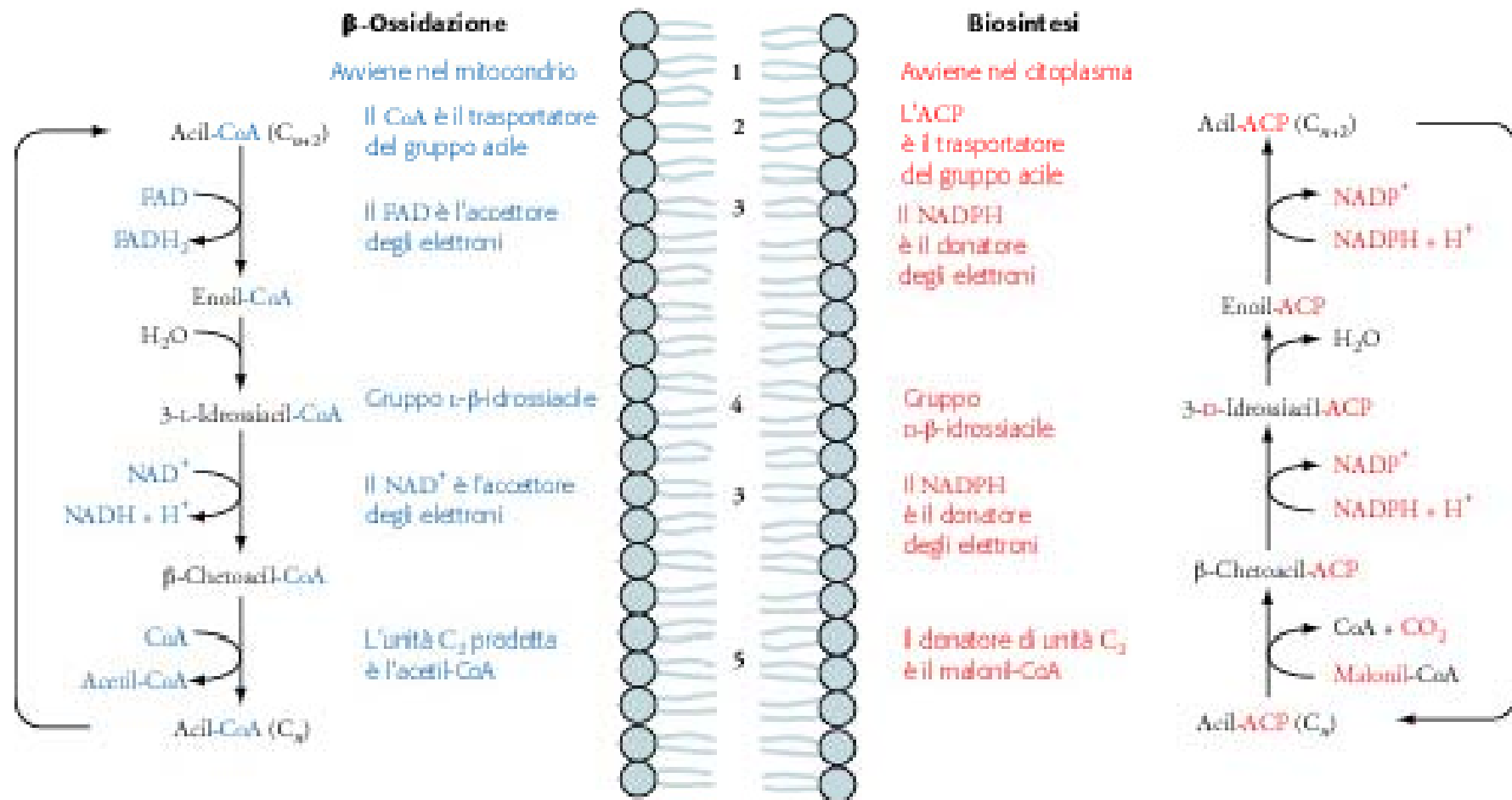
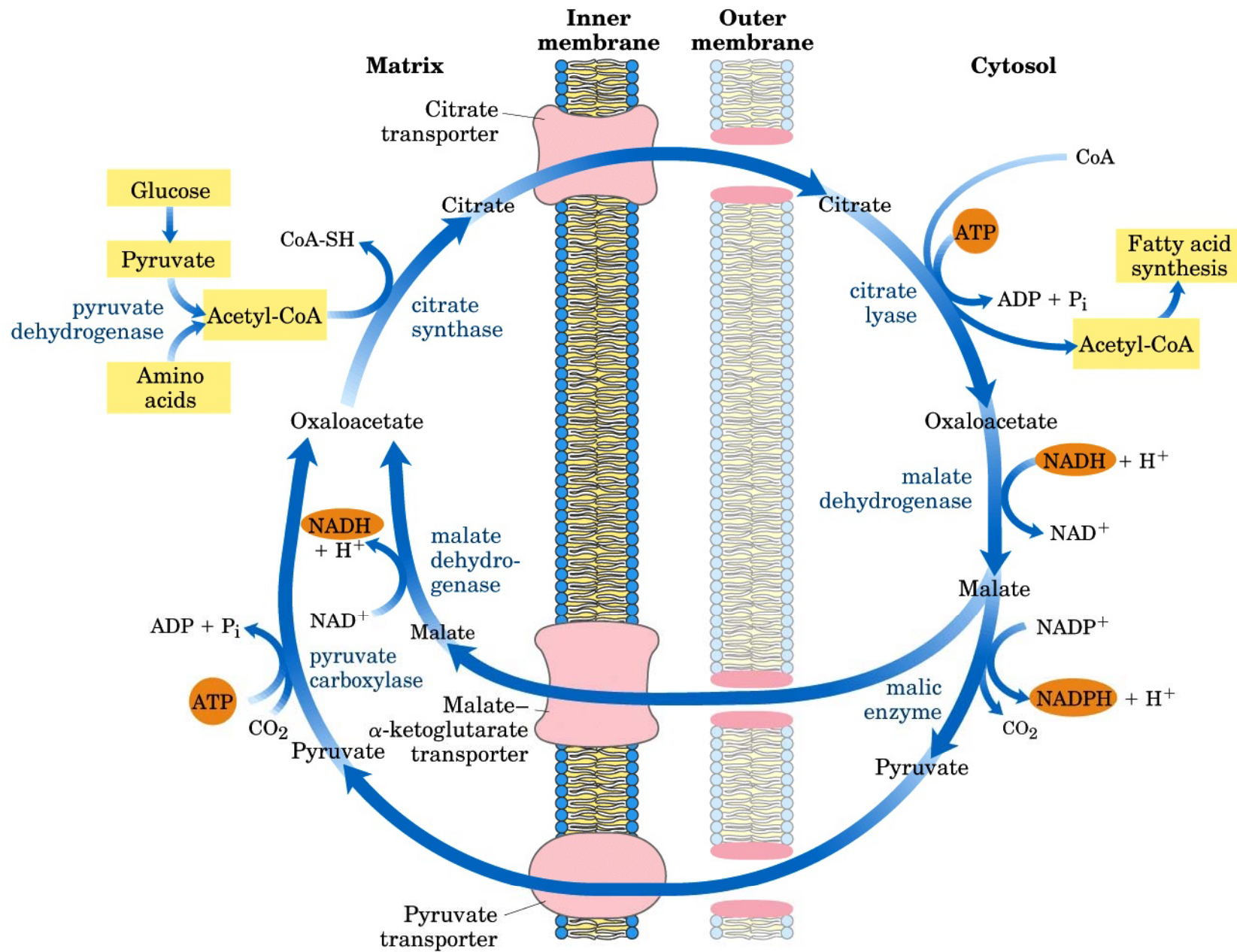


