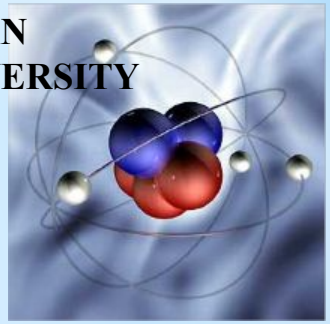
The Ministry of Education and Science of the Republic of KAZAKHSTAN
KHOJA AKHMET YASSAWI INTERNATIONAL KAZAKH-TURKISH UNIVERSITY
FACULTY OF NATURAL SCIENCES

DEPARTMENT OF ECOLOGY AND CHEMISTRY



Topic of the lecture:

Introduction to Biochemistry

Specialty, Code of specialty : 5B011200 (Ғ) – 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?

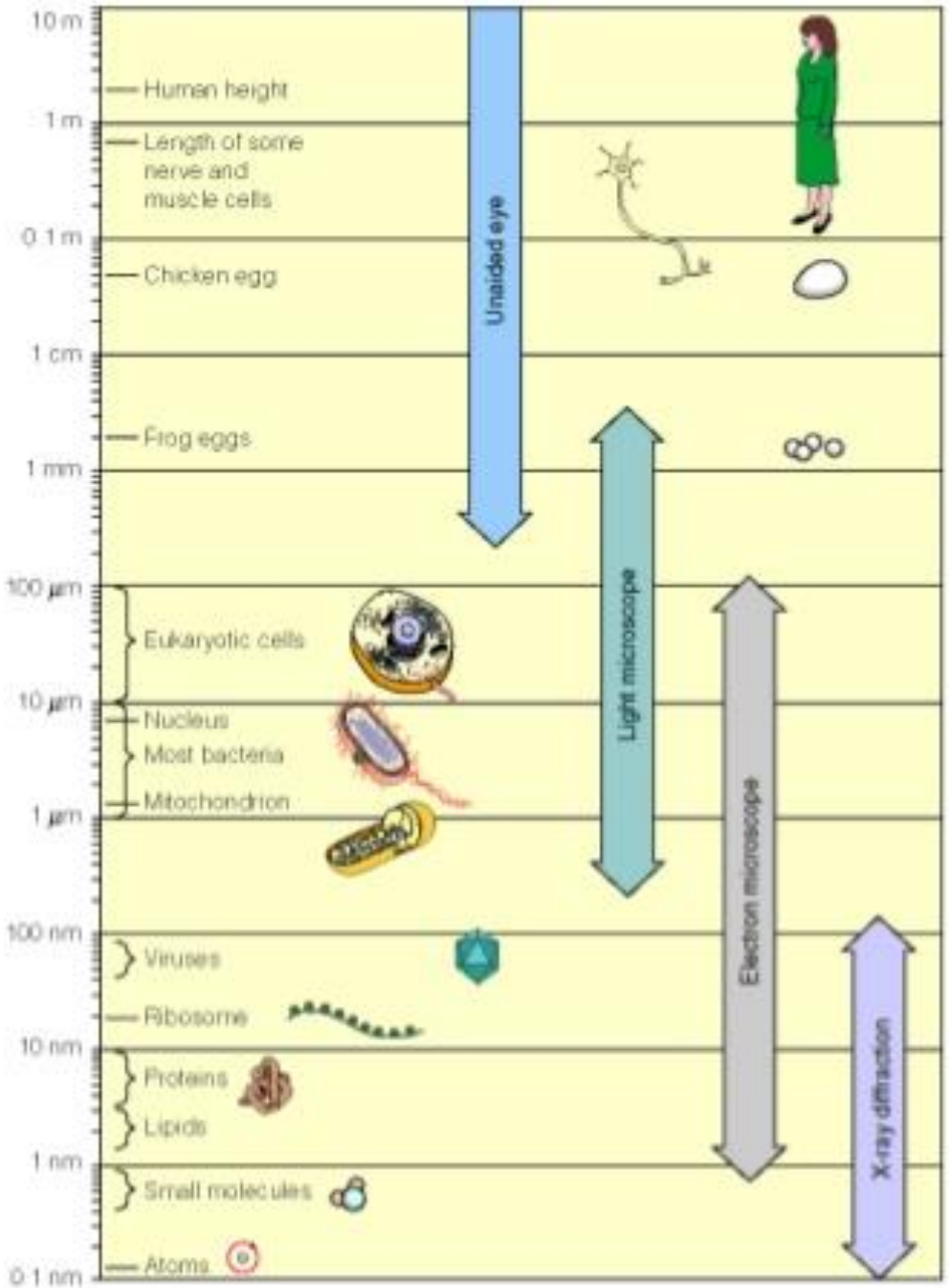
- Medicine
- Agriculture
- Industrial applications
- Environmental applications

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												IIIA	IVA	VA	VIA	VIIA	0
1 H 1.008	IIA						VIIIB			IB	IIB						2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	IIIB	IVB	VB	VIB	VIIB						13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
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 (269)	111 (272)	112 (277)	113	114 (285)	115	116 (289)	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 -macro biogen

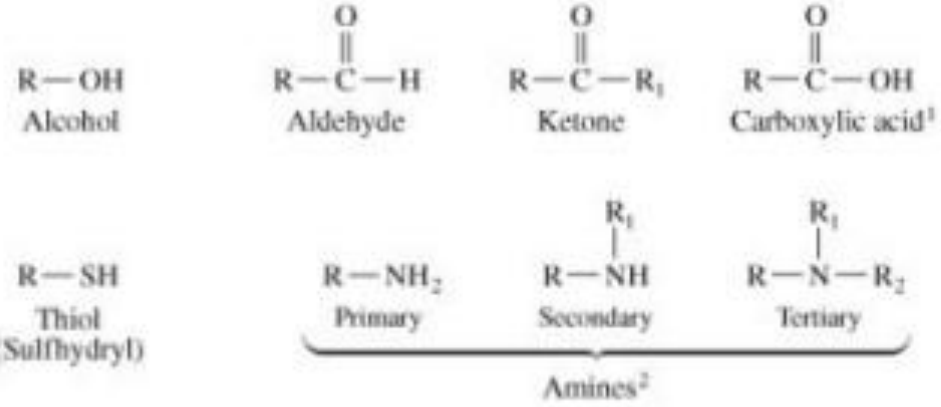
Less abundant, essential for all organisms : Na, Mg, K, Ca, Cl -oligo

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

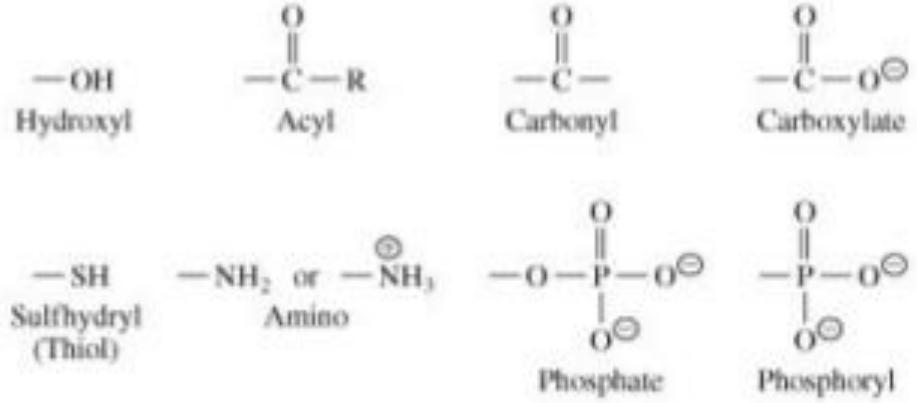
Trace levels, essential for some organisms: V, Cr, Mo, B, Al, Ga, Sn, Si, As, Se, I, -ultra

