Ankara University, Faculty of Agriculture , Department of Fisheries and Aquaculture, Programme of Fisheries and Aquaculture

AQS104: Biochemistry

Reference: Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). ***Lehninger Principles of Biochemistry (5th edition)***. Macmillan.

AQS104 BIOCHEMISTRY: Weekly Programme	
1. Week: • The foundations of biochemistry • Water	**8. Week:** Principles of metabolic regulation The citric acid cycle
2. Week: • Amino acids, peptides, and proteins • The three-dimensional structure of proteins	**9. Week:** Fatty acid catabolism Aino acid oxidation and the production of urea
3. Week: • Protein function • Enzymes	**10. Week:** Oxidative phosphorylation and photophosphorylation Carbohydrate biosynthesis in plants and bacteria
4. Week: • Carbohydrates and Glycobiology • Nucleotides and Nucleic Acids	**11. Week:** Lipid biosynthesis Biosynthesis of amino acids, nucleotides, and related molecules
5. Week: • DNA-based information technologies • Lipids	**12. Week:** Hormonal regulation and integration of mammalian metabolism Genes and chromosomes
6. Week: Biological membranes and transport Biosignaling	**13. Week:** DNA metabolism RNA metabolism
7. Week: Bioenergetics and biochemical reaction types Glycolysis, gluconeogenesis, and the pentose phosphate pathway	**14. Week:** Protein metabolism Regulation of gene expression

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5. Week:

DNA-based Information Technologies

Lipids

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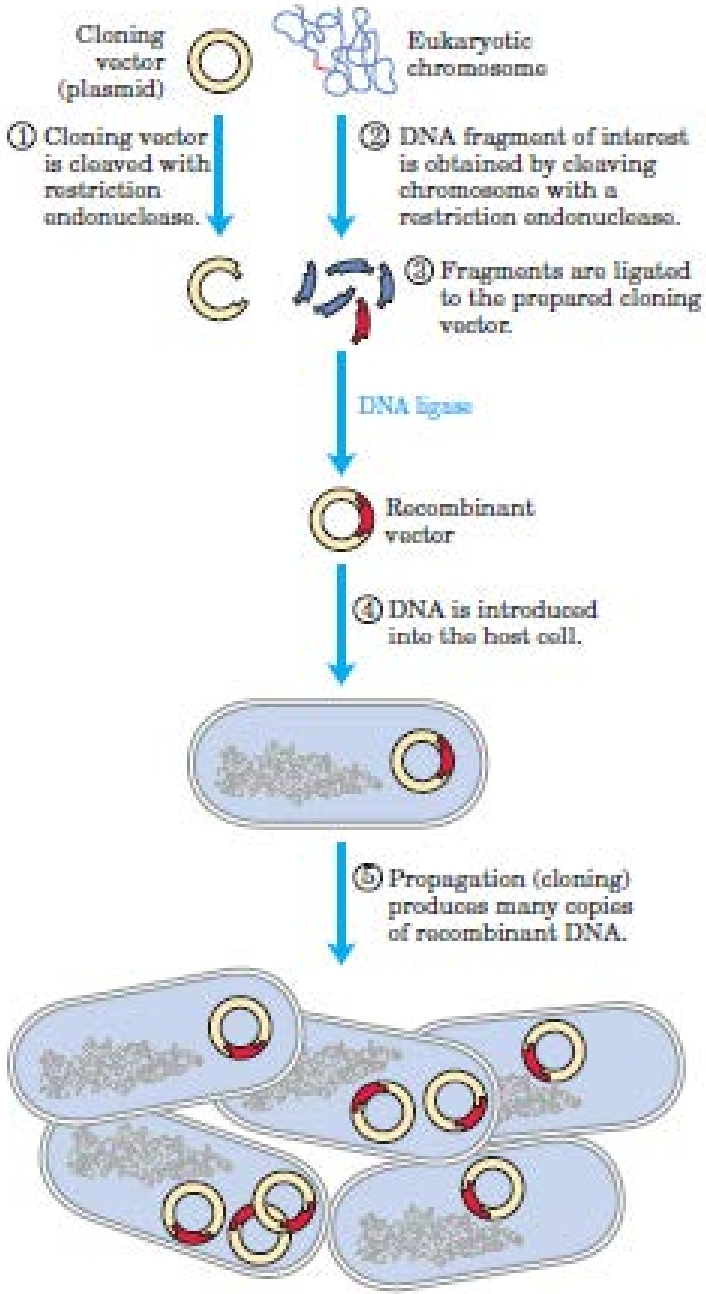

