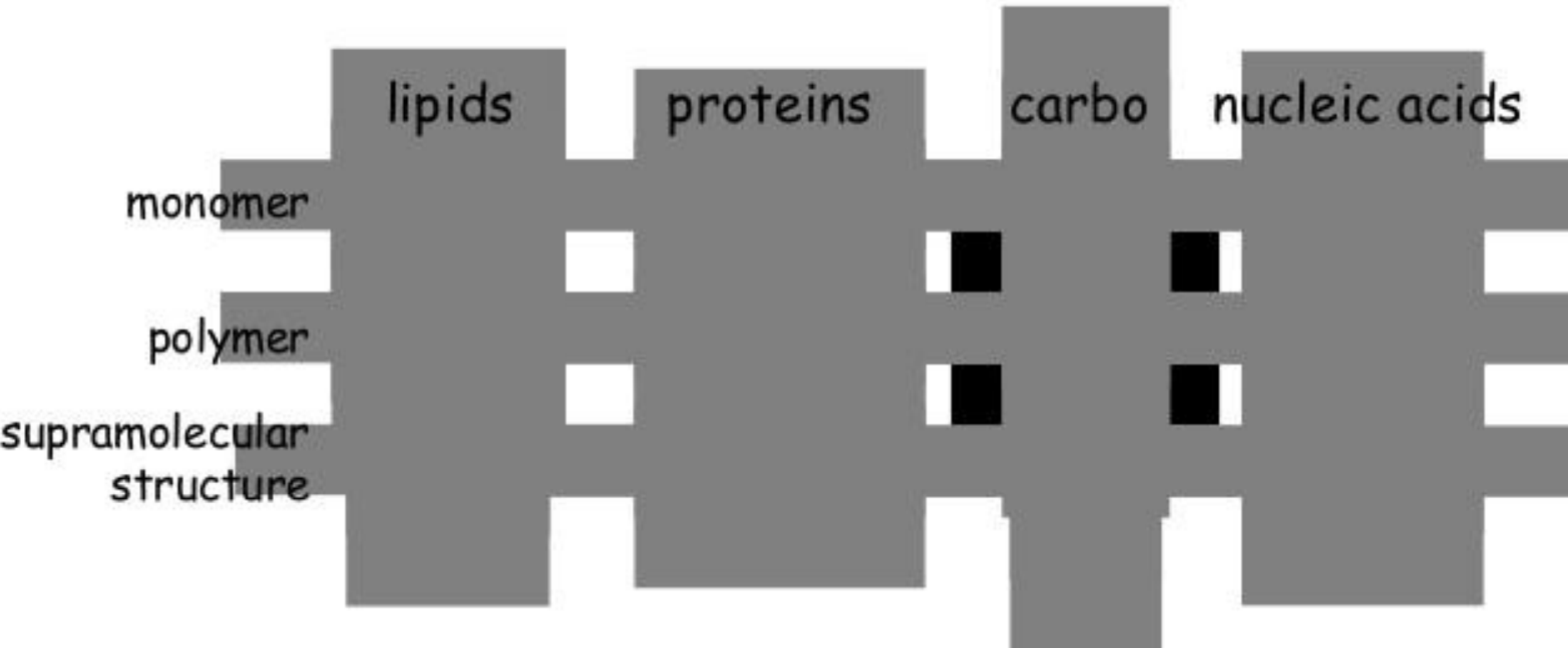
<sup>1</sup> Under most biological conditions, carboxylic acids exist as carboxylate anions:



<sup>2</sup> Under most biological conditions, amines exist as ammonium ions:  $R-\overset{\oplus}{N}H_3$ ,  $R-\overset{\oplus}{N}H_2$ , and  $R-\overset{\oplus}{N}H-R_2$ .



# Many Important Biomolecules are Polymers

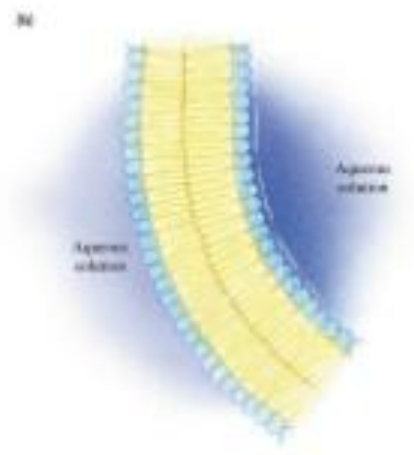
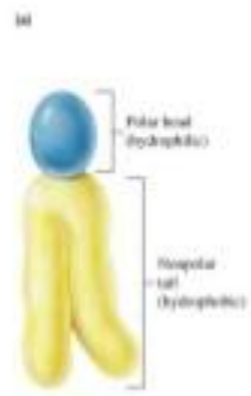
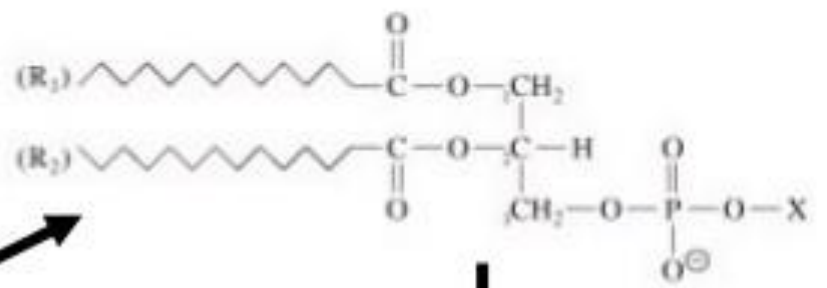
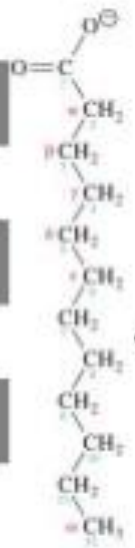