Important compounds, functional groups

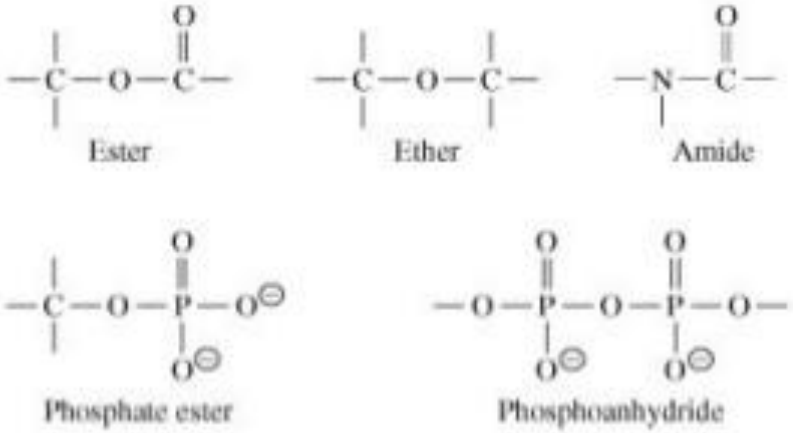
(a) *Organic compounds*



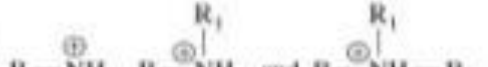
(b) *Functional groups*



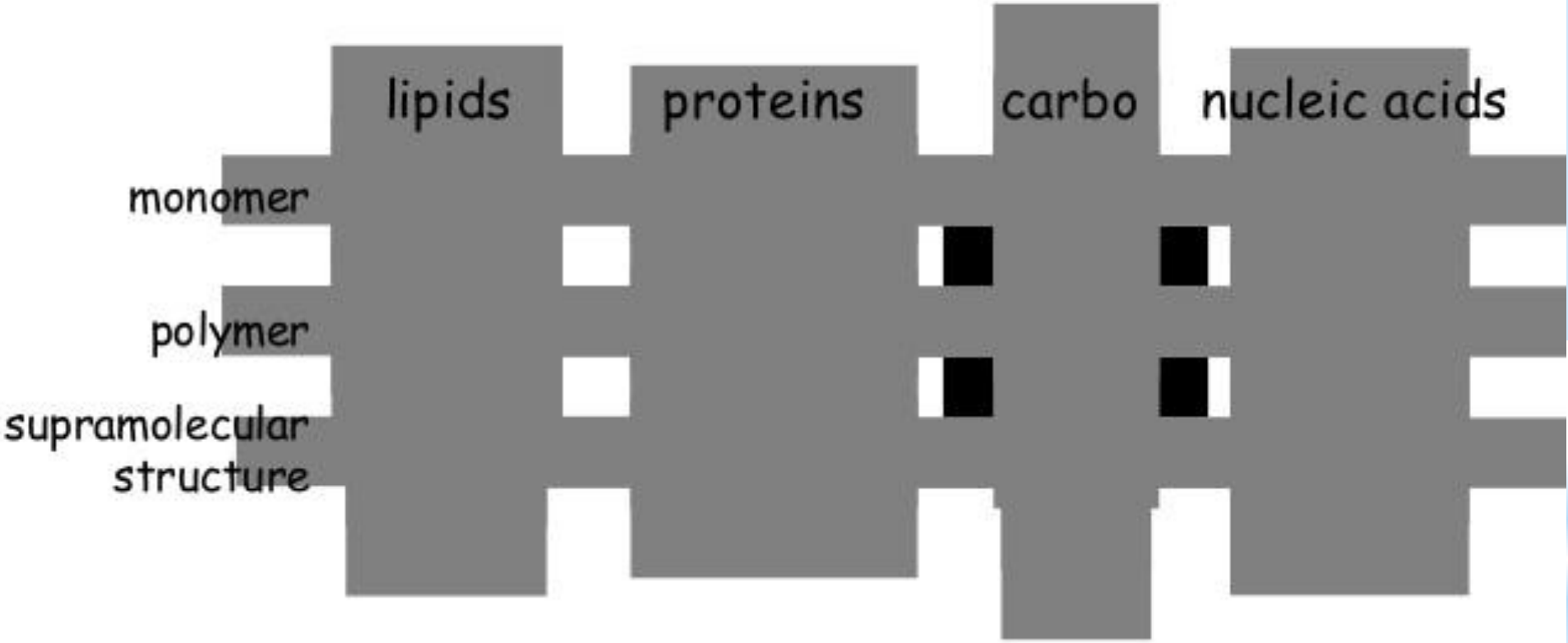
(c) *Linkages in biochemical compounds*



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

[2] Under most biological conditions, amines exist as ammonium ions: 