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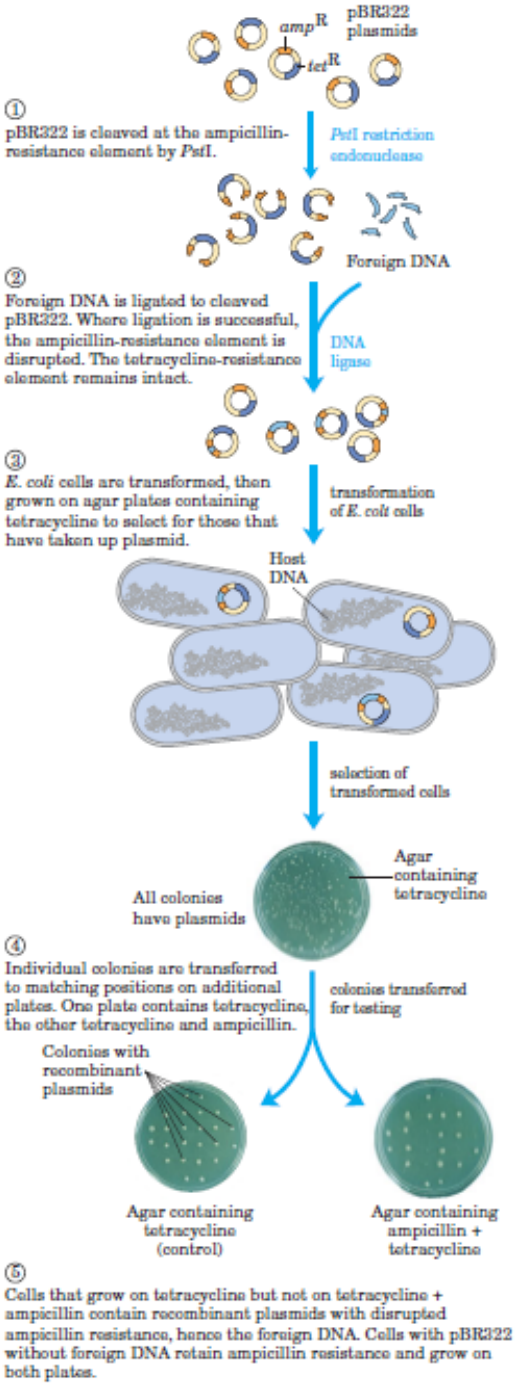