# Lipids

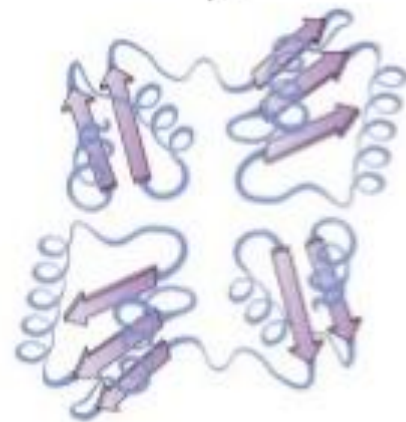
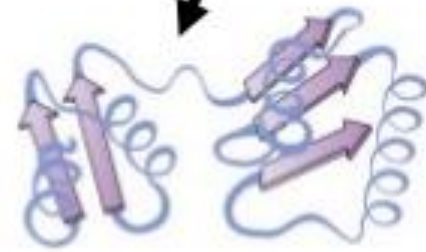
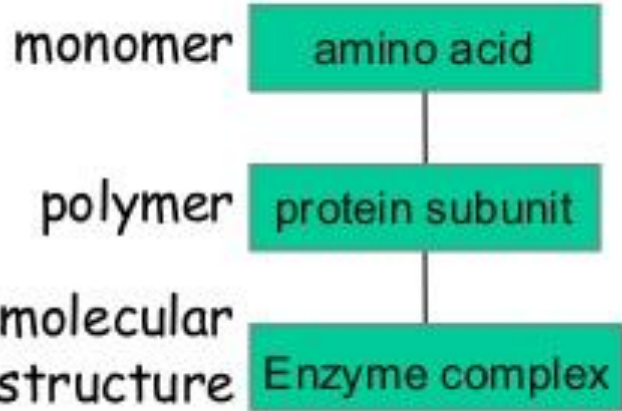
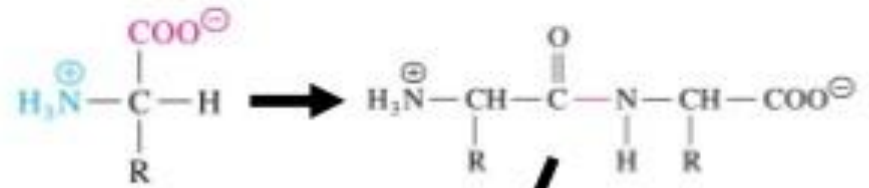
monomer