Many Important Biomolecules are Polymers

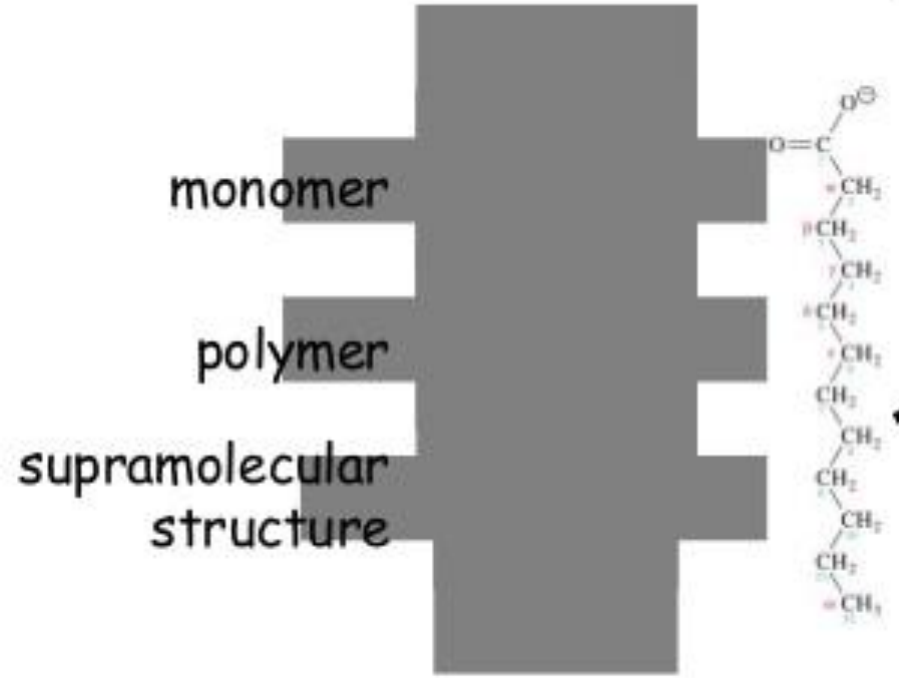


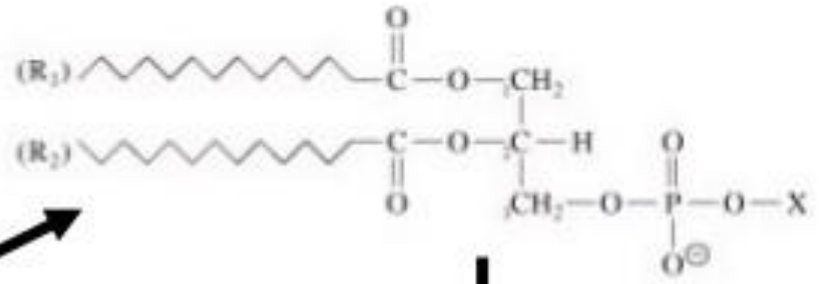
Lipids

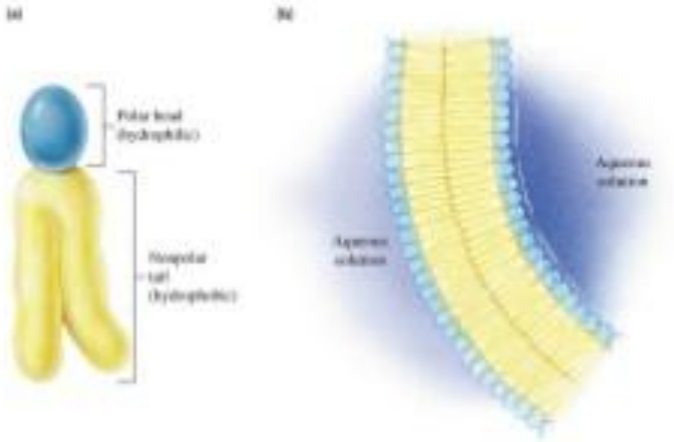
monomer

polymer

supramolecular structure





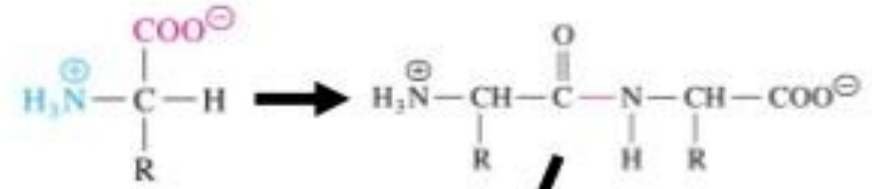


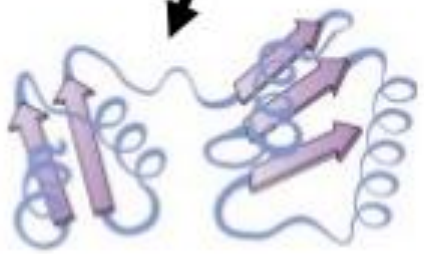
Proteins

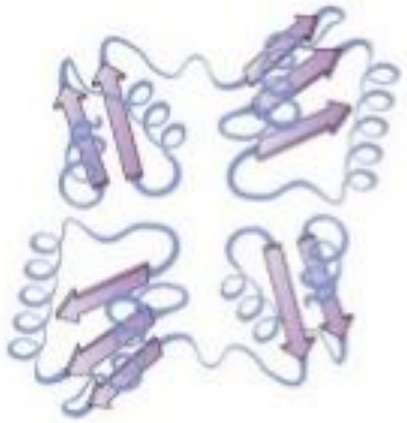
monomer — amino acid

polymer — protein subunit

supramolecular structure — Enzyme complex





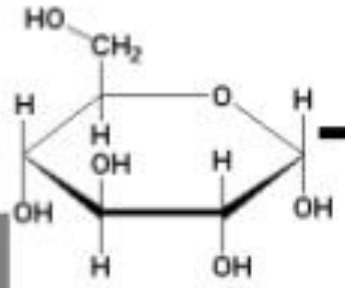


Carbohydrates

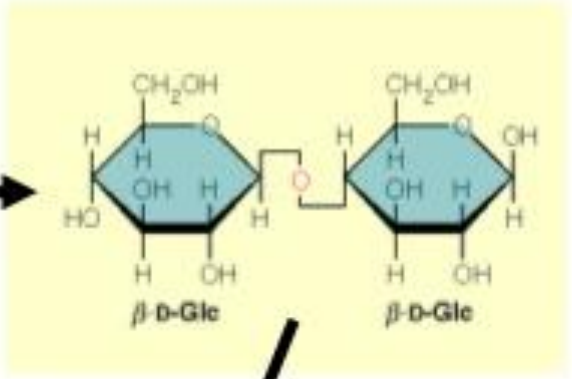