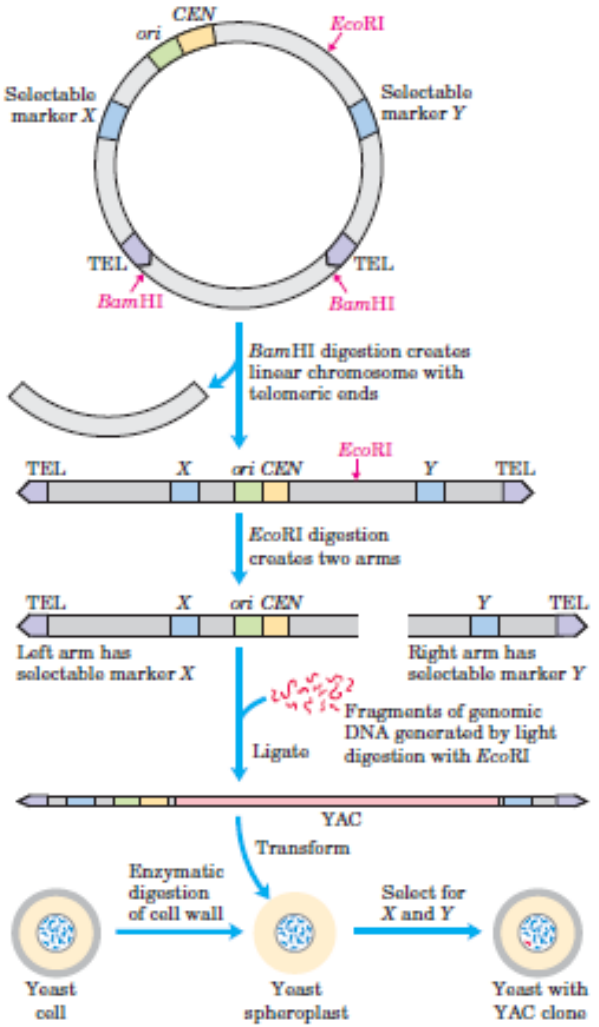

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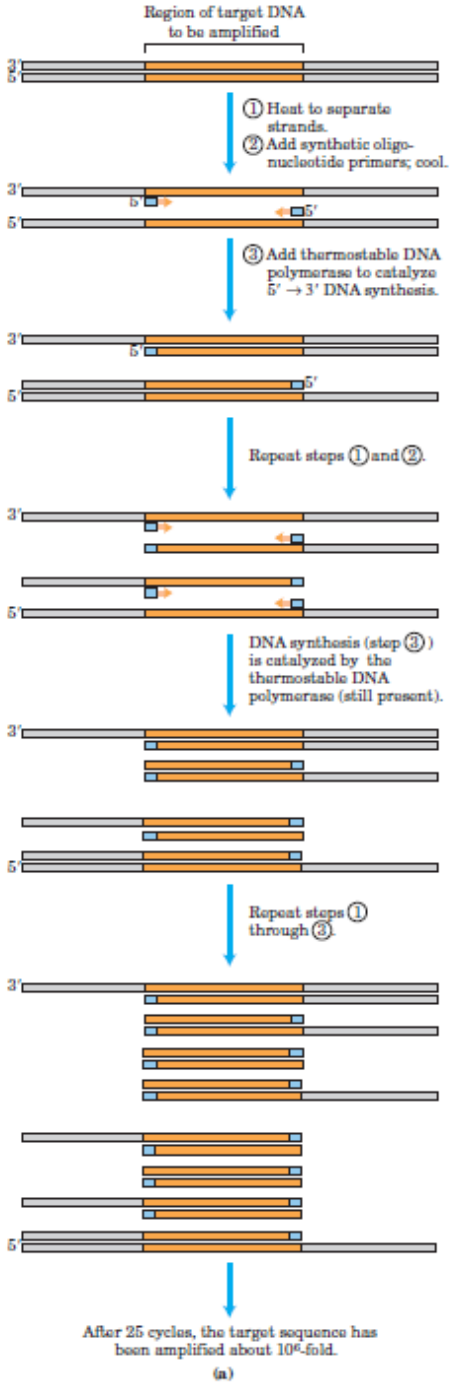

