PIPADOR REVISION

MRCOG Part 1 Revision Notes

Fats: Structure

BIOCHEMISTRY • LECTURE 217

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG PART 1 REVISION NOTES | BIOCHEMISTRY

217 Fats: Structure

Fatty acids, triacylglycerols, phospholipids, cholesterol, eicosanoids and ketone bodies

9 kcal/g	Glycerol + 3 FA	n-6, n-3	3 ketones
Energy density of fat	Triacylglycerol	Essential fatty acids (linoleic, α-linolenic)	Acetoacetate, β-HB, acetone

■ KEY FACTS: Learning objectives

- Classify lipids and describe the structure and nomenclature of fatty acids.
- Describe triacylglycerols, phospholipids (including surfactant) and cholesterol.
- Describe eicosanoids and ketone bodies and their relevance to reproduction and pregnancy.

217.1 Classification

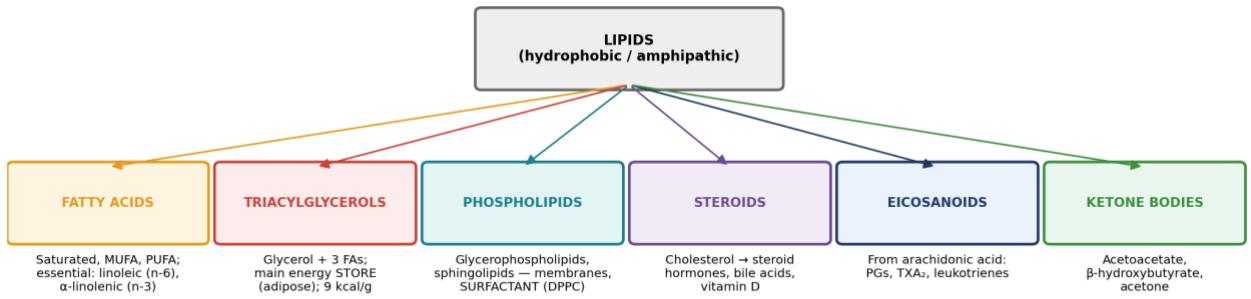


Figure 217.1 — Classes of lipids

217.2 Fatty acids

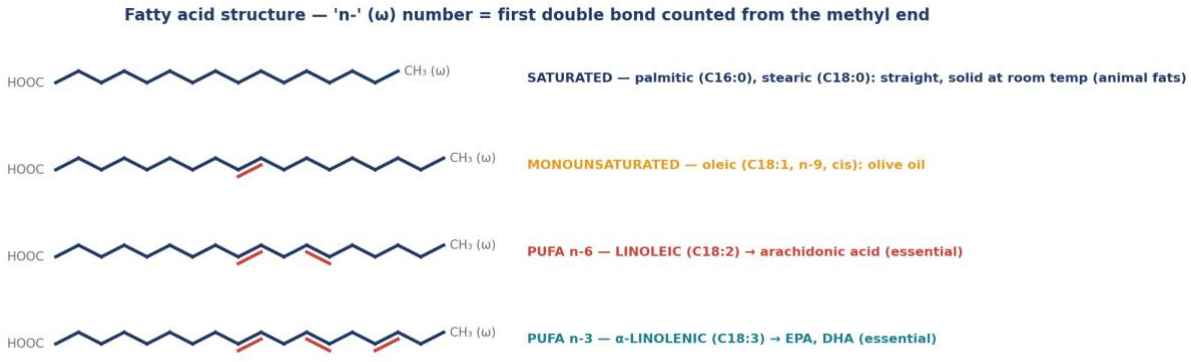


Figure 217.2 — Saturated, monounsaturated and polyunsaturated fatty acids

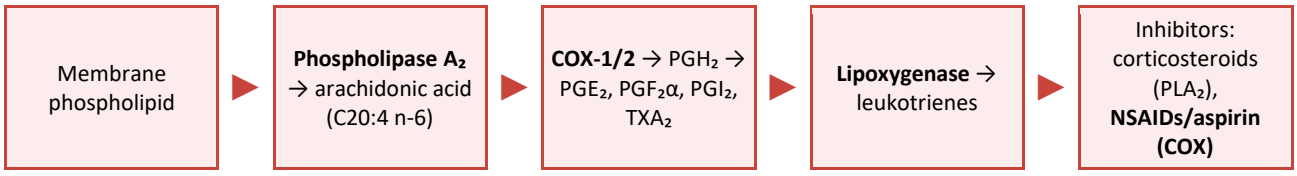
Feature	Details
Structure	Hydrocarbon chain with a terminal carboxyl group; usually even carbon numbers (C16 palmitic, C18 stearic, oleic, linoleic)