polymer

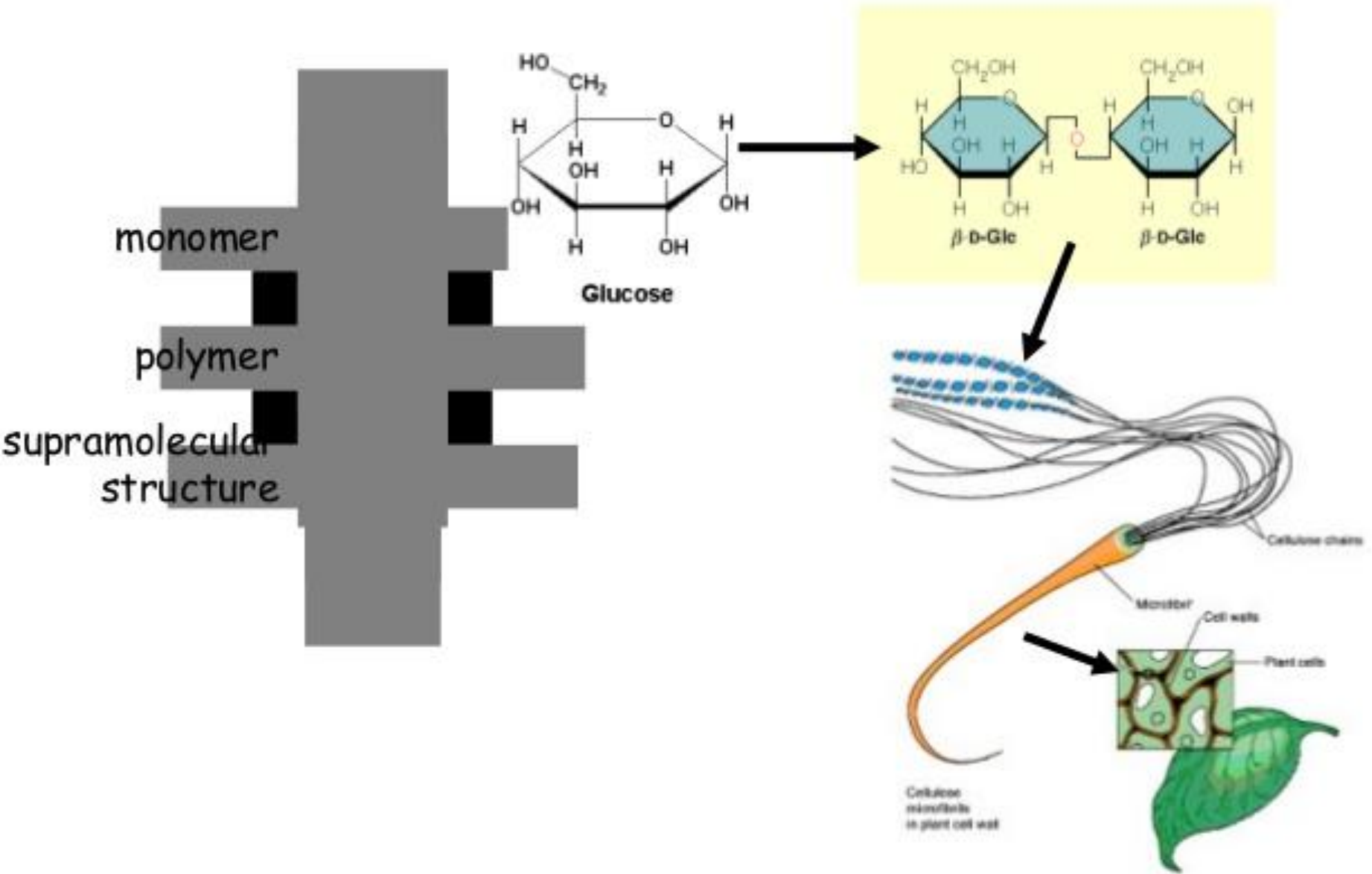
supramolecular structure



# Proteins



# Carbohydrates

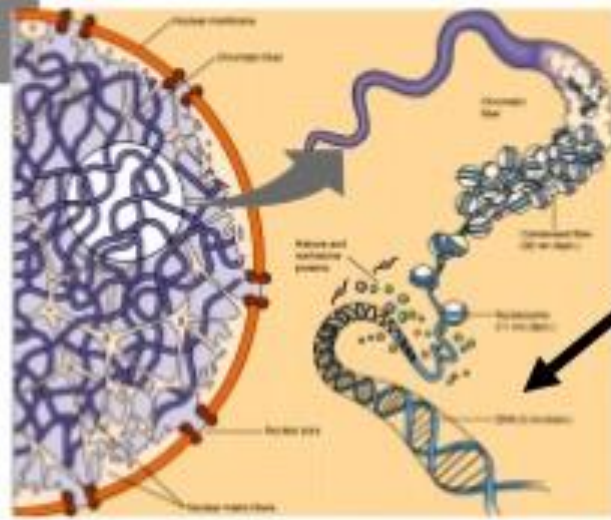
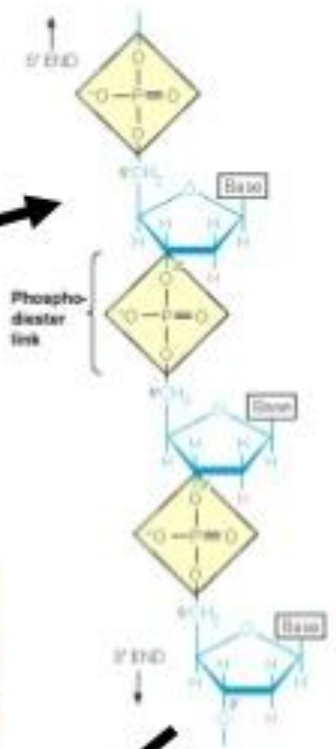
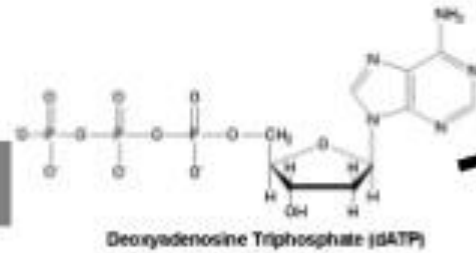


# Nucleic Acids

monomer

polymer

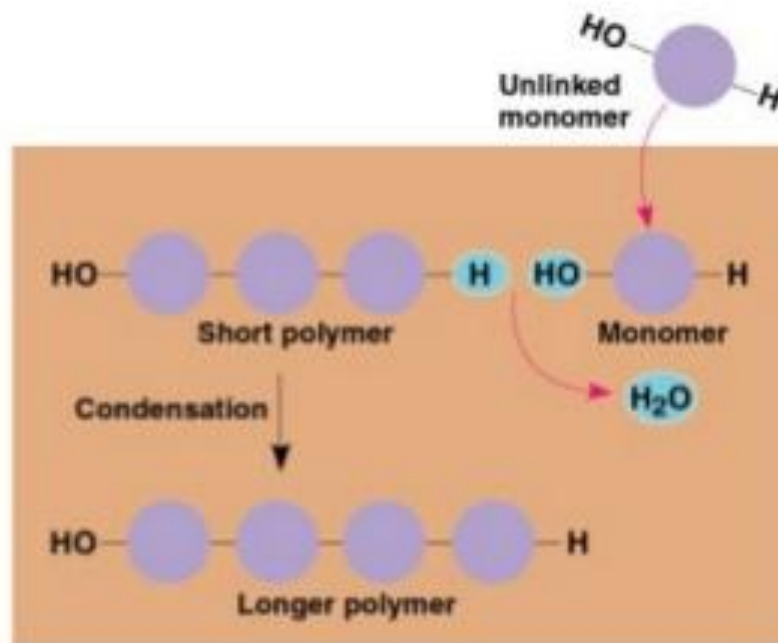
