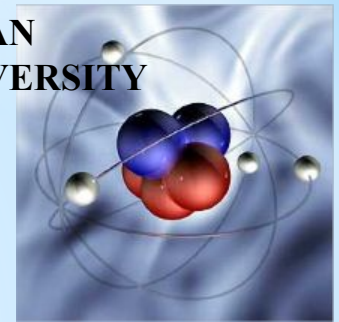




АХМЕТ ЯСАУИ
УНИВЕРСИТЕТИ

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?

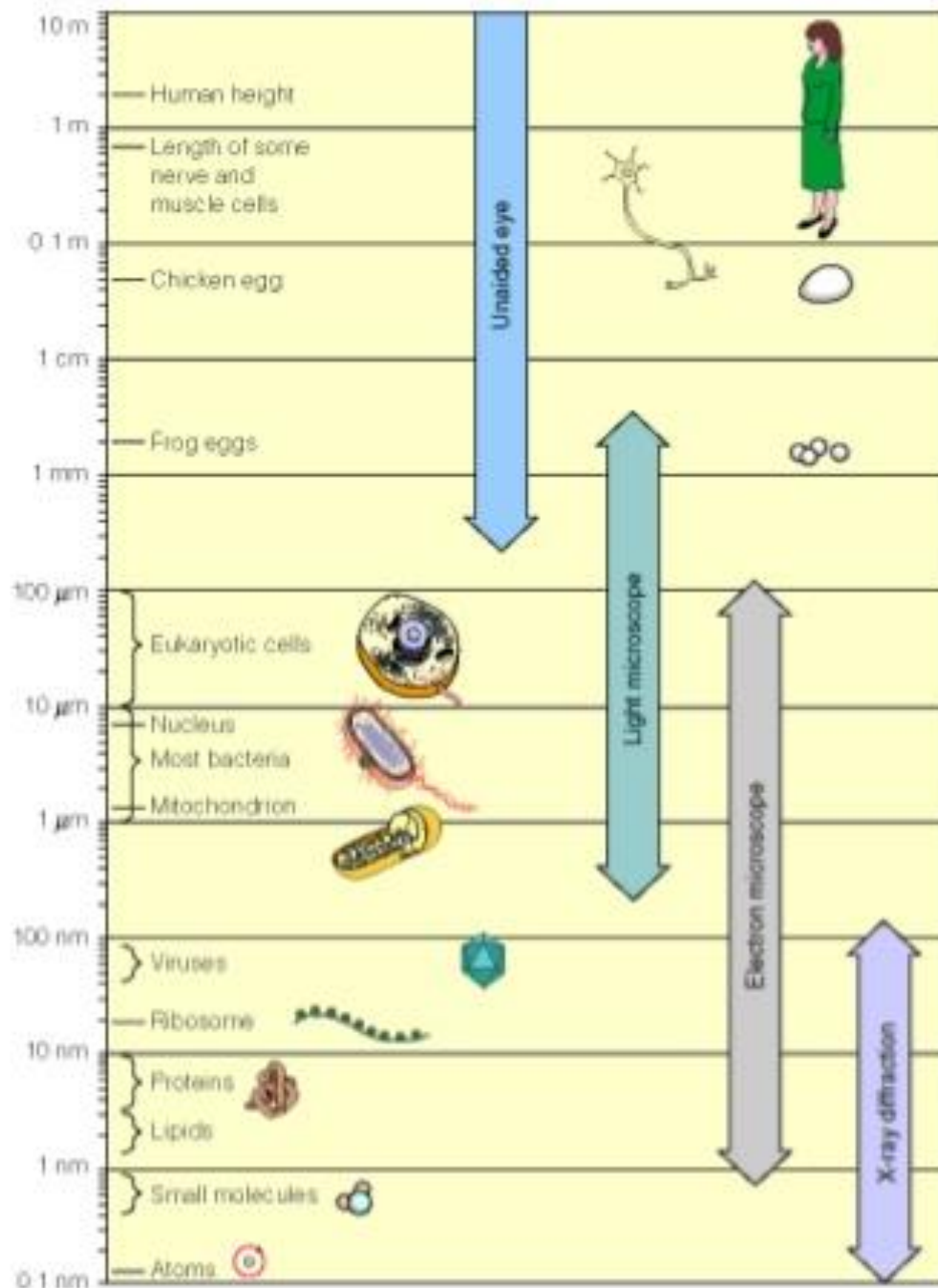
- Medicine
- Agriculture
- Industrial applications
- Environmental applications