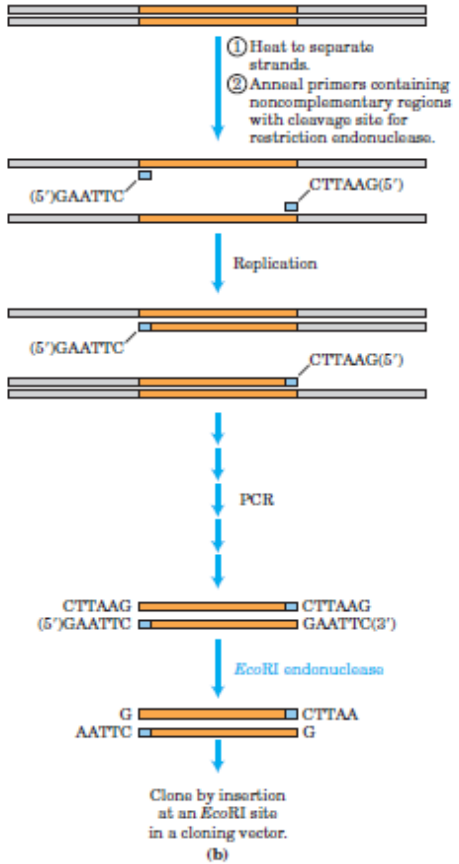

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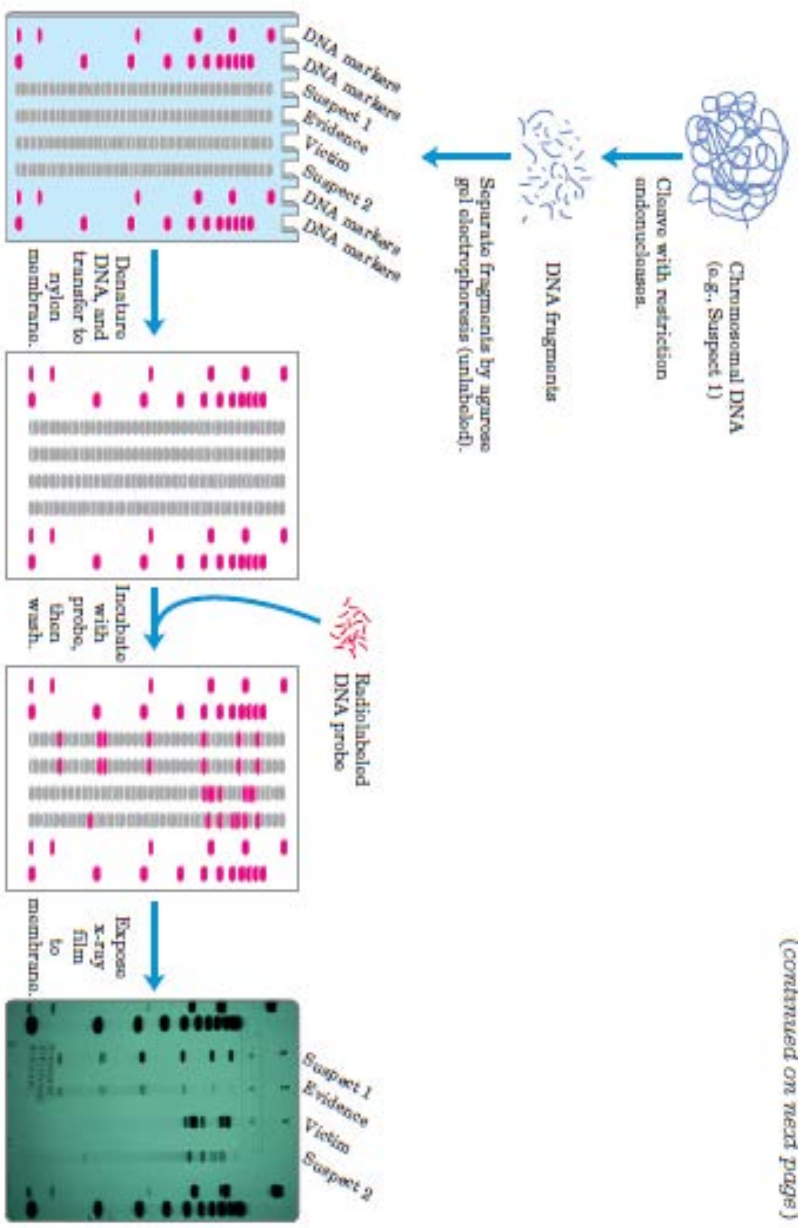

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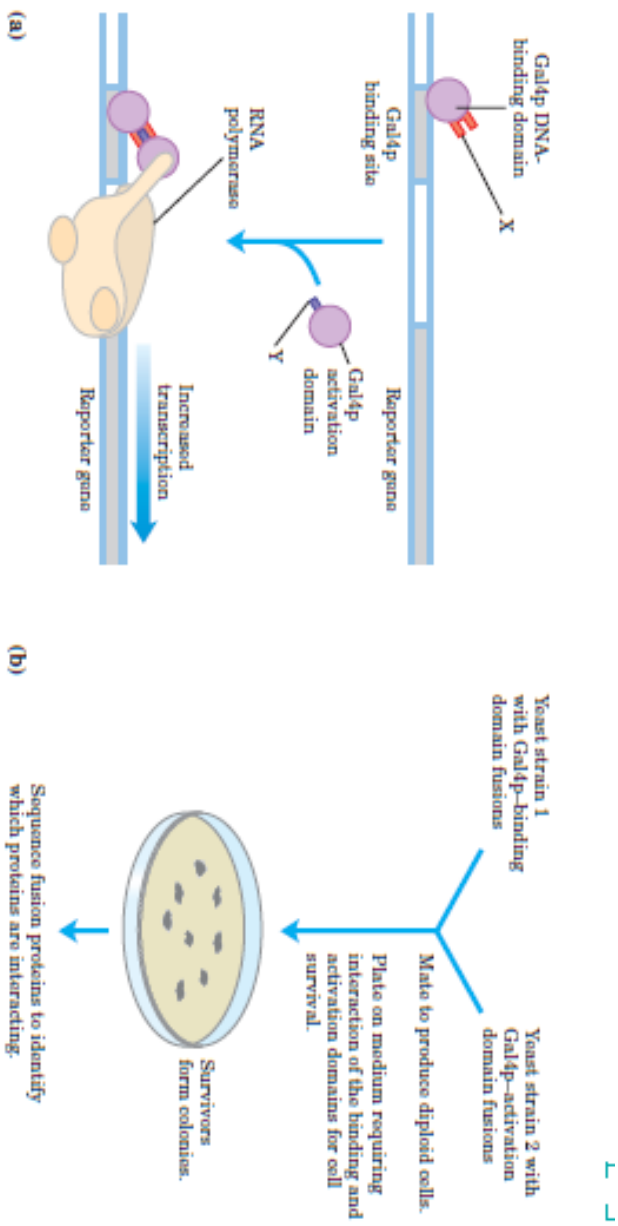