monomer

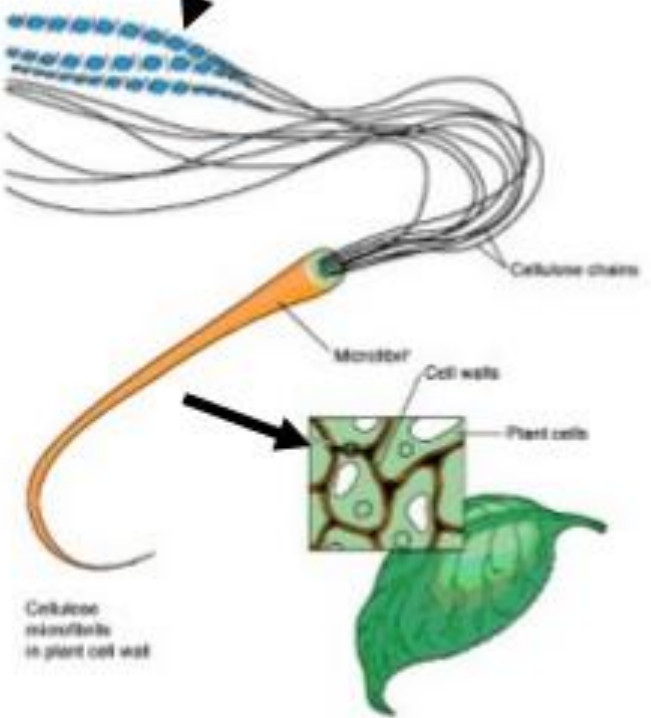
polymer

supramolecular structure



Glucose



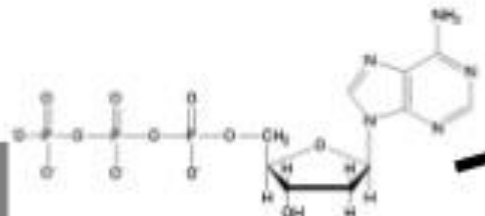


Nucleic Acids

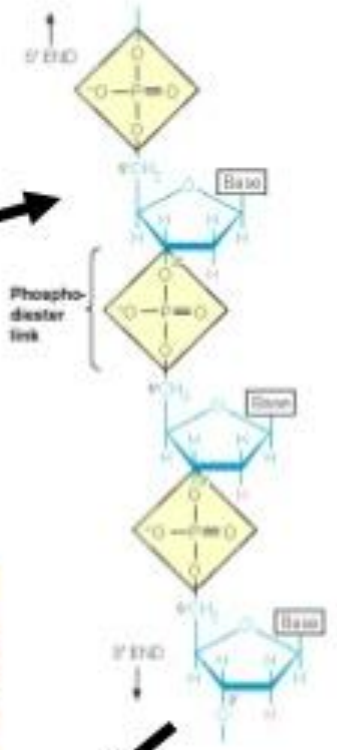
monomer

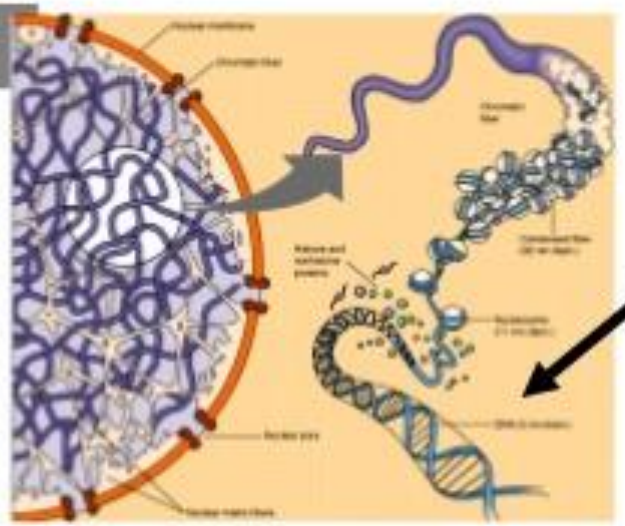
polymer

supramolecular structure



Deoxyadenosine Triphosphate (dATP)

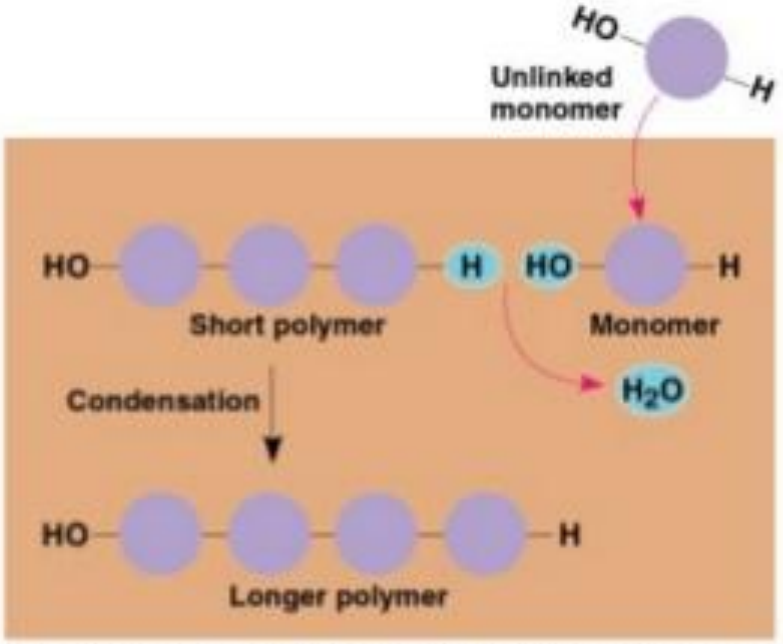




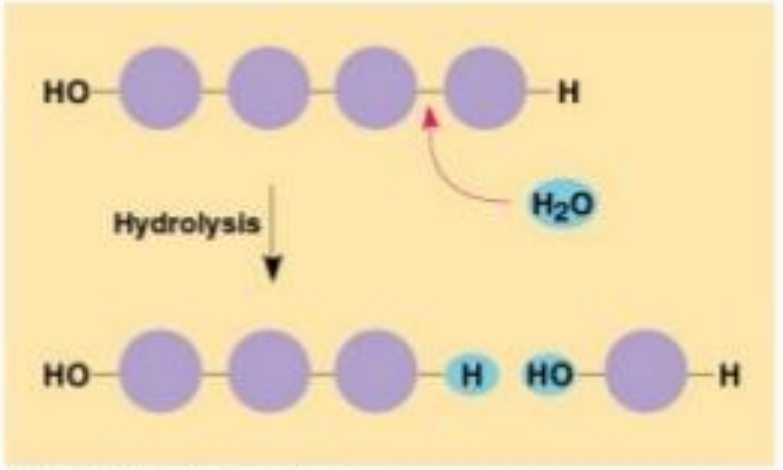
Common theme:

Monomers form polymers through condensations

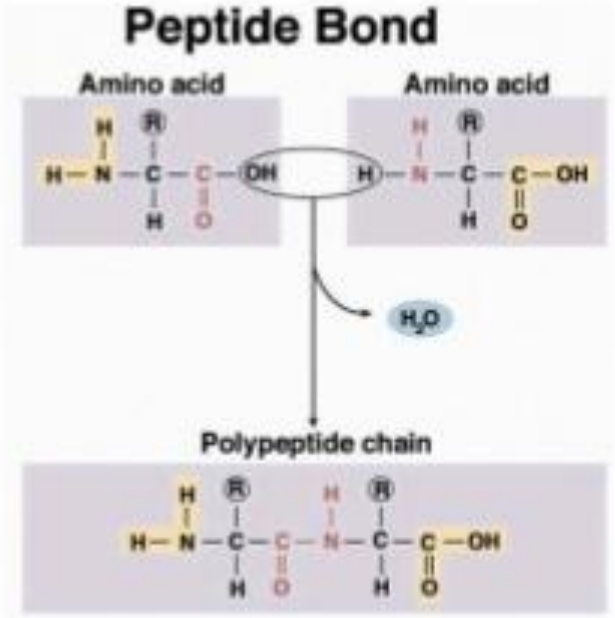
Polymers are broken down through hydrolysis.