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

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

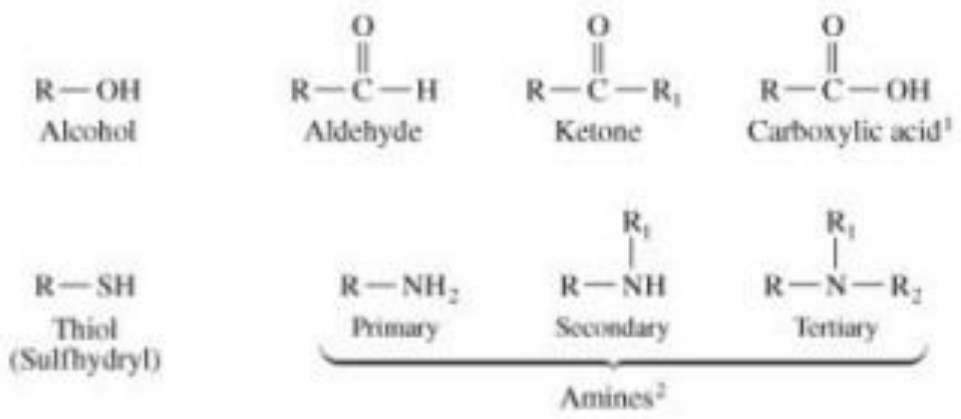
-oligo

-micro

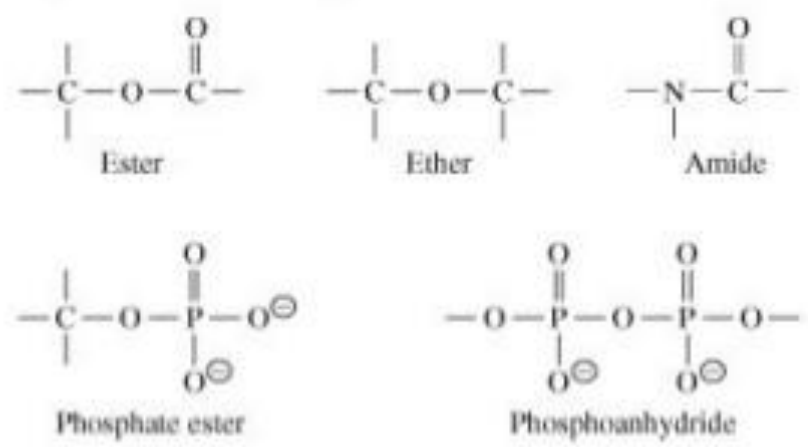
-ultra

Important compounds, functional groups

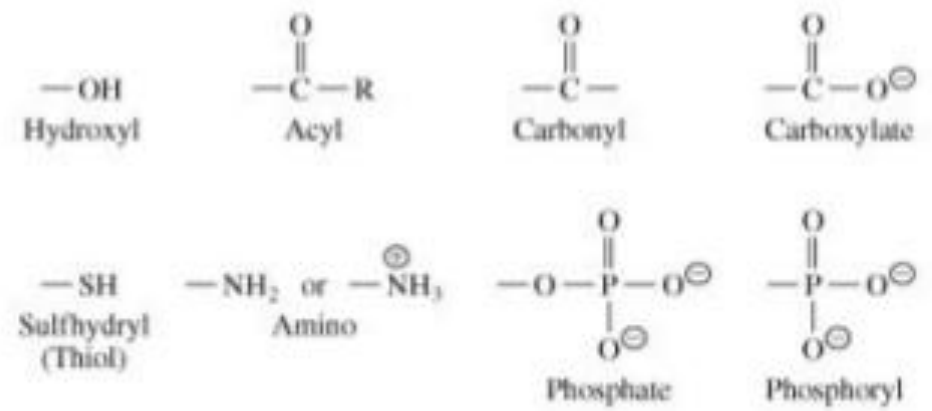
(a) Organic compounds



(c) Linkages in biochemical compounds



(b) Functional groups

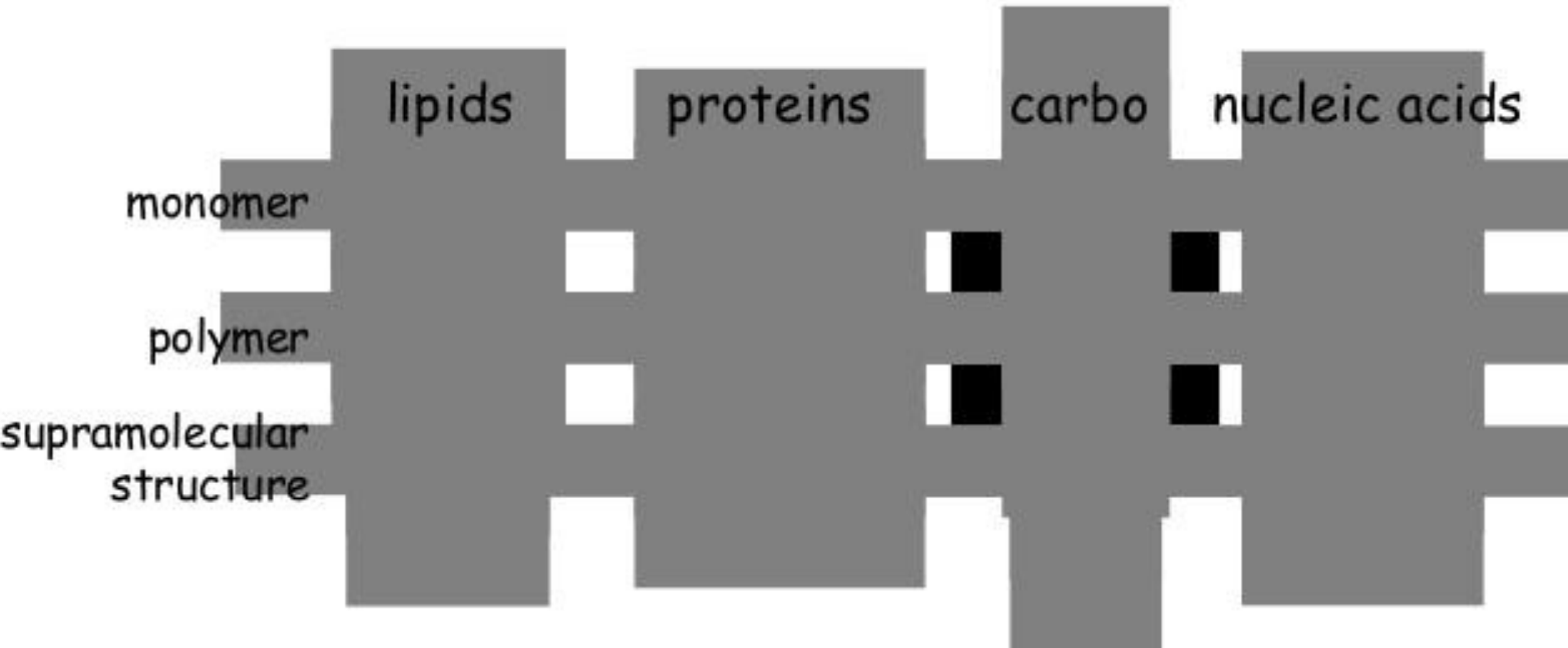


¹ Under most biological conditions, carboxylic acids exist as carboxylate anions:



² 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

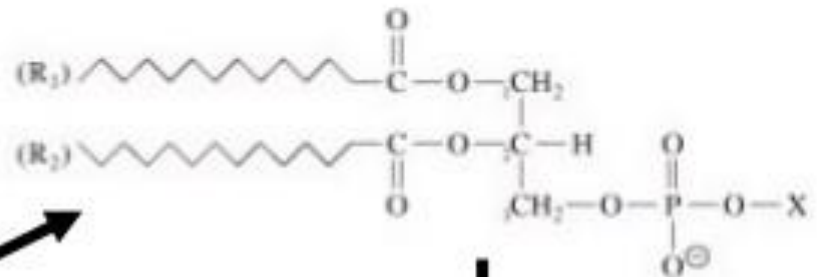
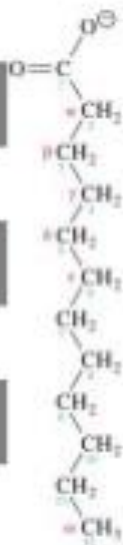