Carbon skeleton	Structure*	Systematic name†	Common name (derivation)	Melting point (°C)	Solubility at 30 °C (mg/g solvent)	
					Water	Benzene
12:0	$CH_3(CH_2)_{10}COOH$	*n*-Dodecanoic acid	Lauric acid (Latin *laurus*, "laurel plant")	44.2	0.063	2,600
14:0	$CH_3(CH_2)_{12}COOH$	*n*-Tetradecanoic acid	Myristic acid (Latin *Myristica*, nutmeg genus)	53.9	0.024	874
16:0	$CH_3(CH_2)_{14}COOH$	*n*-Hexadecanoic acid	Palmitic acid (Latin *palma*, "palm tree")	63.1	0.0083	348
18:0	$CH_3(CH_2)_{16}COOH$	*n*-Octadecanoic acid	Stearic acid (Greek *stear*, "hard fat")	69.6	0.0034	124
20:0	$CH_3(CH_2)_{18}COOH$	*n*-Eicosanoic acid	Arachidic acid (Latin *Arachis*, legume genus)	76.5		
24:0	$CH_3(CH_2)_{22}COOH$	*n*-Tetracosanoic acid	Lignoceric acid (Latin *lignum*, "wood" + *cera*, "wax")	86.0		
16:1(Δ^9)	$CH_3(CH_2)_5CH{=}CH(CH_2)_7COOH$	*cis*-9-Hexadecenoic acid	Palmitoleic acid	1 to −0.5		
18:1(Δ^9)	$CH_3(CH_2)_7CH{=}CH(CH_2)_7COOH$	*cis*-9-Octadecenoic acid	Oleic acid (Latin *oleum*, "oil")	13.4		
18:2($\Delta^{9,12}$)	$CH_3(CH_2)_4CH{=}CHCH_2CH{=}CH(CH_2)_7COOH$	*cis*-,*cis*-9,12-Octadecadienoic acid	Linoleic acid (Greek *linon*, "flax")	1–5		
18:3($\Delta^{9,12,15}$)	$CH_3CH_2CH{=}CHCH_2CH{=}CHCH_2CH{=}CH(CH_2)_7COOH$	*cis*-,*cis*-,*cis*-9,12,15-Octadecatrienoic acid	α-Linolenic acid	−11		
20:4($\Delta^{5,8,11,14}$)	$CH_3(CH_2)_4CH{=}CHCH_2CH{=}CHCH_2CH{=}CHCH_2CH{=}CH(CH_2)_3COOH$	*cis*-,*cis*-,*cis*-,*cis*-5, 8,11, 14- Icosatetraenoic acid	Arachidonic acid	−49.5		

*All acids are shown in their nonionized form. At pH 7, all free fatty acids have an ionized carboxylate. Note that numbering of carbon atoms begins at the carboxyl carbon.

†The prefix *n*- indicates the "normal" unbranched structure. For instance, "dodecanoic" simply indicates 12 carbon atoms, which could be arranged in a variety of branched forms; "n-dodecanoic" specifies the linear, unbranched form. For unsaturated fatty acids, the configuration of each double bond is indicated; in biological fatty acids the configuration is almost always cis.