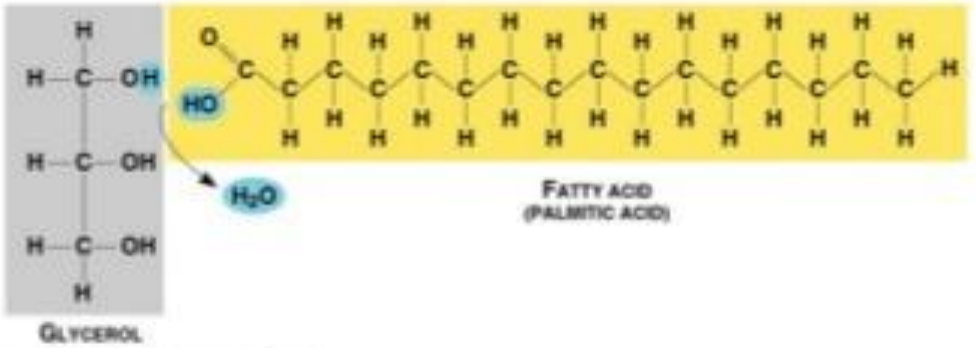


(a) Condensation (dehydration) synthesis of a polymer

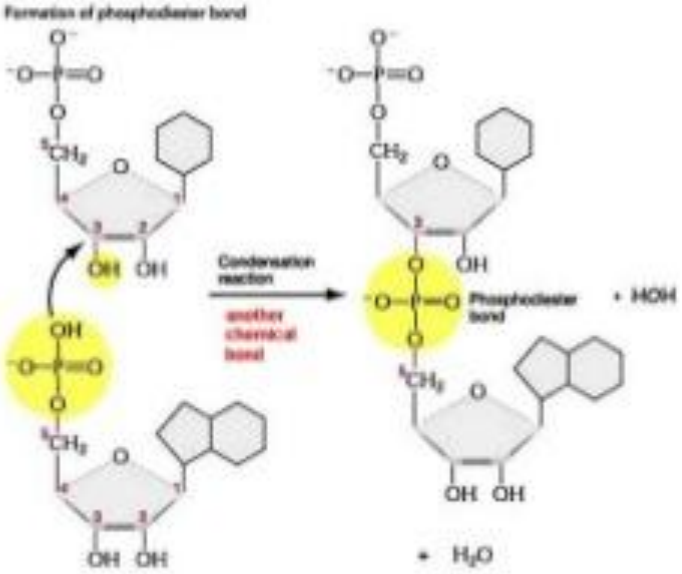


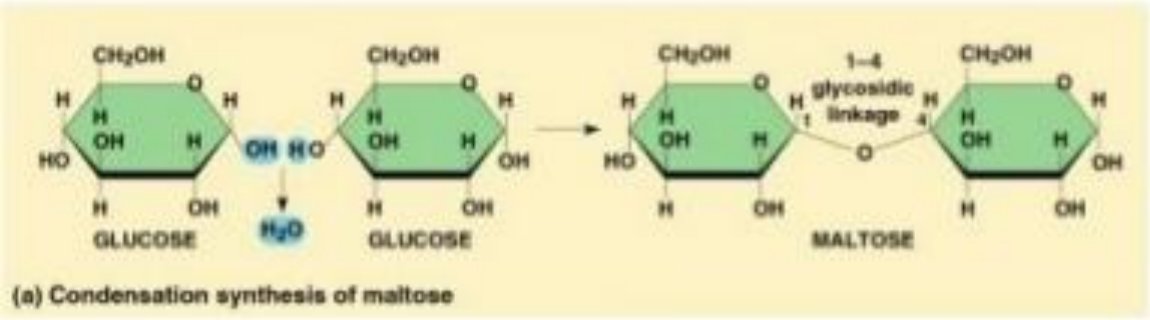
(b) Hydrolysis of a polymer





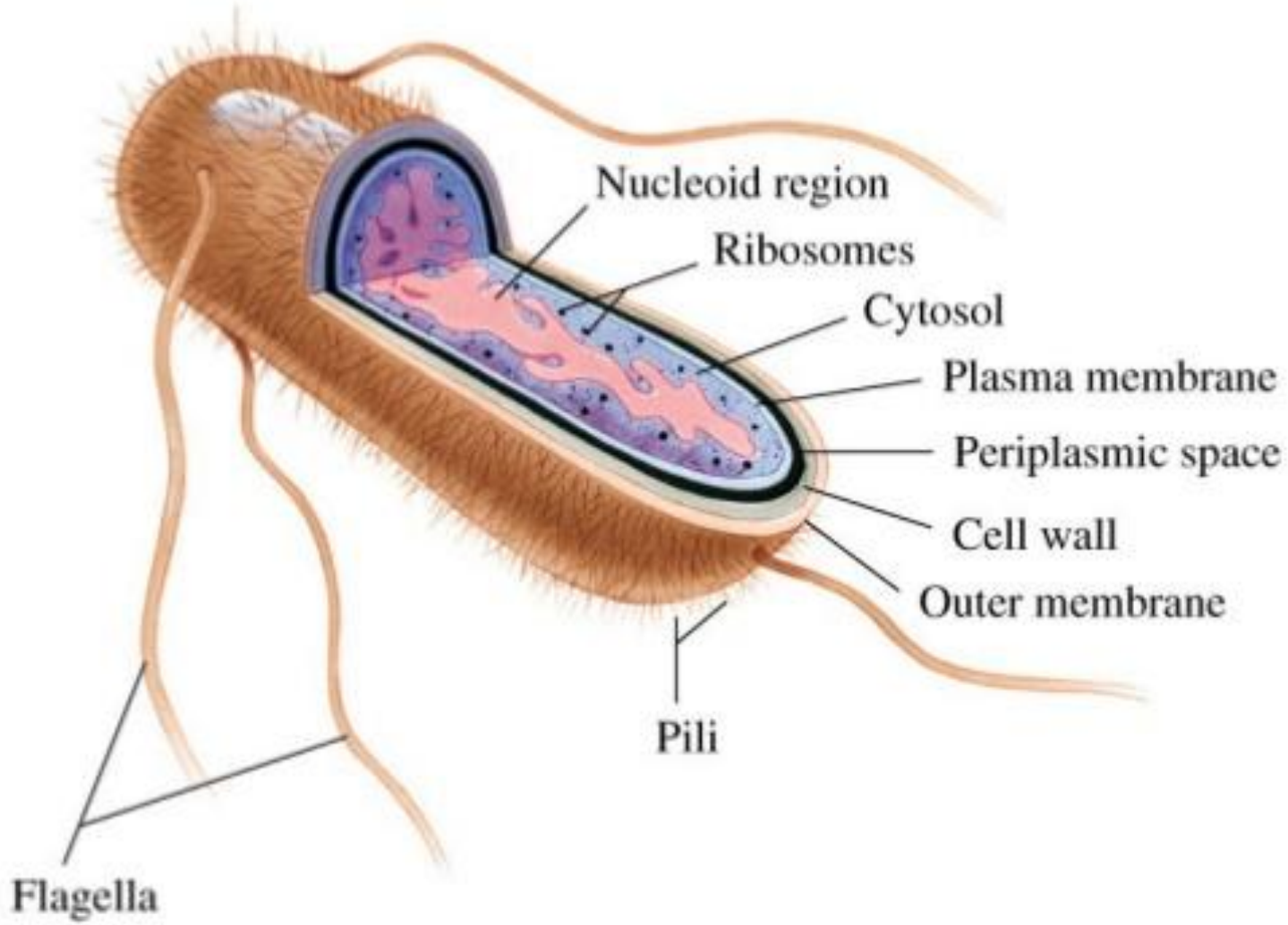
(a) Dehydration synthesis
(condensation reaction)