Lipids

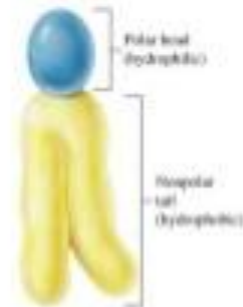
monomer

polymer

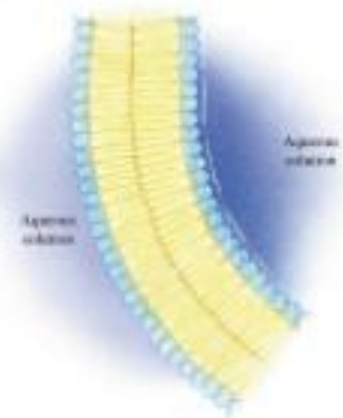
supramolecular
structure



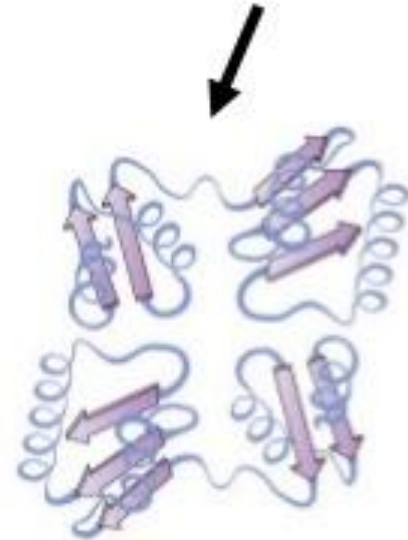
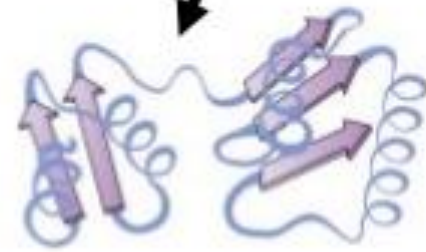
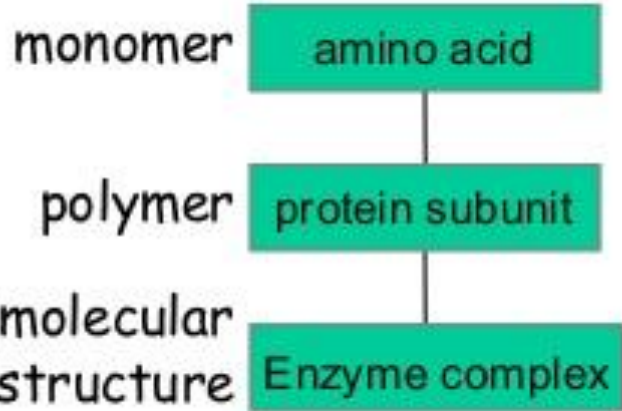
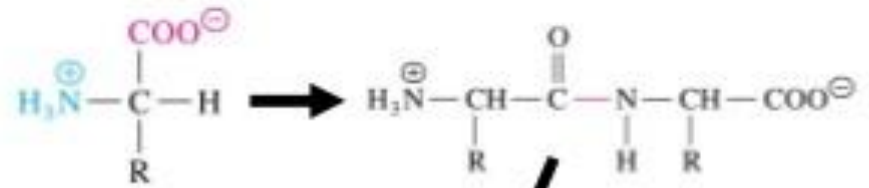
iii



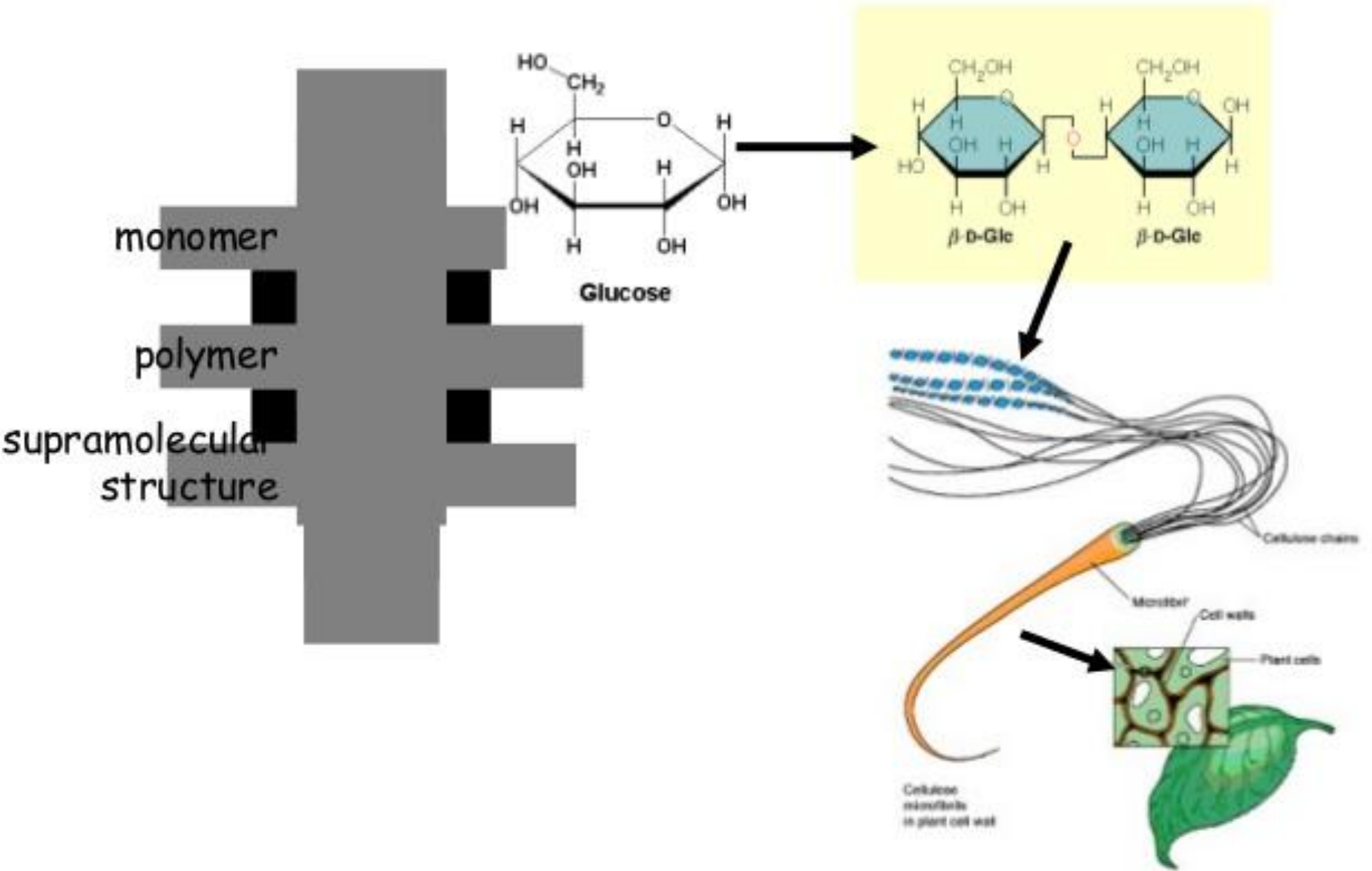
iv



Proteins



Carbohydrates

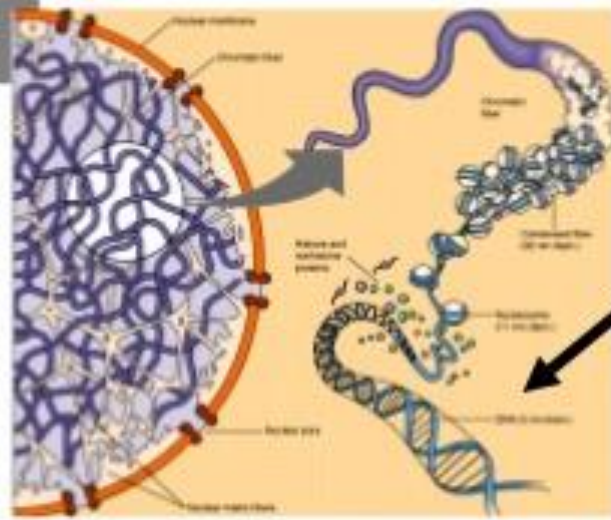
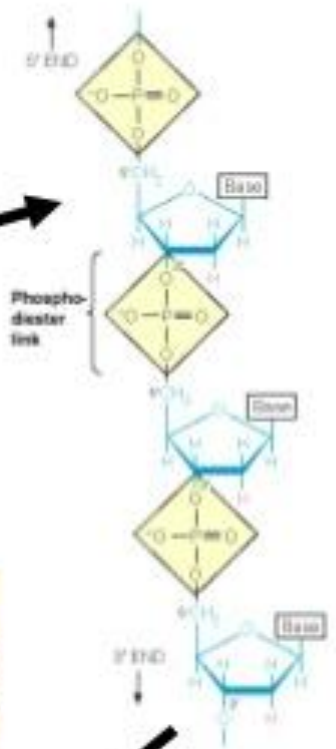
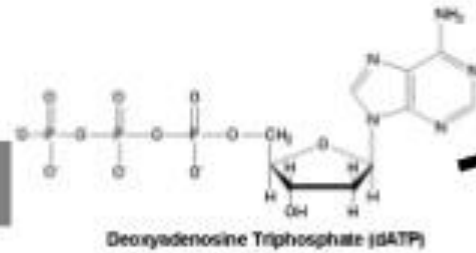