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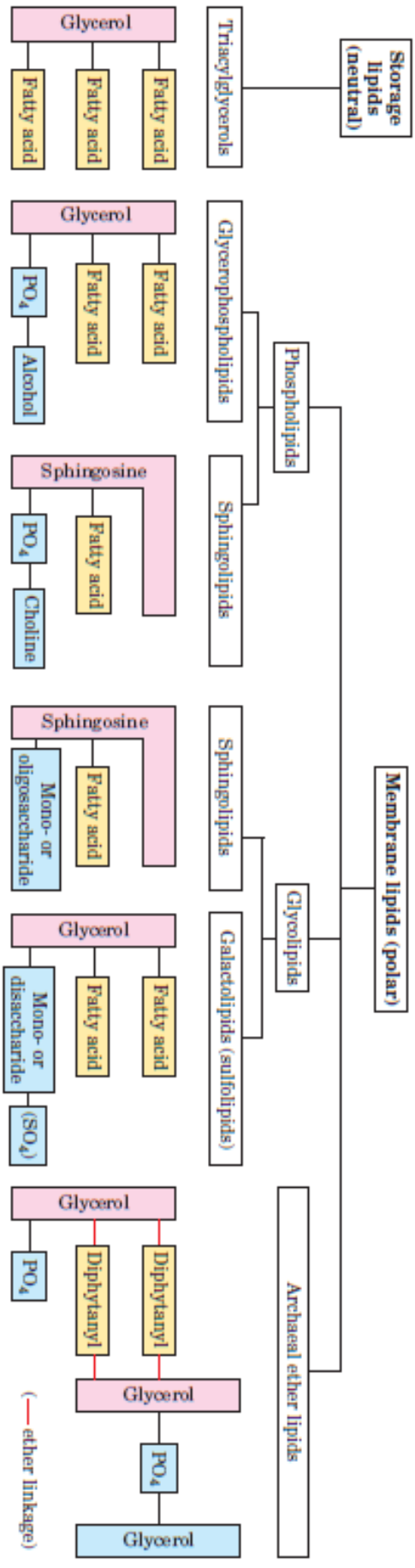
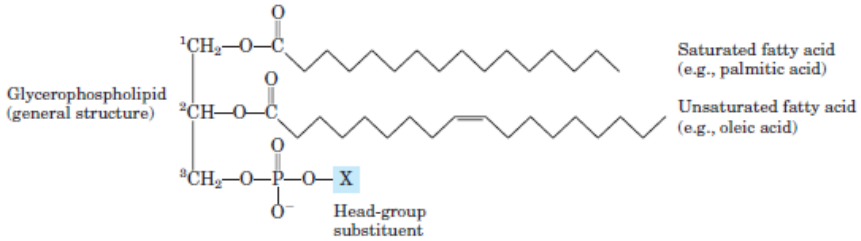




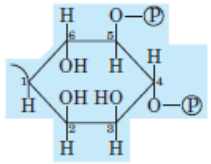
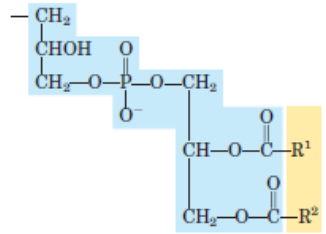
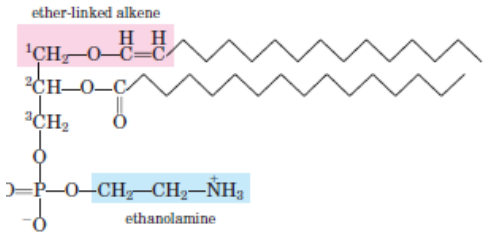
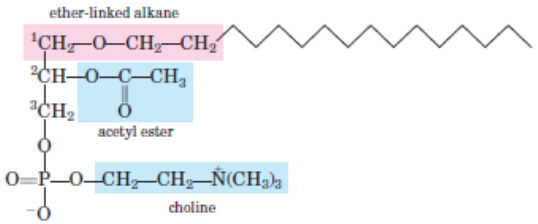
Name of glycerophospholipid	Name of X—O	Formula of X	Net charge (at pH 7)
Phosphatidic acid	—	—H	−1
Phosphatidylethanolamine	Ethanolamine	$-CH_2-CH_2-\overset{+}{N}H_3$	0
Phosphatidylcholine	Choline	$-CH_2-CH_2-\overset{+}{N}(CH_3)_3$	0
Phosphatidylserine	Serine	$-CH_2-\underset{COO^-}{CH}-\overset{+}{N}H_3$	−1
Phosphatidylglycerol	Glycerol	$-CH_2-\underset{OH}{CH}-CH_2-OH$	−1
Phosphatidylinositol 4,5-bisphosphate	*myo*-Inositol 4,5-bisphosphate		−4
Cardiolipin	Phosphatidyl-glycerol		−2