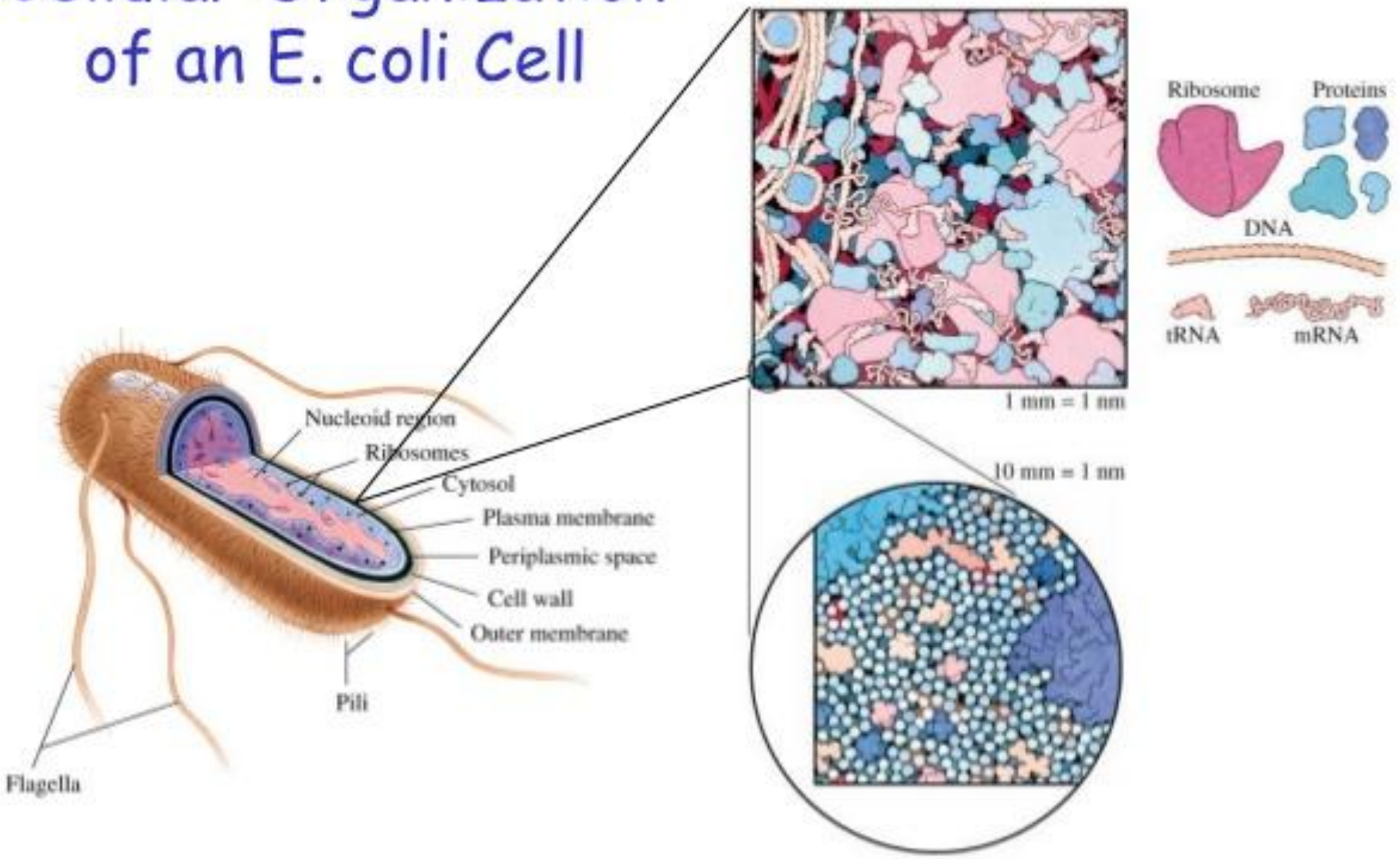


(a) Condensation synthesis of maltose

Prokaryote Cell

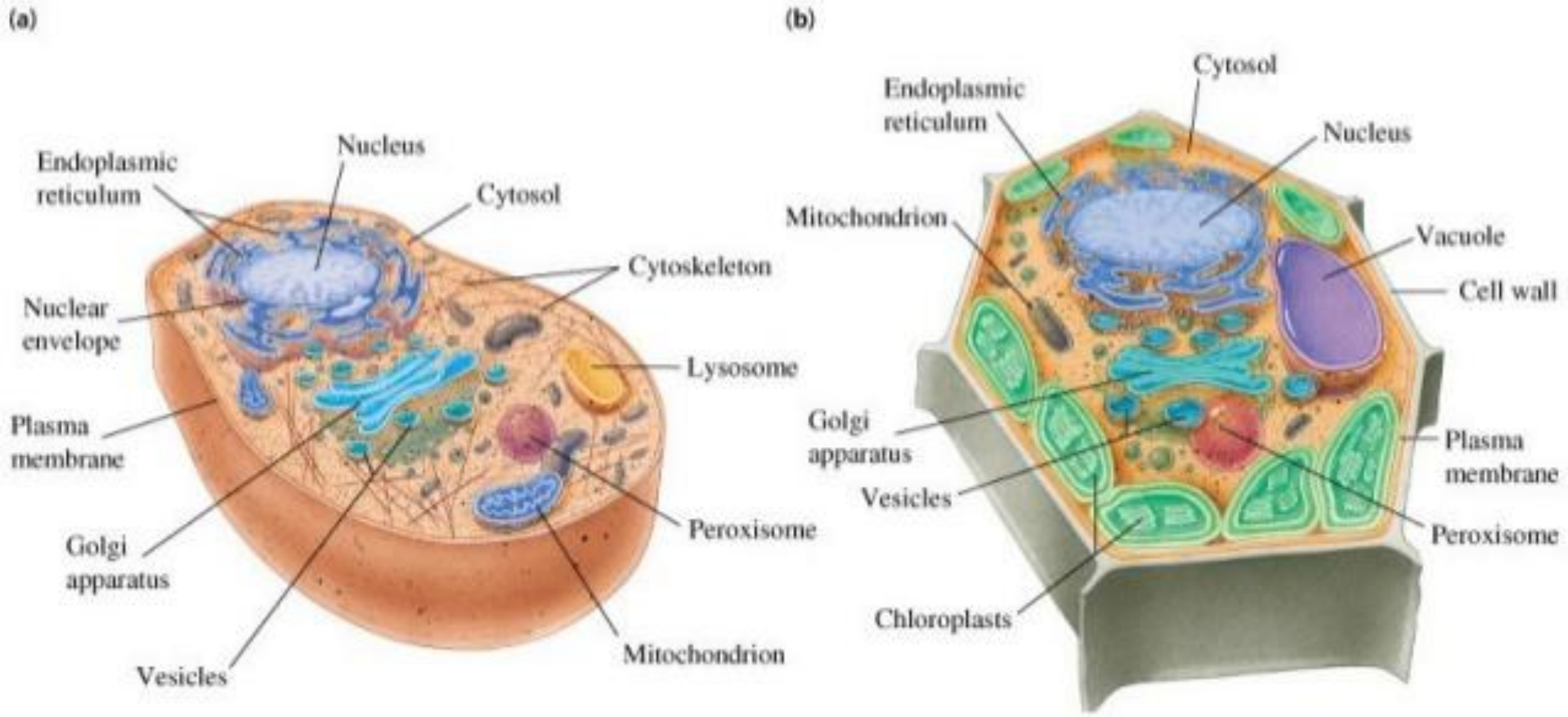


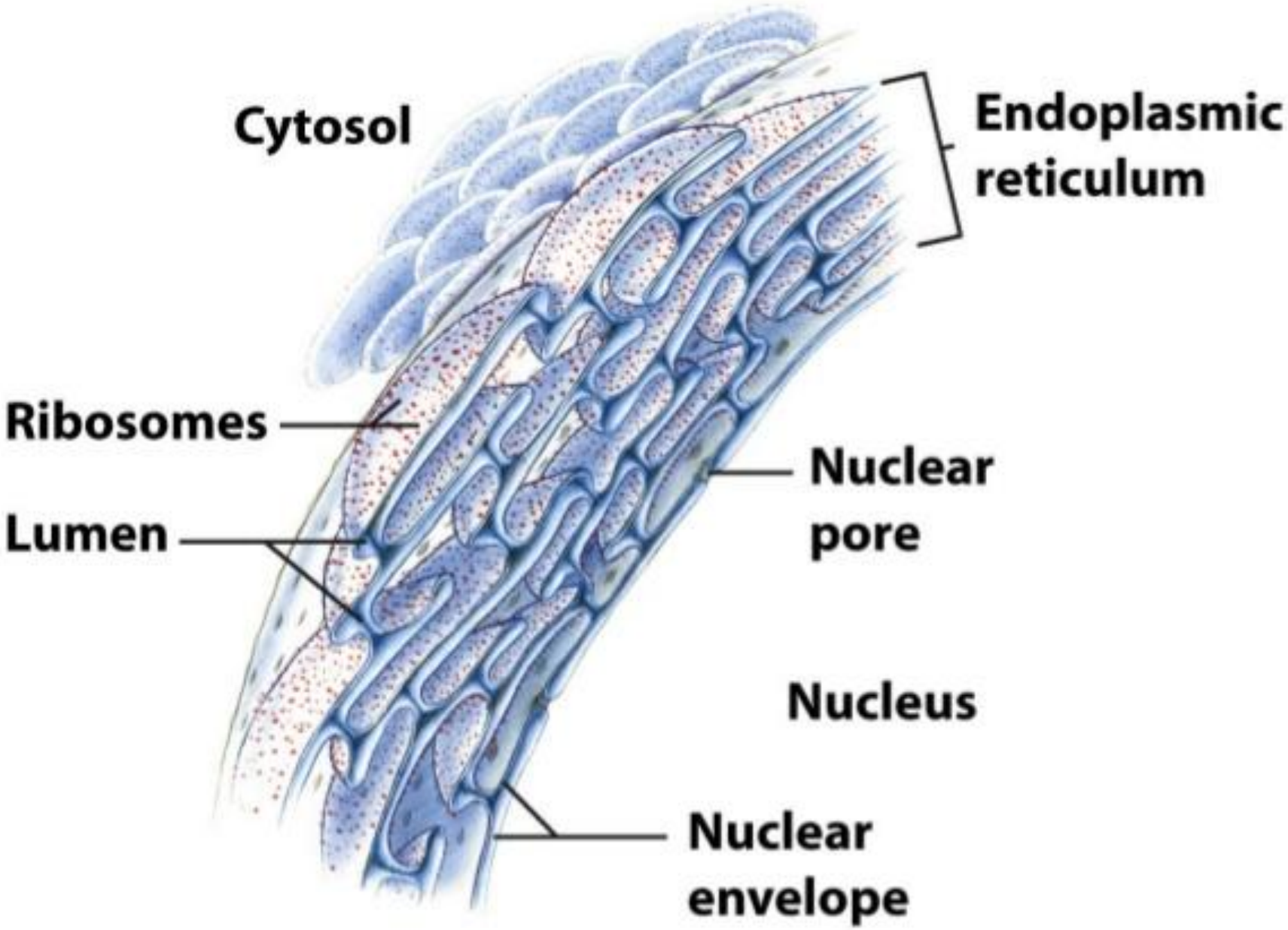
Cellular Organization of an E. coli Cell