Biosintesi degli acidi grassi

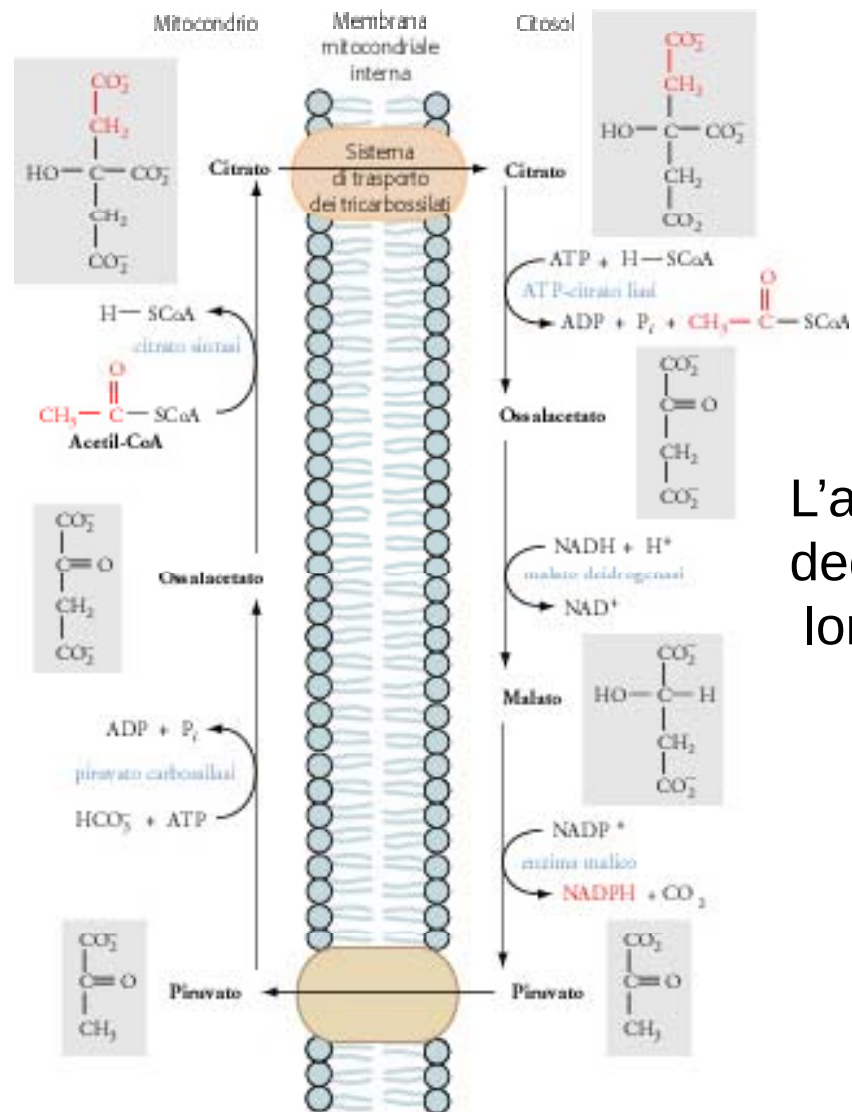
- La biosintesi degli acidi grassi avviene tramite la condensazione di unità C_2 , un processo inverso rispetto alla beta-ossidazione.
- Tuttavia, la via di sintesi è diversa da quella di ossidazione