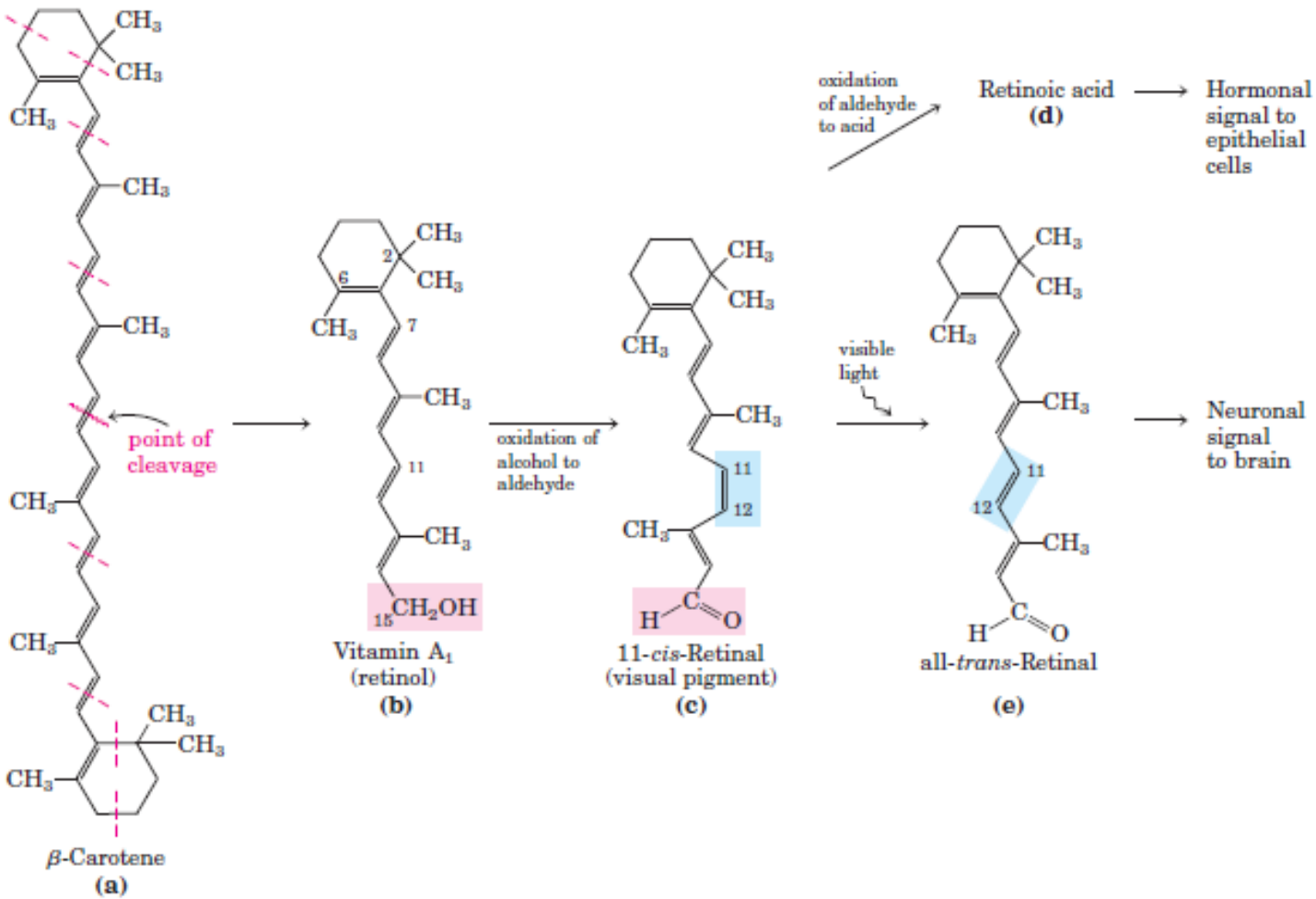
FIGURE 10–9 Glycerophospholipids. The common glycerophospholipids are diacylglycerols linked to head-group alcohols through a phosphodiester bond. Phosphatidic acid, a phosphomonoester, is the parent compound. Each derivative is named for the head-group alcohol (X), with the prefix "phosphatidyl-." In cardiolipin, two phosphatidic acids share a single glycerol (R^1 and R^2 are fatty acyl groups).