Nucleic Acids

monomer

polymer

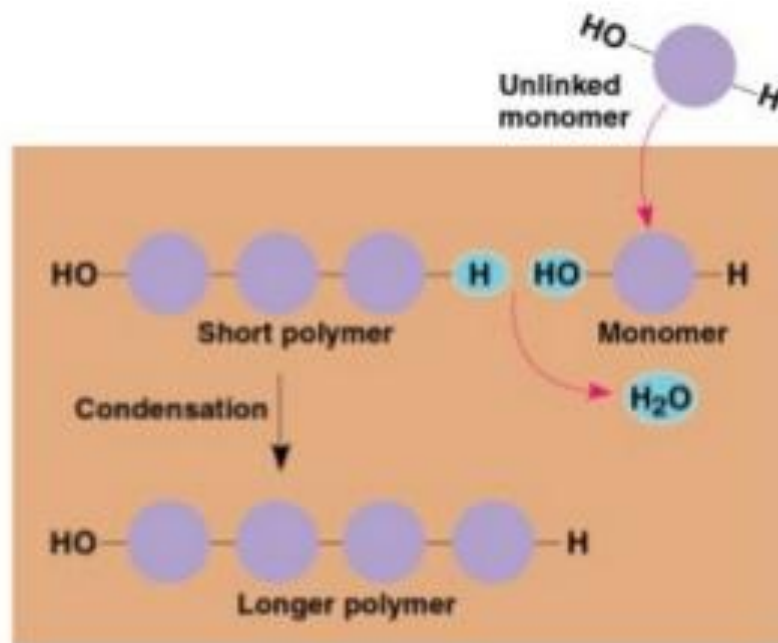
supramolecular
structure



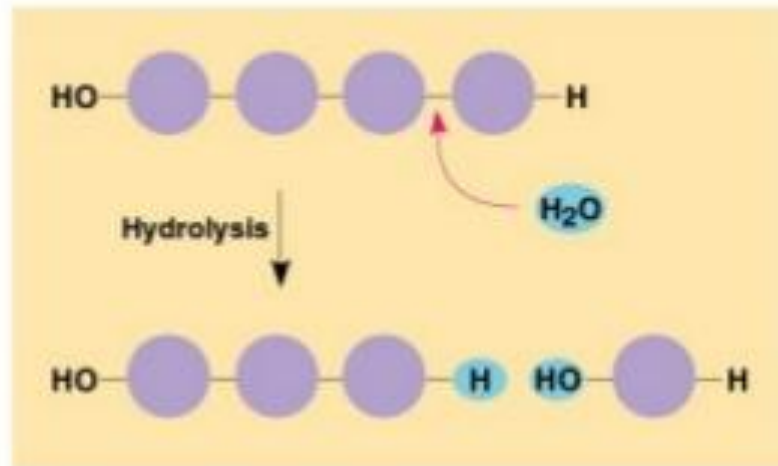
Common theme:

Monomers form polymers through condensations

Polymers are broken down through hydrolysis.

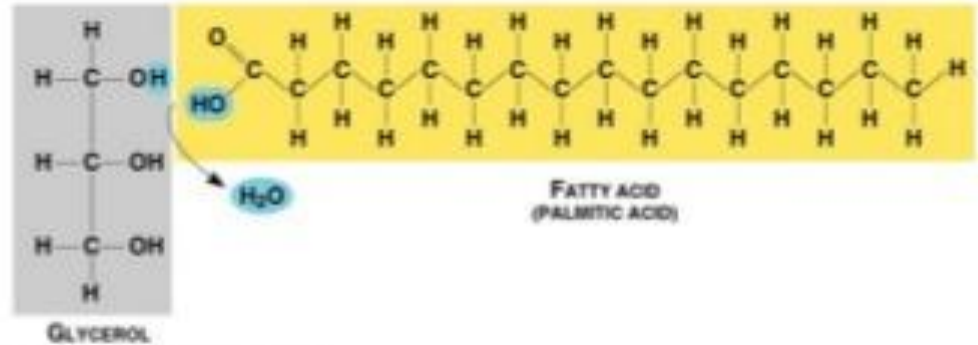
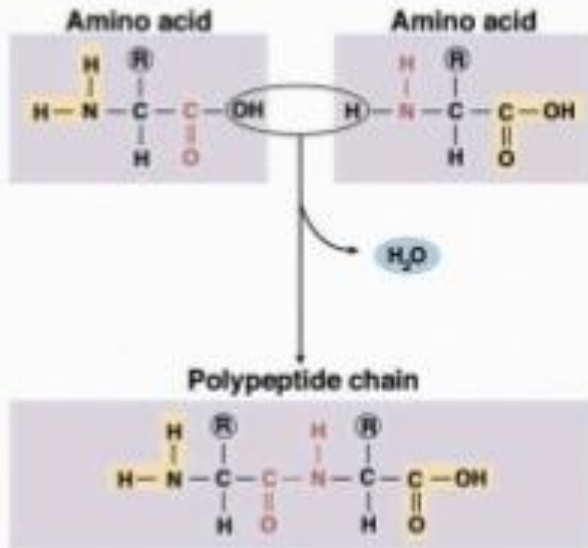


(a) Condensation (dehydration) synthesis of a polymer



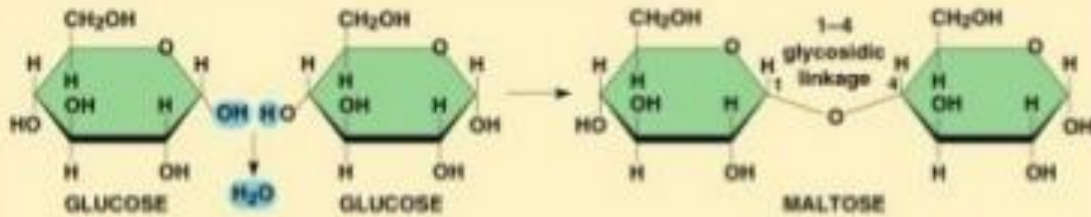
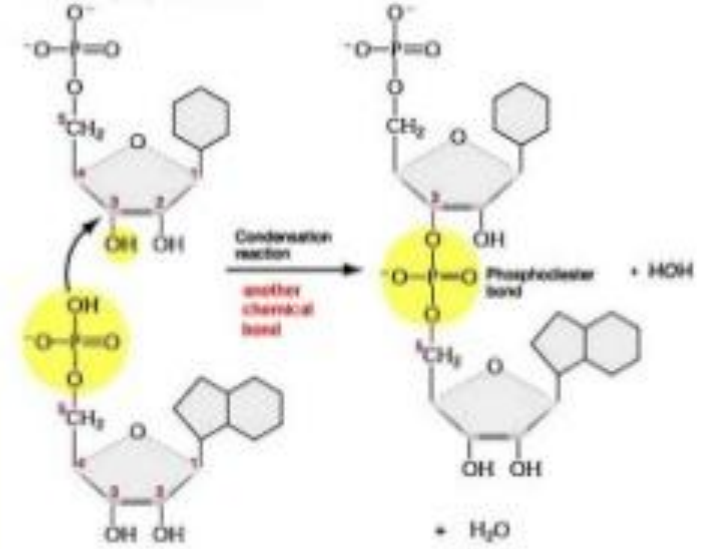
(b) Hydrolysis of a polymer