supramolecular  
structure



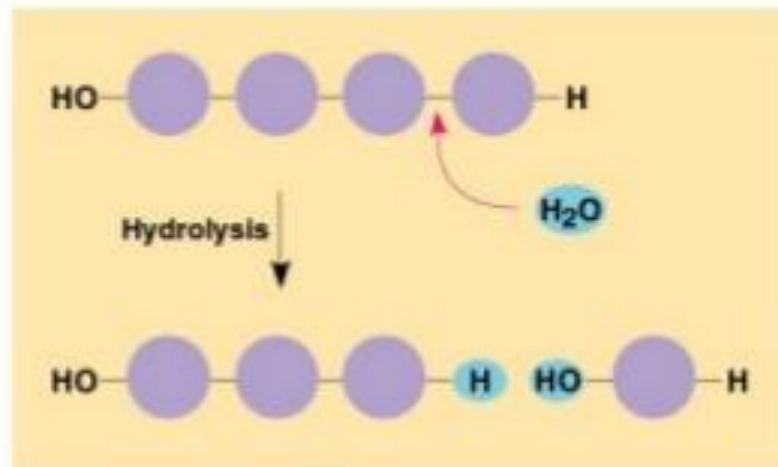
**Common theme:**

**Monomers form polymers through condensations**

**Polymers are broken down through hydrolysis.**

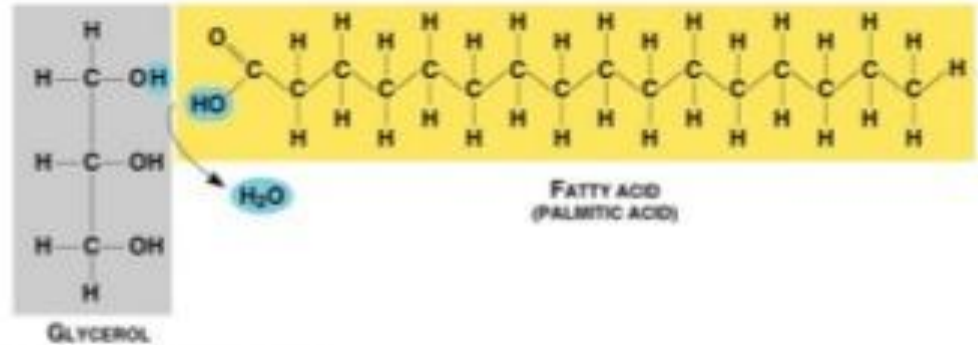
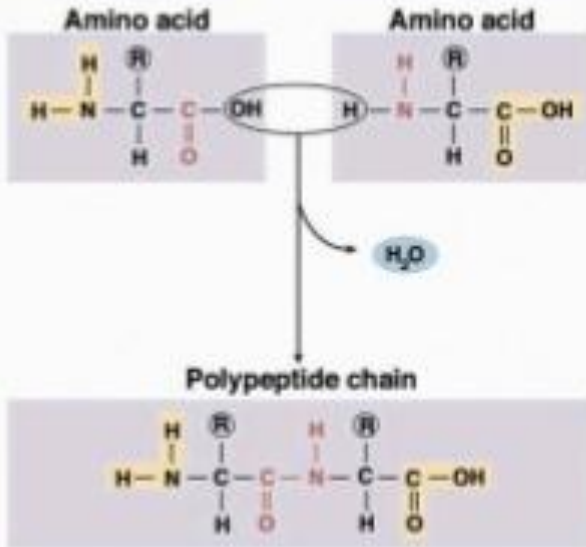