Plasmalogen



Platelet-activating factor



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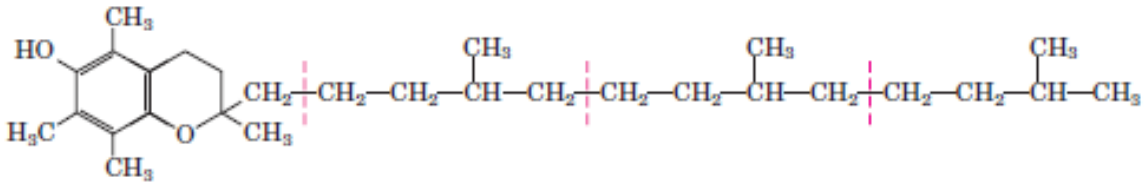
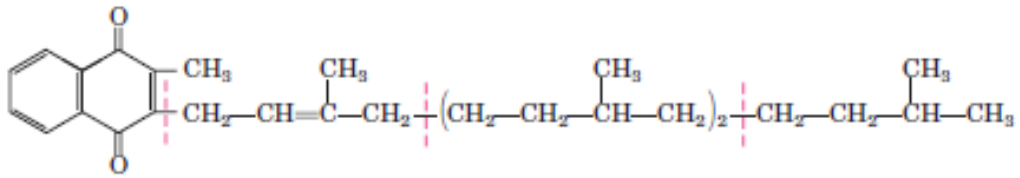
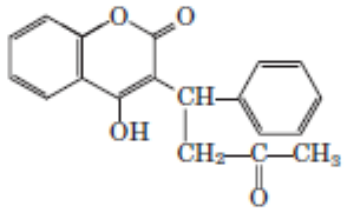
(a)
Vitamin E: an antioxidant



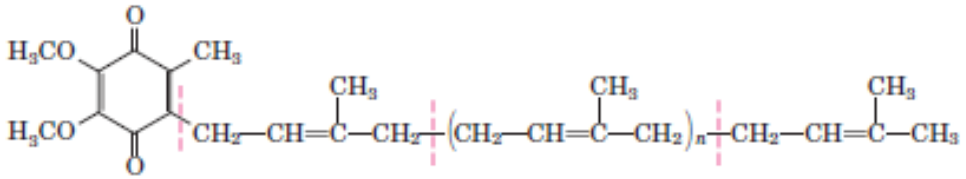
(b)
Vitamin K_1: a blood-clotting cofactor (phylloquinone)



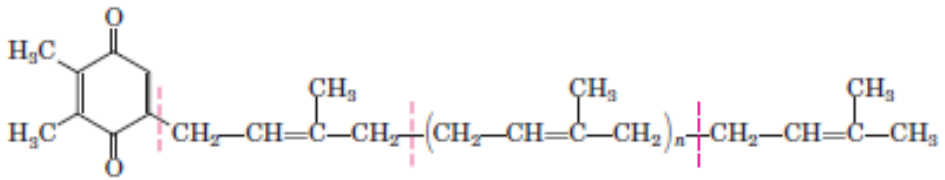
(c)
Warfarin: a blood anticoagulant



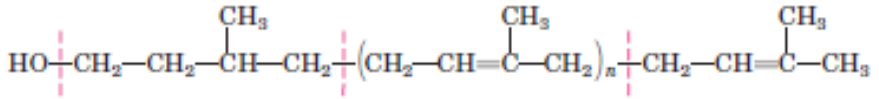
(d)
Ubiquinone: a mitochondrial electron carrier (coenzyme Q) (n = 4 to 8)



(e)
Plastoquinone: a chloroplast electron carrier (n = 4 to 8)



(f)
Dolichol: a sugar carrier (n = 9 to 22)



Category	Category code	Examples
Fatty acids	FA	Oleate, stearoyl-CoA, palmitoylcarnitine
Glycerolipids	GL	Di- and triacylglycerols
Glycerophospholipids	GP	Phosphatidylcholine, phosphatidylserine, phosphatidylethanolamine
Sphingolipids	SP	Sphingomyelin, ganglioside GM2
Sterol lipids	ST	Cholesterol, progesterone, bile acids
Prenol lipids	PR	Farnesol, geraniol, retinol, ubiquinone
Saccharolipids	SL	Lipopolysaccharide
Polyketides	PK	Tetracycline, aflatoxin B_1

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