Peptide Bond



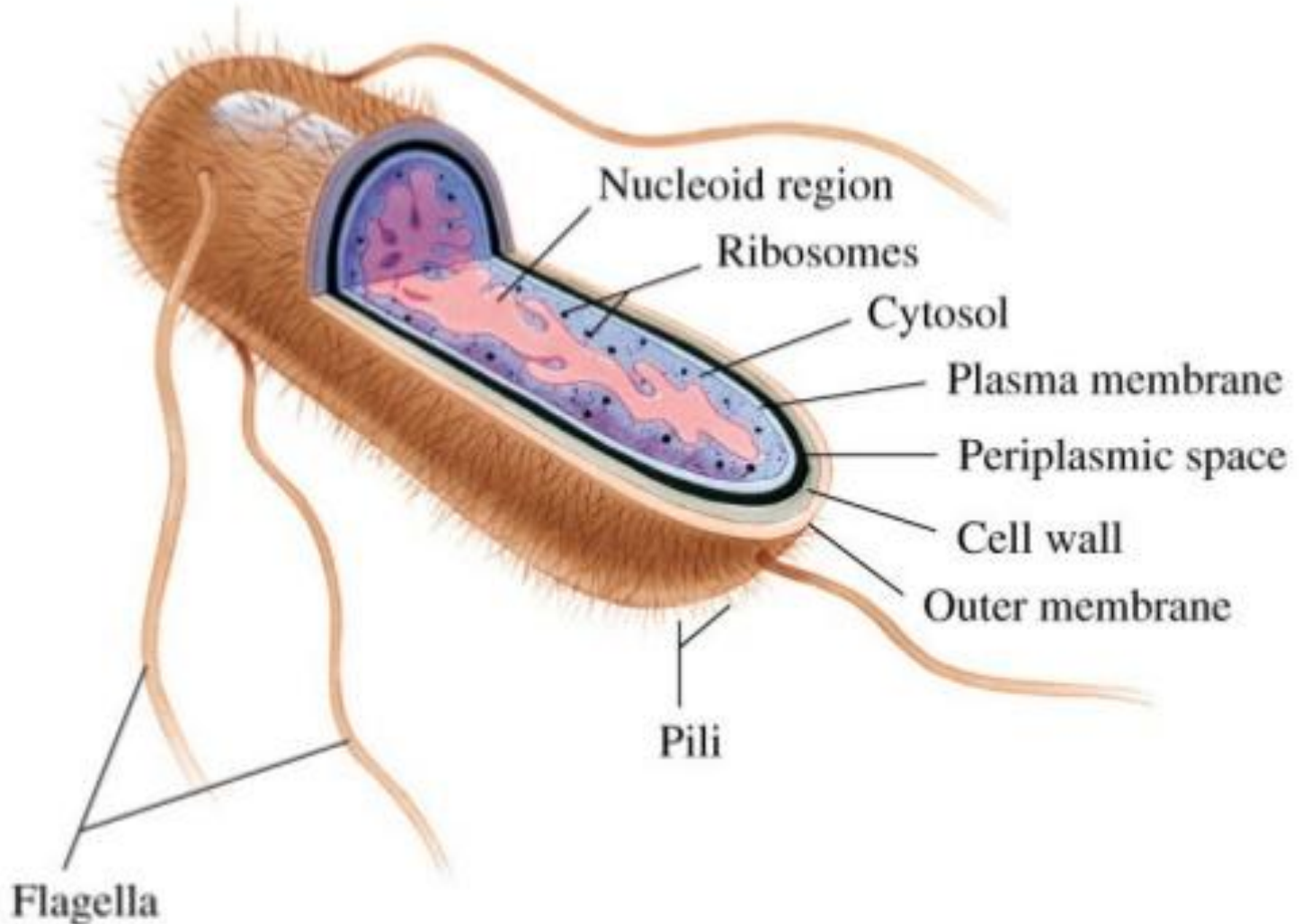
(a) Dehydration synthesis
(condensation reaction)