(a) Condensation (dehydration) synthesis of a polymer

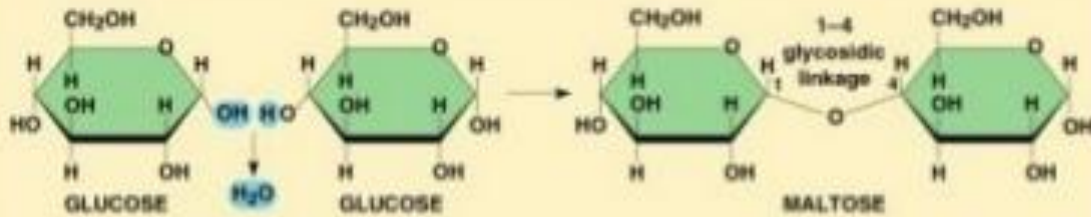
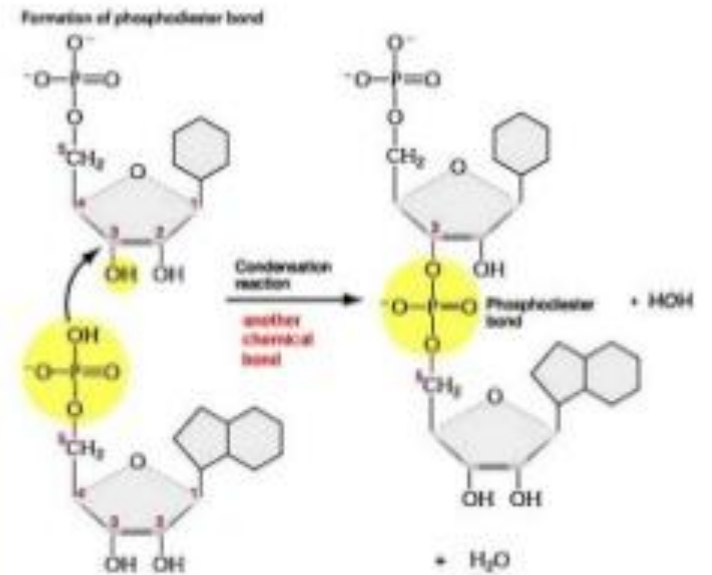


(b) Hydrolysis of a polymer

# Peptide Bond

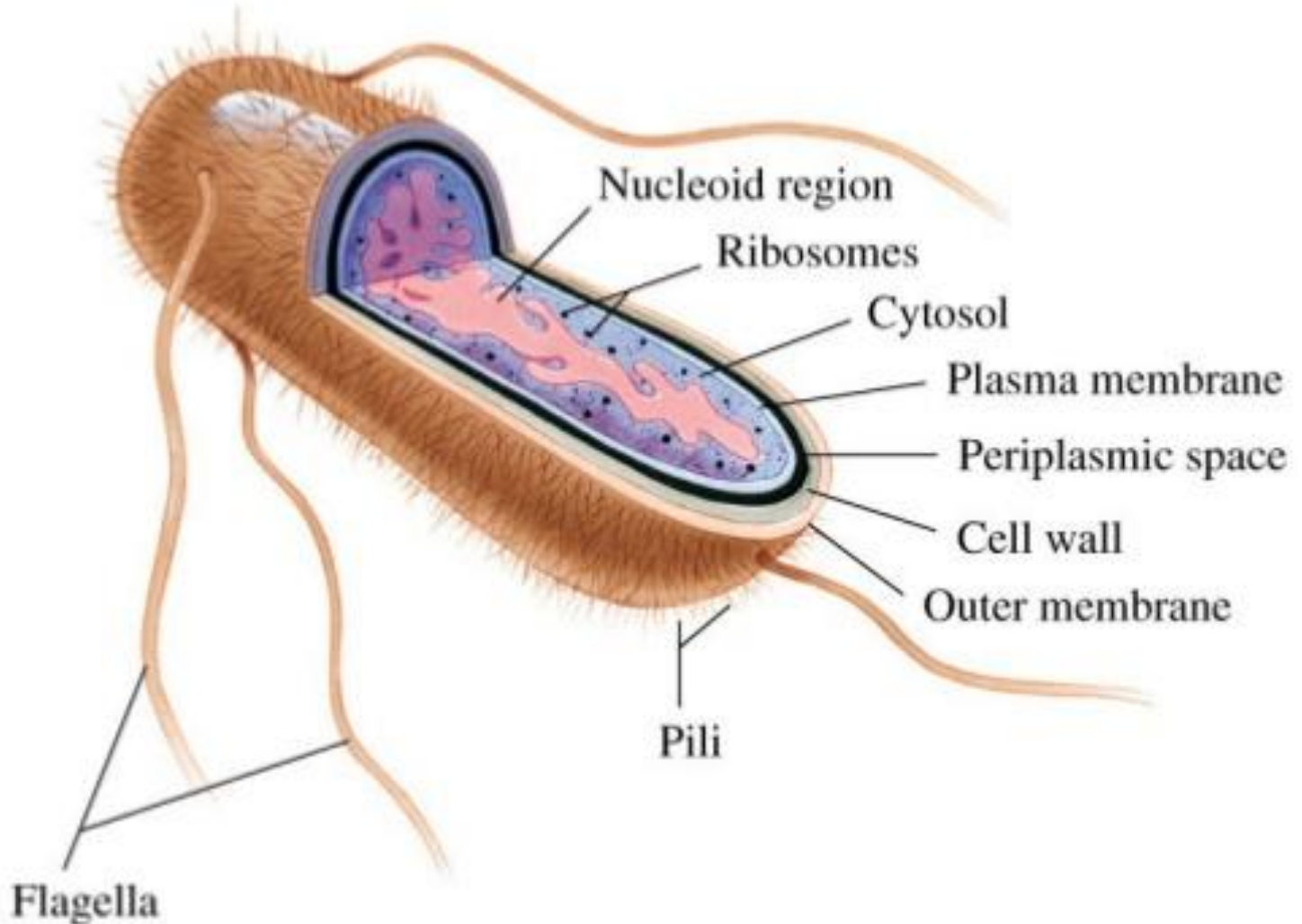


(a) Dehydration synthesis  
(condensation reaction)