Feature	Details
Nomenclature	C18:2 n-6 = 18 carbons, 2 double bonds, first double bond 6 carbons from the methyl (ω) end
Saturation	Saturated (no double bonds; ↑ LDL), MUFA (one; olive oil), PUFA (≥ 2; vegetable/fish oils). Natural double bonds are cis (kinked); trans fats (industrial hydrogenation) ↑ LDL, ↓ HDL — harmful
Essential fatty acids	Humans cannot insert double bonds beyond C9: linoleic acid (n-6) → arachidonic acid; α-linolenic acid (n-3) → EPA, DHA (conversion inefficient — oily fish)
DHA in pregnancy	Concentrated in fetal brain and retina; accrued mainly in the 3rd trimester via selective placental transfer ('biomagnification'); preterm infants miss this — DHA in preterm formula/milk

217.3 Triacylglycerols, phospholipids and cholesterol

Lipid	Structure	Functions / clinical
Triacylglycerols (TAG)	Glycerol esterified with 3 fatty acids	Main energy store (adipose — anhydrous, 9 kcal/g); transported in chylomicrons/VLDL; ↑ 2–3× in pregnancy; severe hypertriglyceridaemia → pancreatitis (rare in pregnancy)
Glycerophospholipids	Glycerol + 2 FA + phosphate + head group (choline, ethanolamine, serine, inositol)	Membranes (amphipathic bilayer); phosphatidylinositol → IP_3/DAG signalling; phosphatidylserine (apoptosis, coagulation); antiphospholipid antibodies target phospholipid–protein complexes (β2-GPI)
Surfactant	Dipalmitoyl-phosphatidylcholine (lecithin), phosphatidylglycerol, SP-A–D	↓ Alveolar surface tension; L/S ratio ≥ 2 and PG indicate fetal lung maturity (Lecture 132)
Sphingolipids	Sphingosine backbone (sphingomyelin, gangliosides, cerebrosides)	Myelin; lysosomal storage disorders (Tay–Sachs, Gaucher, Niemann–Pick)
Cholesterol	4-ring steroid nucleus (C27)	Membranes; precursor of steroid hormones (via StAR/CYP11A1), bile acids, vitamin D; placenta uses maternal LDL-cholesterol for progesterone

217.4 Eicosanoids



Eicosanoid	Reproductive actions
PGE_2	Cervical ripening, fever, ductus arteriosus patency, gastric protection (dinoprostone)
$PGF_2\alpha$	Myometrial contraction, luteolysis, menstruation, dysmenorrhoea (carboprost)
PGI_2 (prostacyclin)	Vasodilatation, ↓ platelet aggregation — ↑ in normal pregnancy
TXA_2	Vasoconstriction, platelet aggregation — PGI_2:TXA_2 imbalance in pre-eclampsia → low-dose aspirin (preferentially ↓ platelet TXA_2)

217.5 Ketone bodies

Acetoacetate, **β-hydroxybutyrate** (the main circulating ketone; measured in blood) and **acetone** (volatile — fruity breath) are made in liver mitochondria from acetyl-CoA when fatty acid oxidation exceeds TCA capacity (low insulin, high glucagon). They are water-soluble fuels for brain, heart, muscle and **fetus** (Lecture 219). Urine dipsticks detect acetoacetate (not β-HB).

217.6 Must-know summary

■ EXAM TIP

- Fatty acids: saturated / MUFA / PUFA; cis vs **trans**; essential = **linoleic (n-6) and α-linolenic (n-3)**; **DHA** for fetal brain/retina (3rd trimester).
- TAG = glycerol + 3 FA (energy store); phospholipids form membranes; **DPPC = surfactant**.
- Cholesterol → steroids, bile acids, vitamin D.
- Arachidonic acid → PGs/TXA_2 (COX) and leukotrienes (LOX); aspirin ↓ TXA_2 in pre-eclampsia prevention.
- Ketones: acetoacetate, **β-hydroxybutyrate**, acetone.

■ MNEMONIC / MEMORY AID

Essential fatty acids — 'LA and ALA': Linoleic Acid (n-6) and Alpha-Linolenic Acid (n-3). **$PGF_2\alpha$ = 'F for Force' (contraction); PGE_2 = 'E for Effacement'**.