Formation of phosphodiester bond

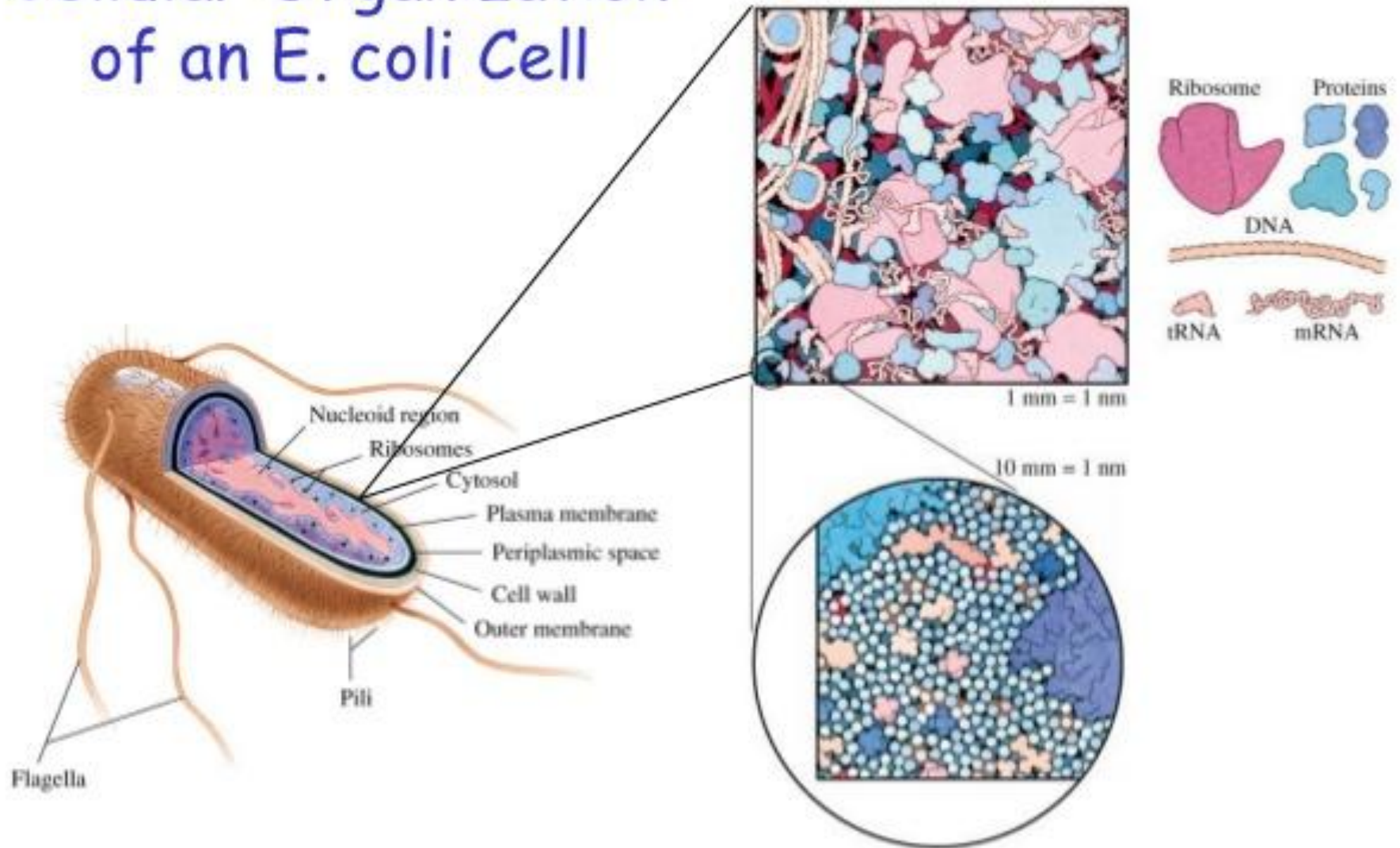


(a) Condensation synthesis of maltose

Prokaryote Cell



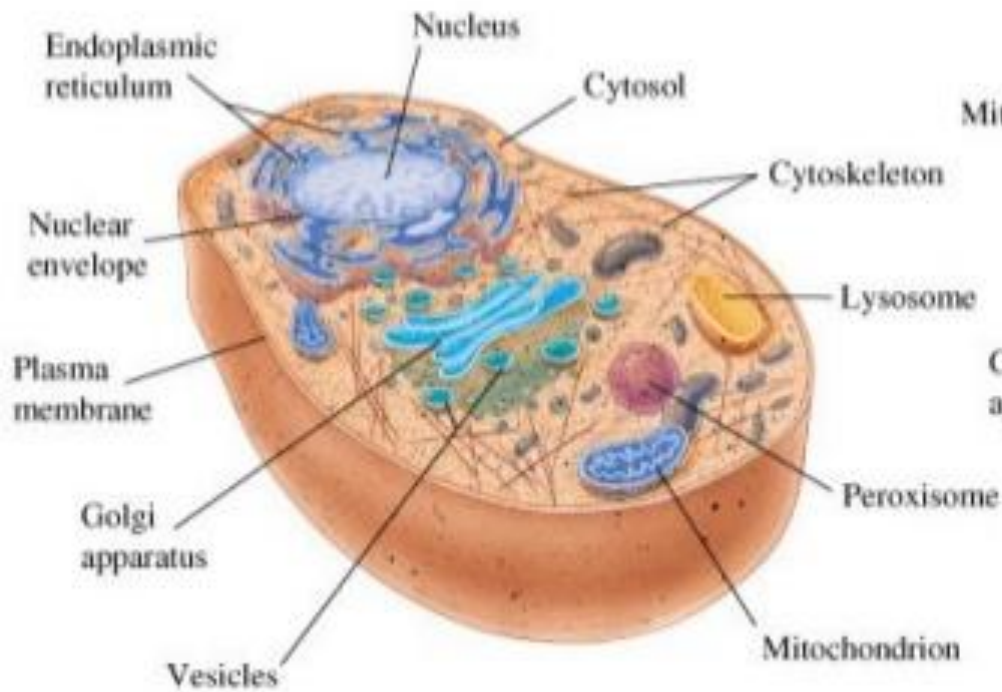
Cellular Organization of an E. coli Cell