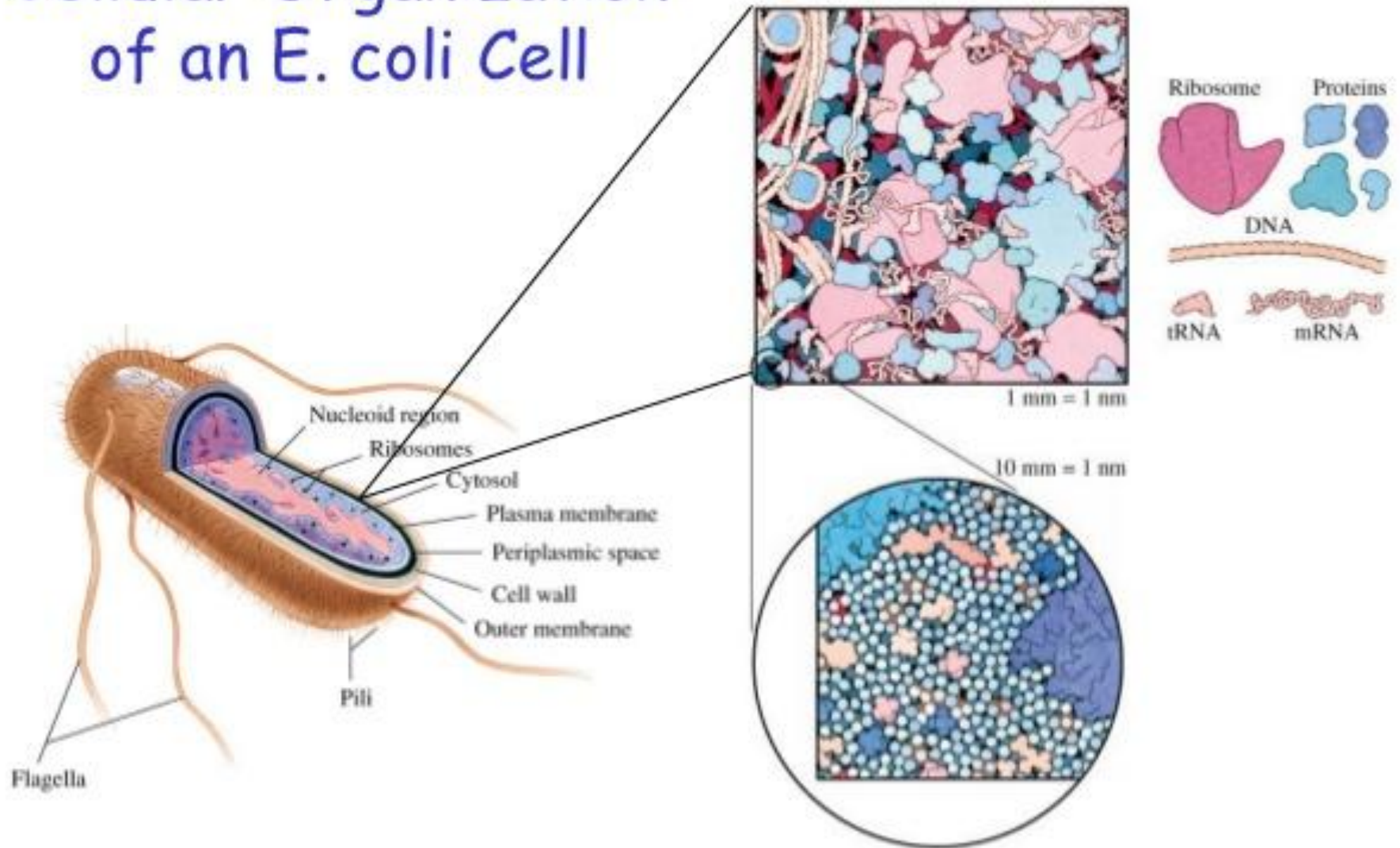
(a) Condensation synthesis of maltose

# Prokaryote Cell





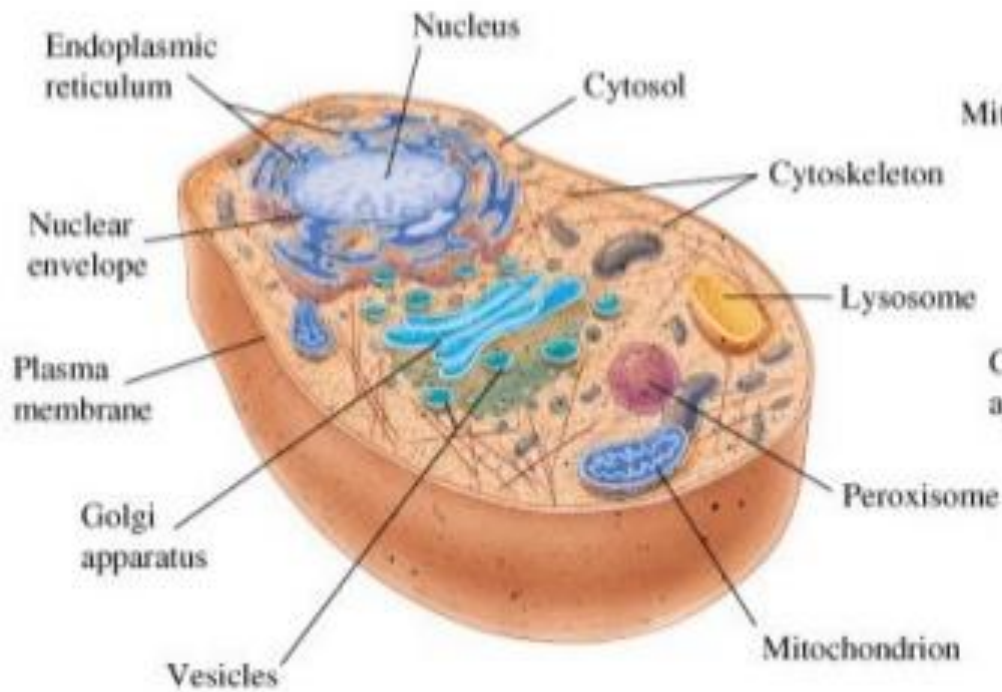
# Cellular Organization of an E. coli Cell