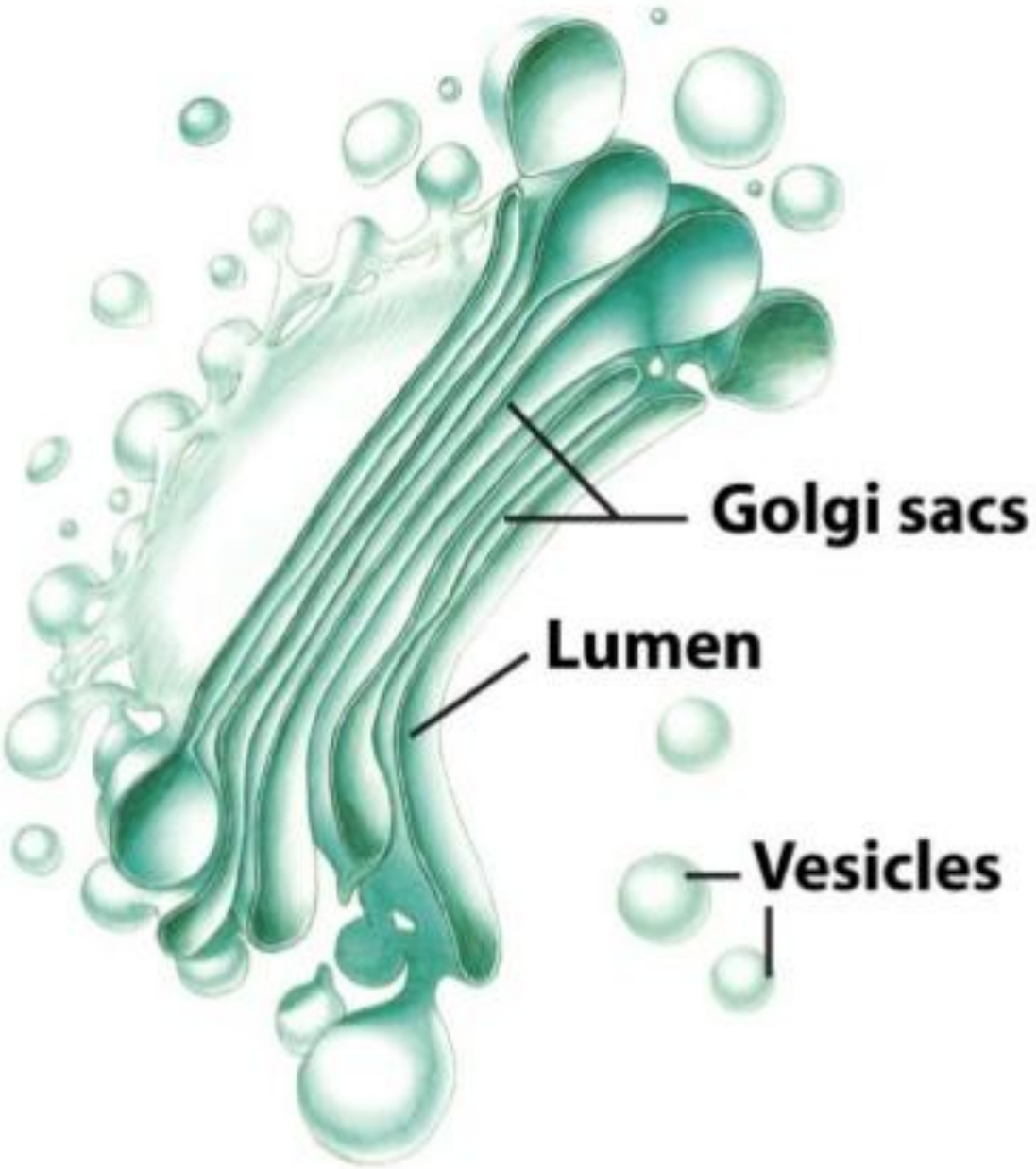
200 – 300 mg protein / mL cytoplasm

Eukaryote Cell

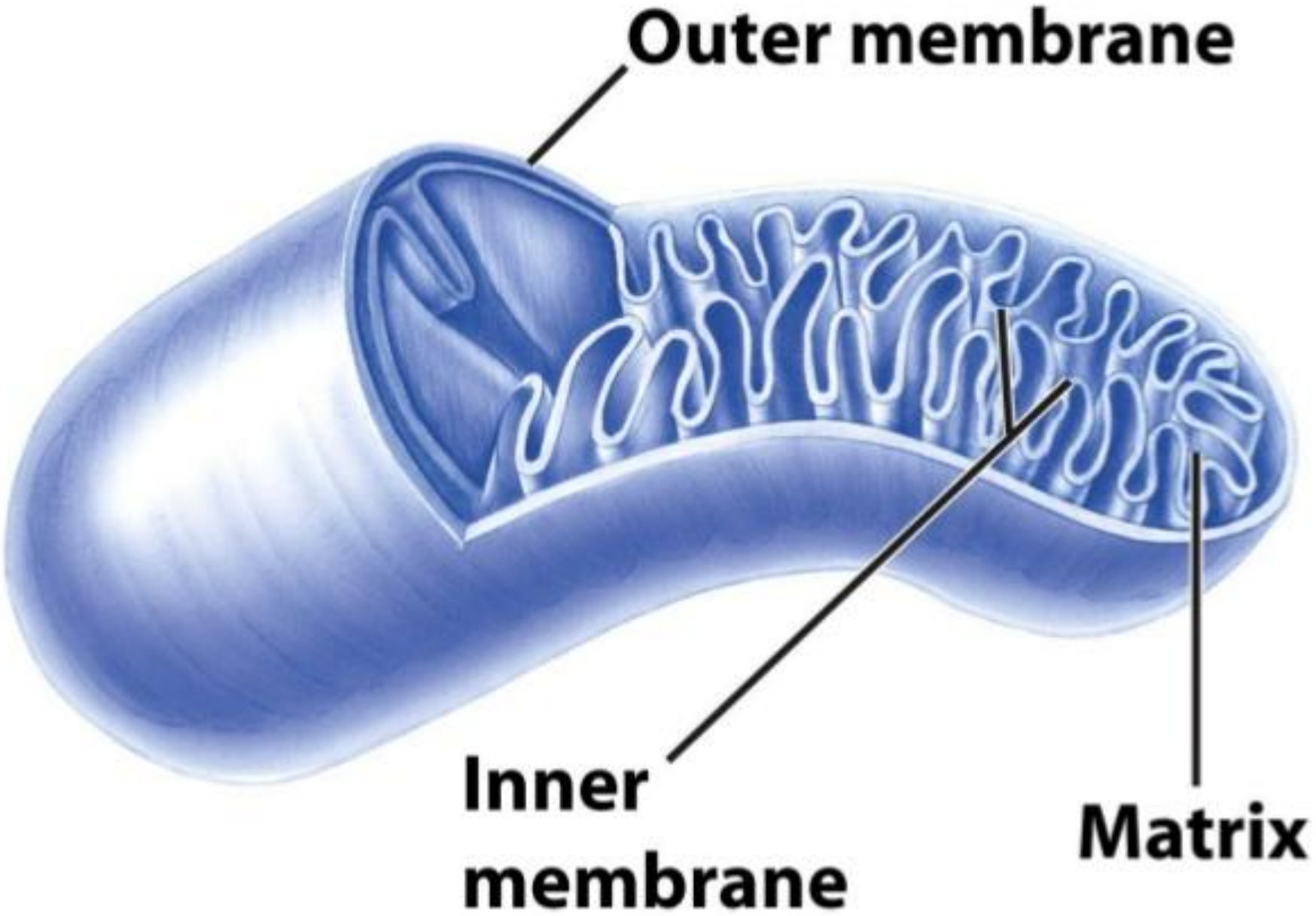




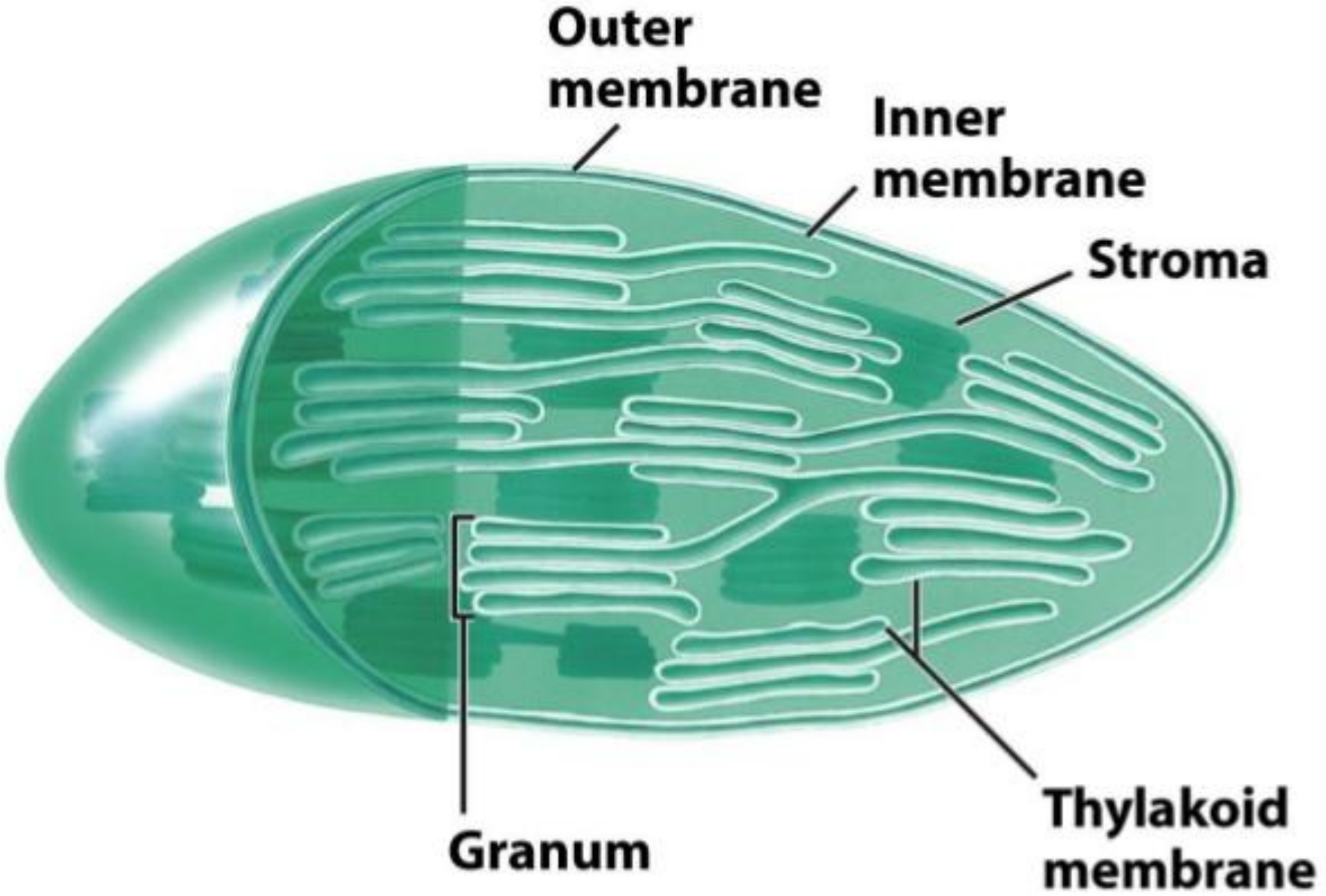
Unnumbered figure pg 19 Principles of Biochemistry, 4/e



Unnumbered figure pg 20a Principles of Biochemistry, 4/e



Unnumbered figure pg 20b Principles of Biochemistry, 4/e



Unnumbered figure pg 21 Principles of Biochemistry, 4/e

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:

10. Olshanova K.M., Piskarev S.K., Barashkov K.M. Analytical chemistry. M., 2001
11. Baeshov A.B., Sarbaeva G.T. Electrochemical analysis methods. Shymkent, 2003
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13. http://www.learn4good.com/bookstore/ecology_books_cds_for_academic_students.htm
14. http://www.press.uchicago.edu/ucp/books/book/chicago/T/bo11161054.html

Thank you for attention!

НАЗАРЛАРЫҢЫЗҒА РАХМЕТ!