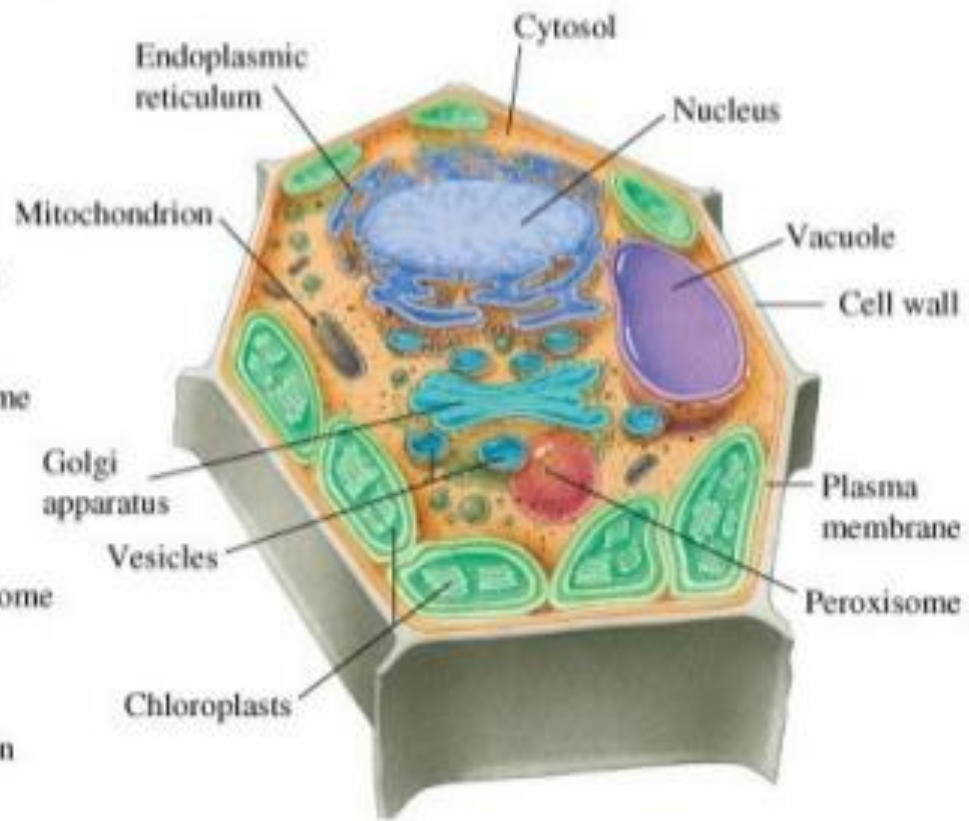
200 - 300 mg protein / mL cytoplasm

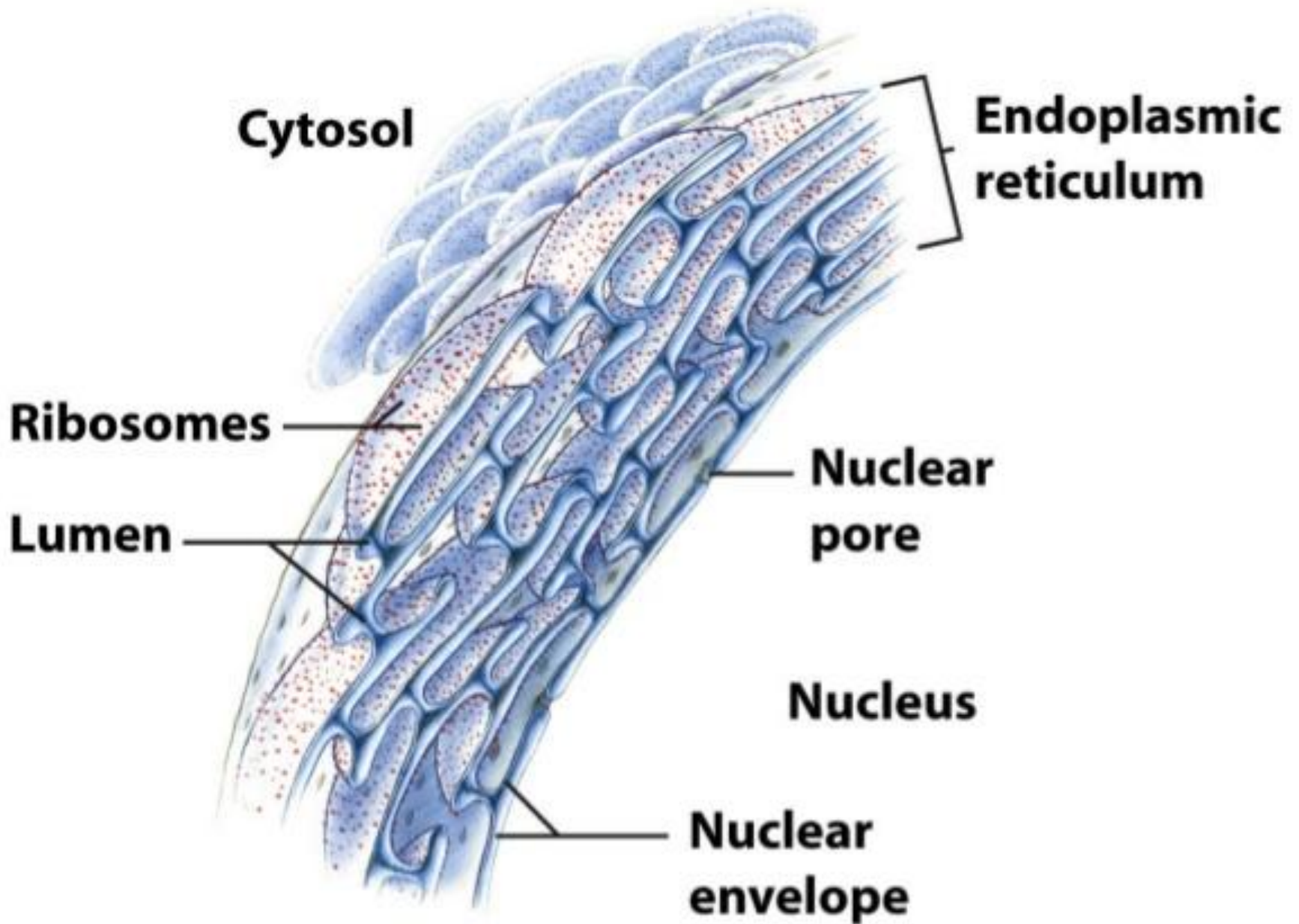
Eukaryote Cell

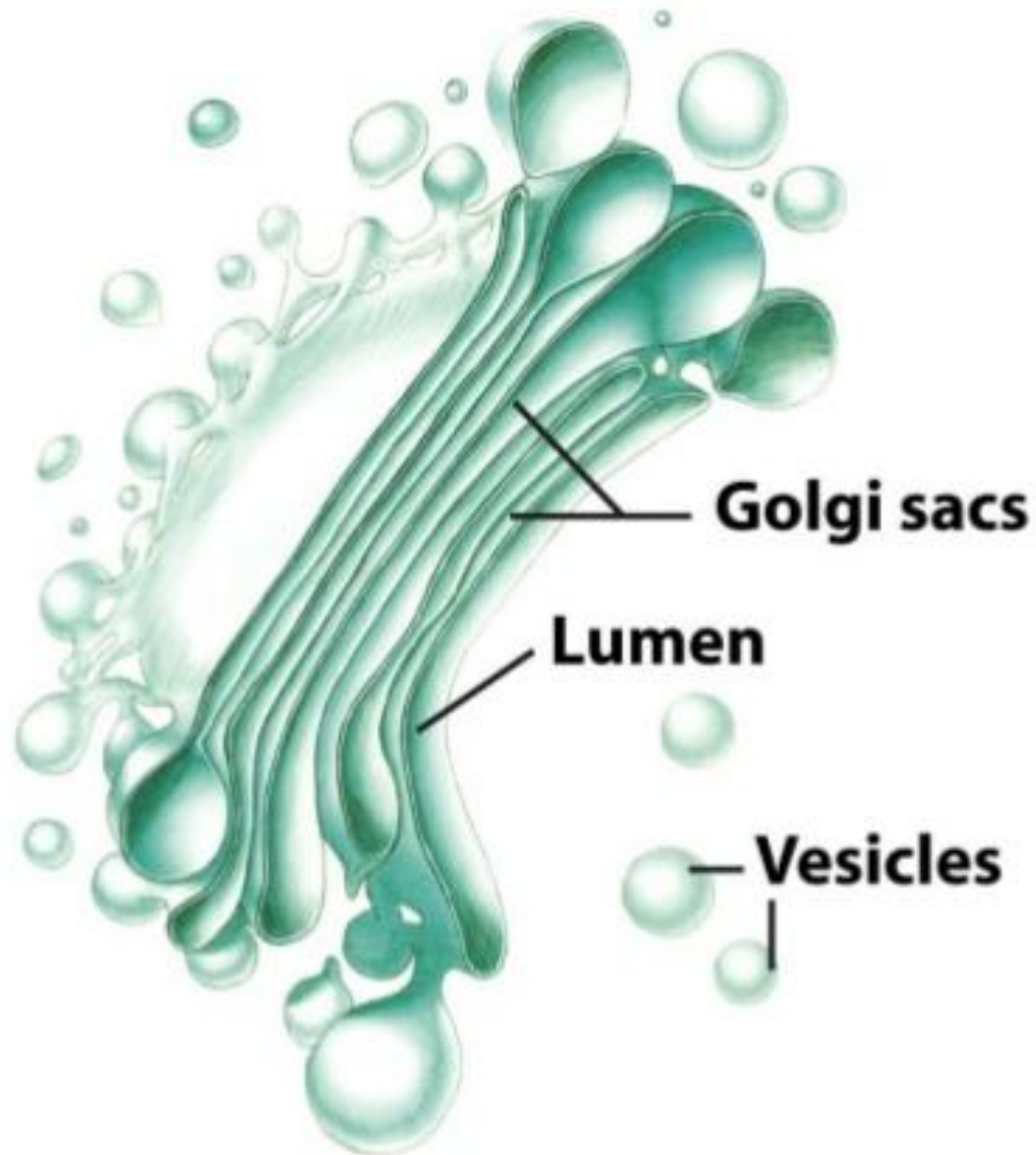
(a)