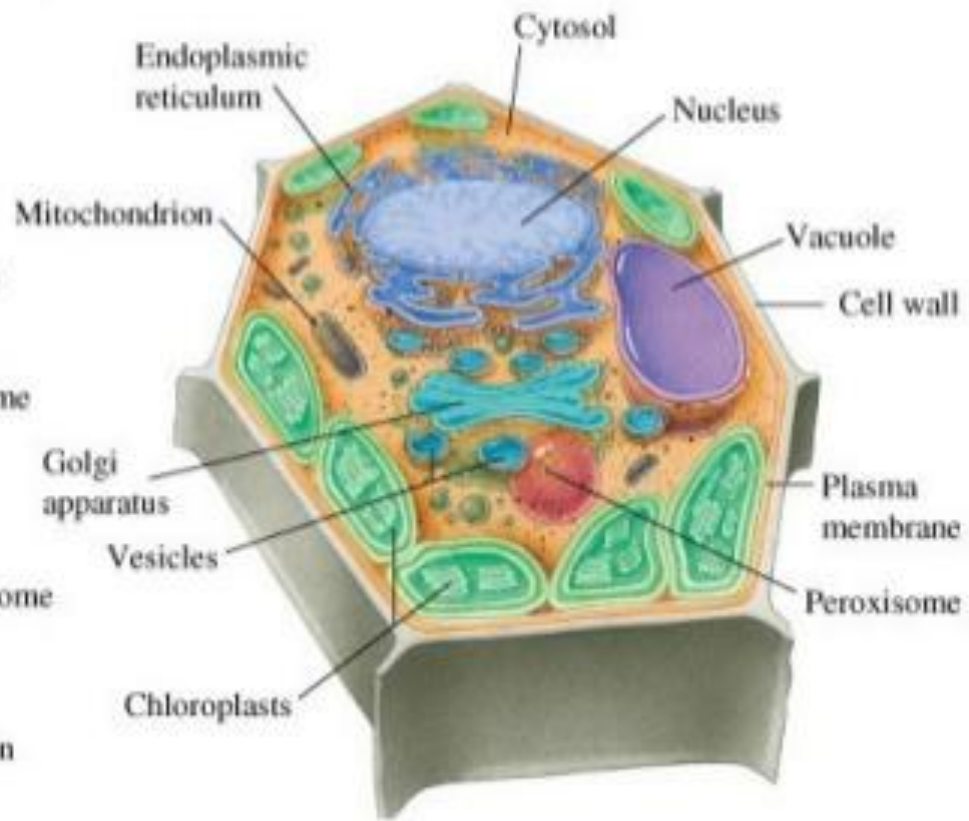
200 - 300 mg protein / mL cytoplasm

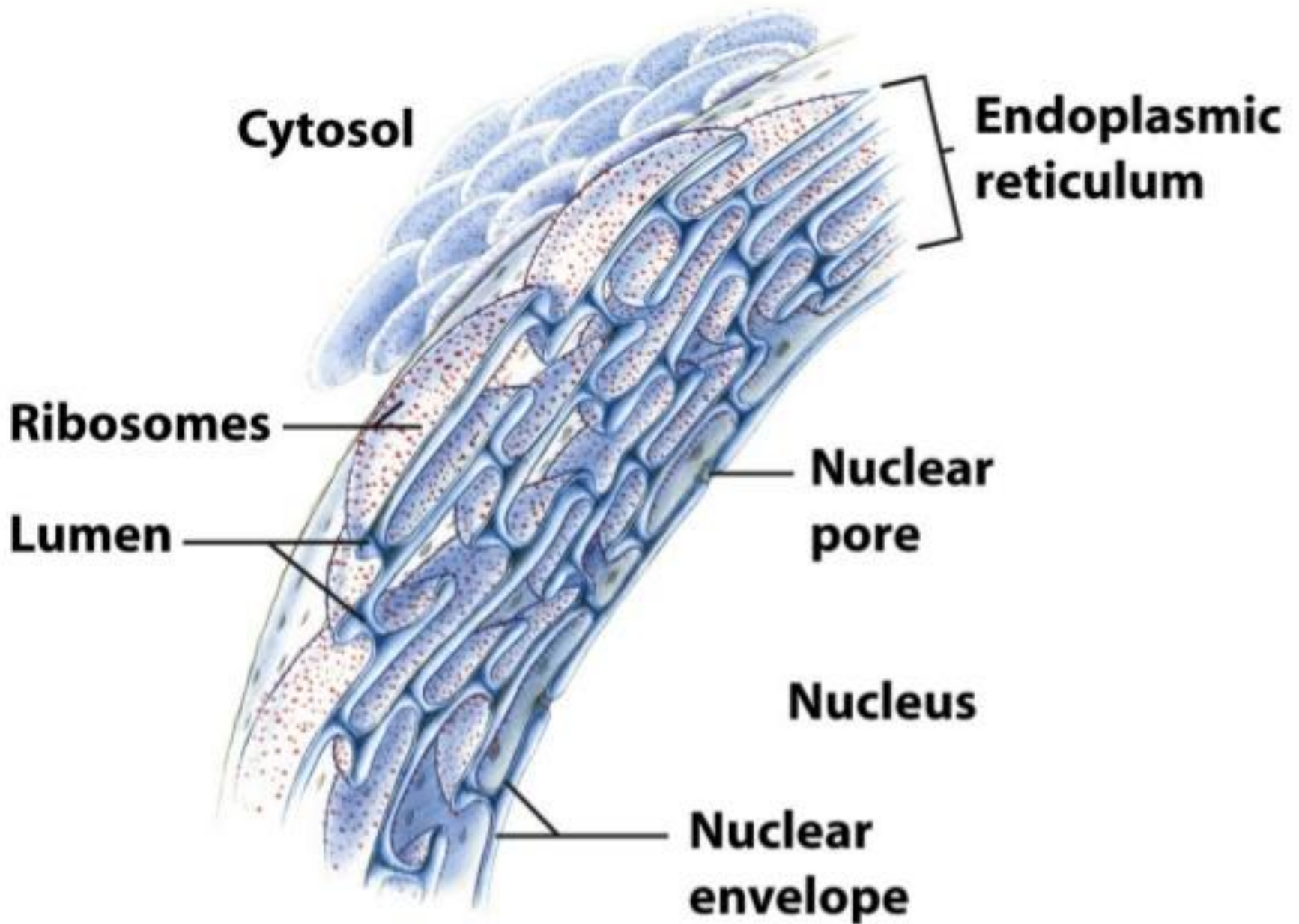
# Eukaryote Cell

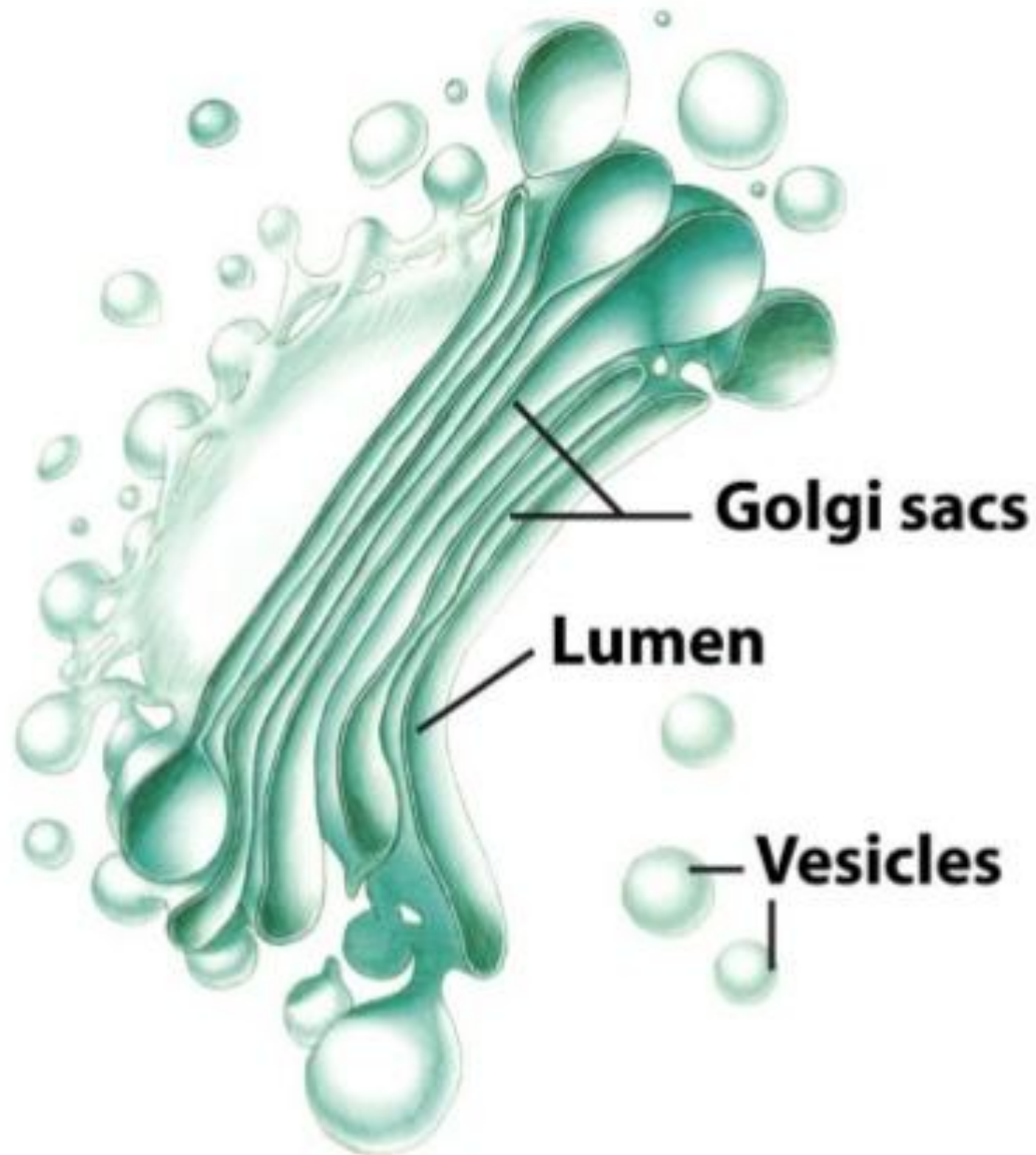
(a)