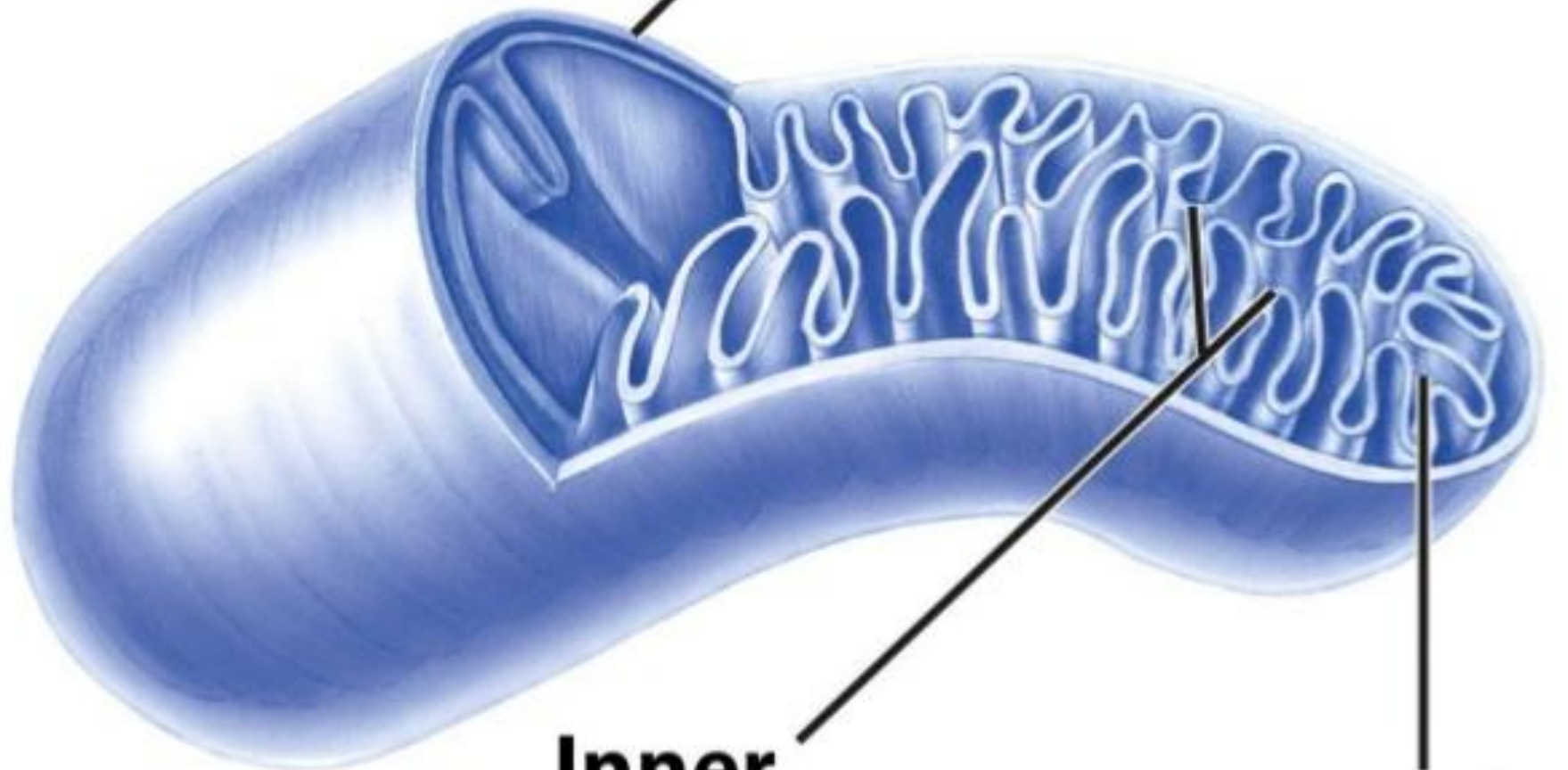
(b)





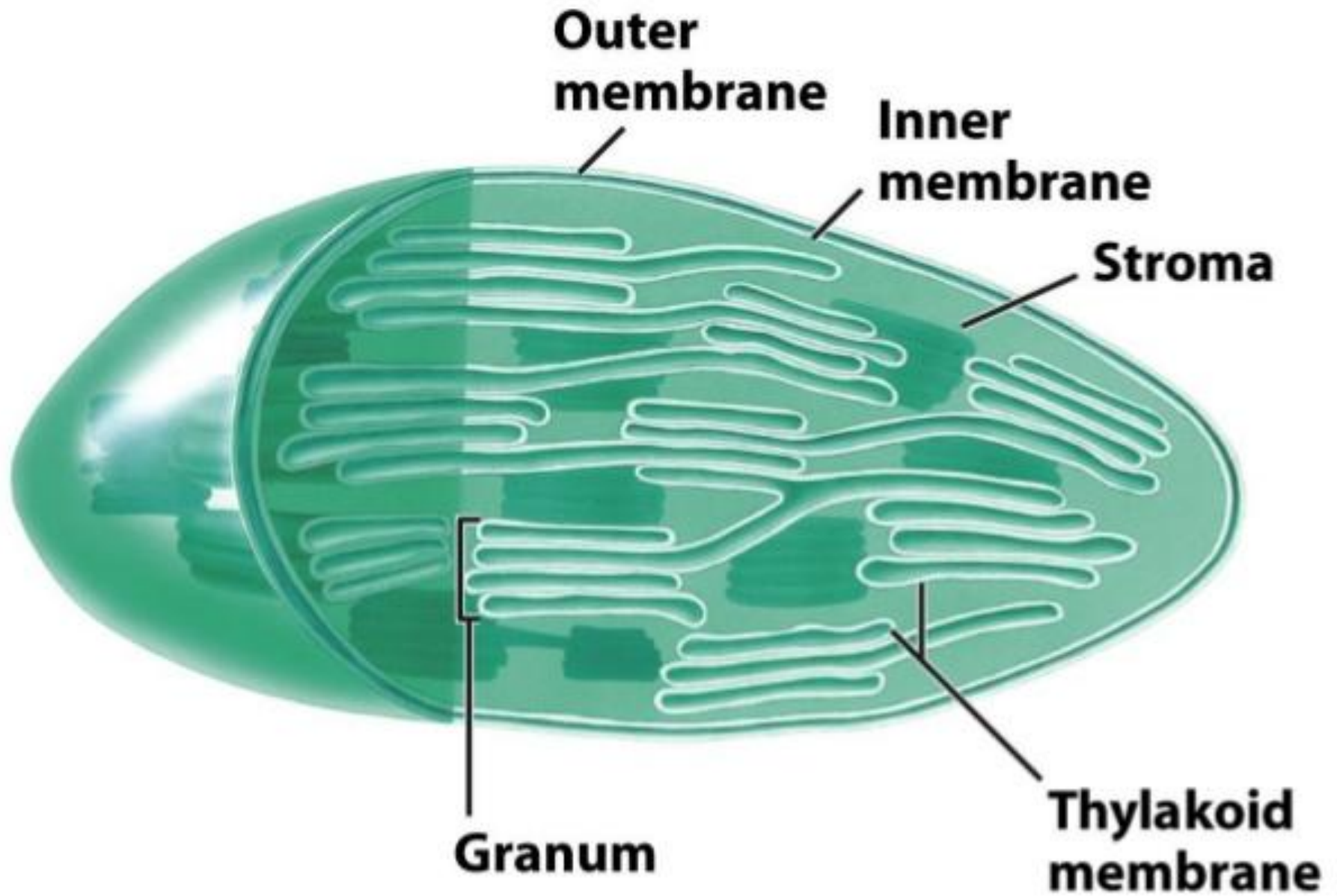


Outer membrane



**Inner
membrane**

Matrix



Tiered assignments:

Questions of the first level:

Questions of the second level:

Questions third level:

References:

Primary:

1. Alekseev V.N., The course of qualitative chemical micro-analysis. M.: Chemistry, 2013
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Thank you for attention!

**НАЗАРЛАРЫҢЫЗҒА
РАХМЕТ!**