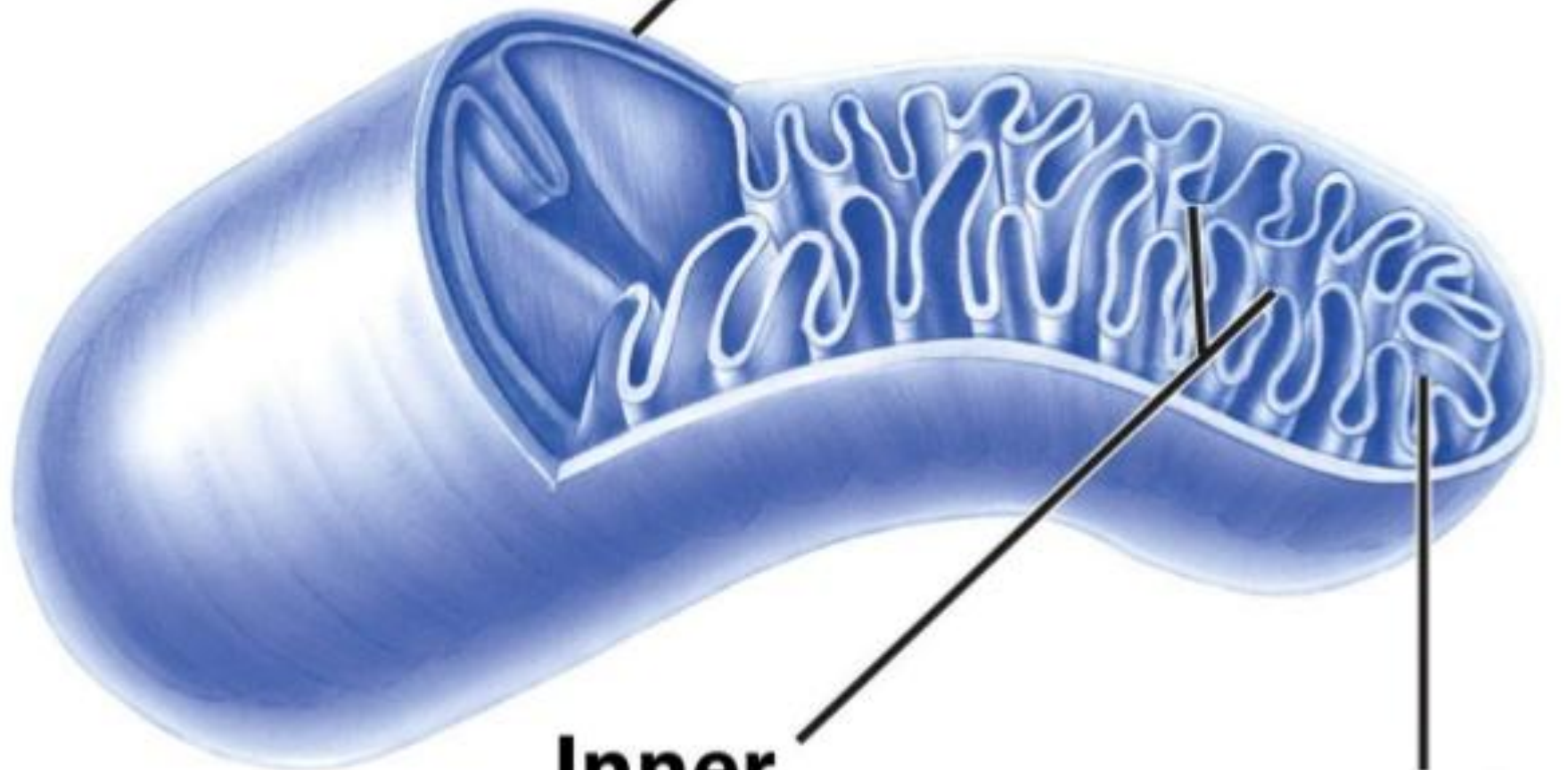
(b)





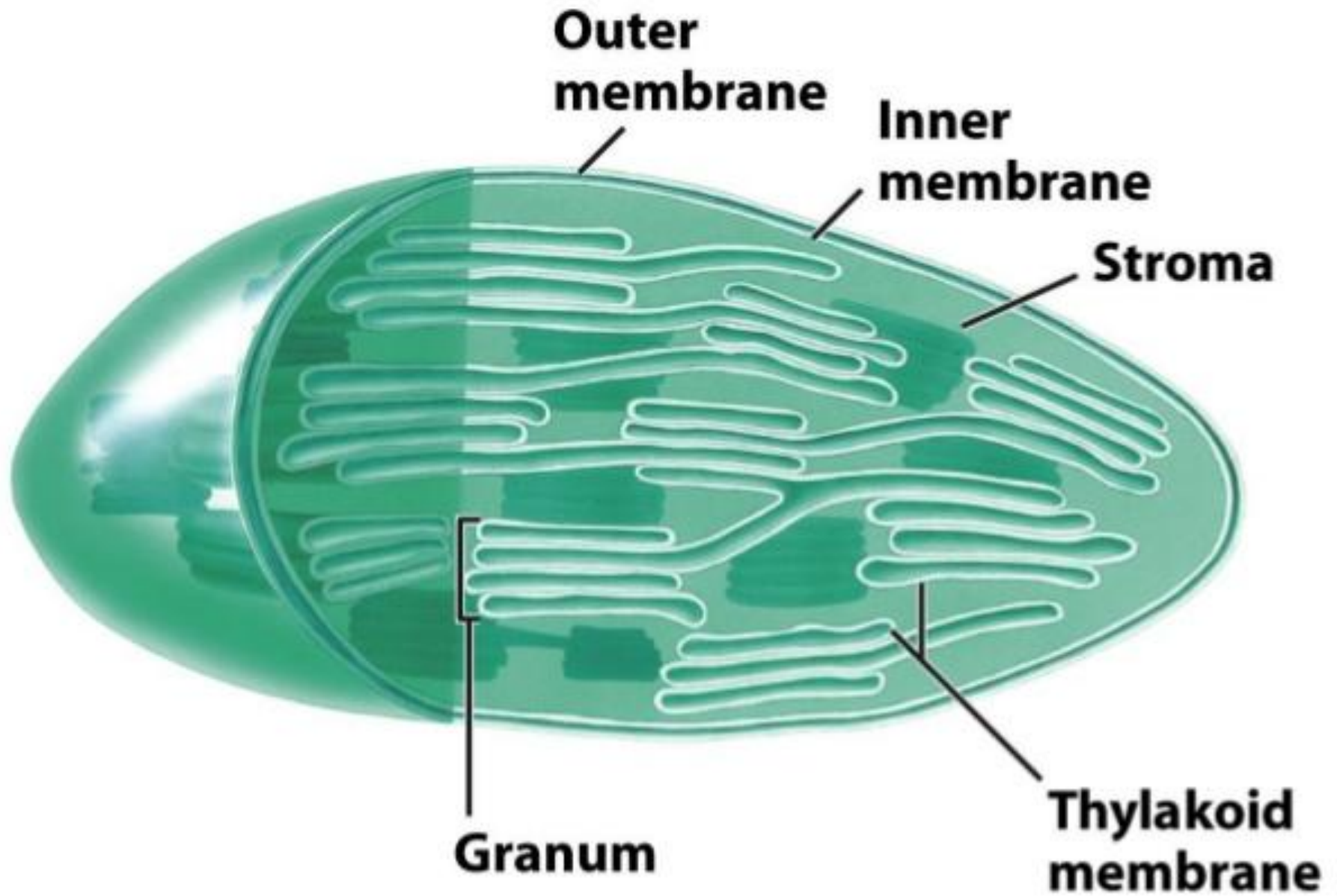


**Outer membrane**



**Inner  
membrane**

**Matrix**



# Tiered assignments:

Questions of the first level:

Questions of the second level:

Questions third level:

# References:

## Primary:

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2. Hanina T.I., Nikitina N.G. Analytical chemistry. - Moscow, 2012
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## Additional:

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14. <http://www.press.uchicago.edu/ucp/books/book/chicago/T/bo11161054.html>



*Thank you for attention!*

**НАЗАРЛАРЫҢЫЗҒА  
РАХМЕТ!**