Confronto tra beta ossidazione e sintesi degli acidi grassi



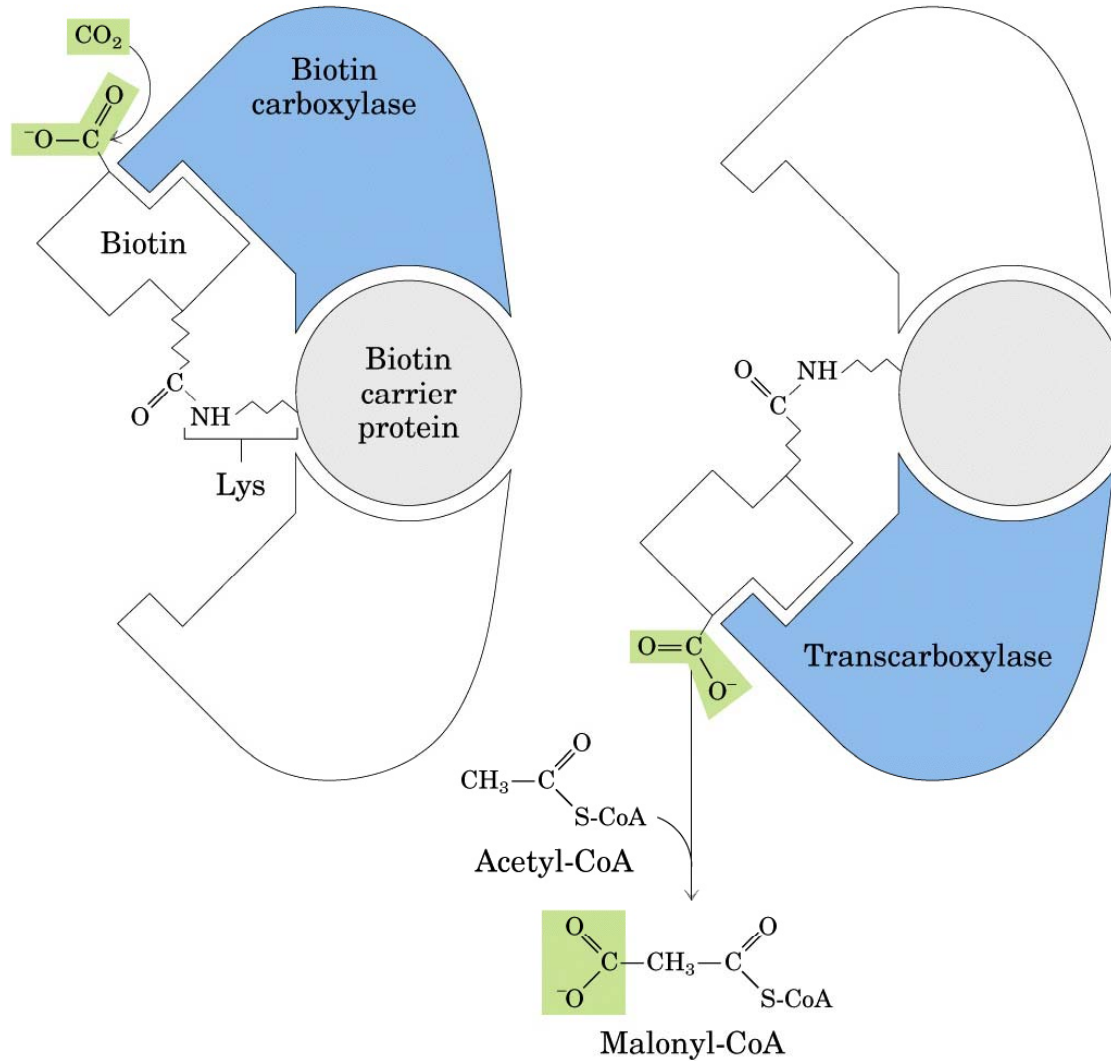


Trasporto nel citosol dell'acetil-CoA mitocondriale

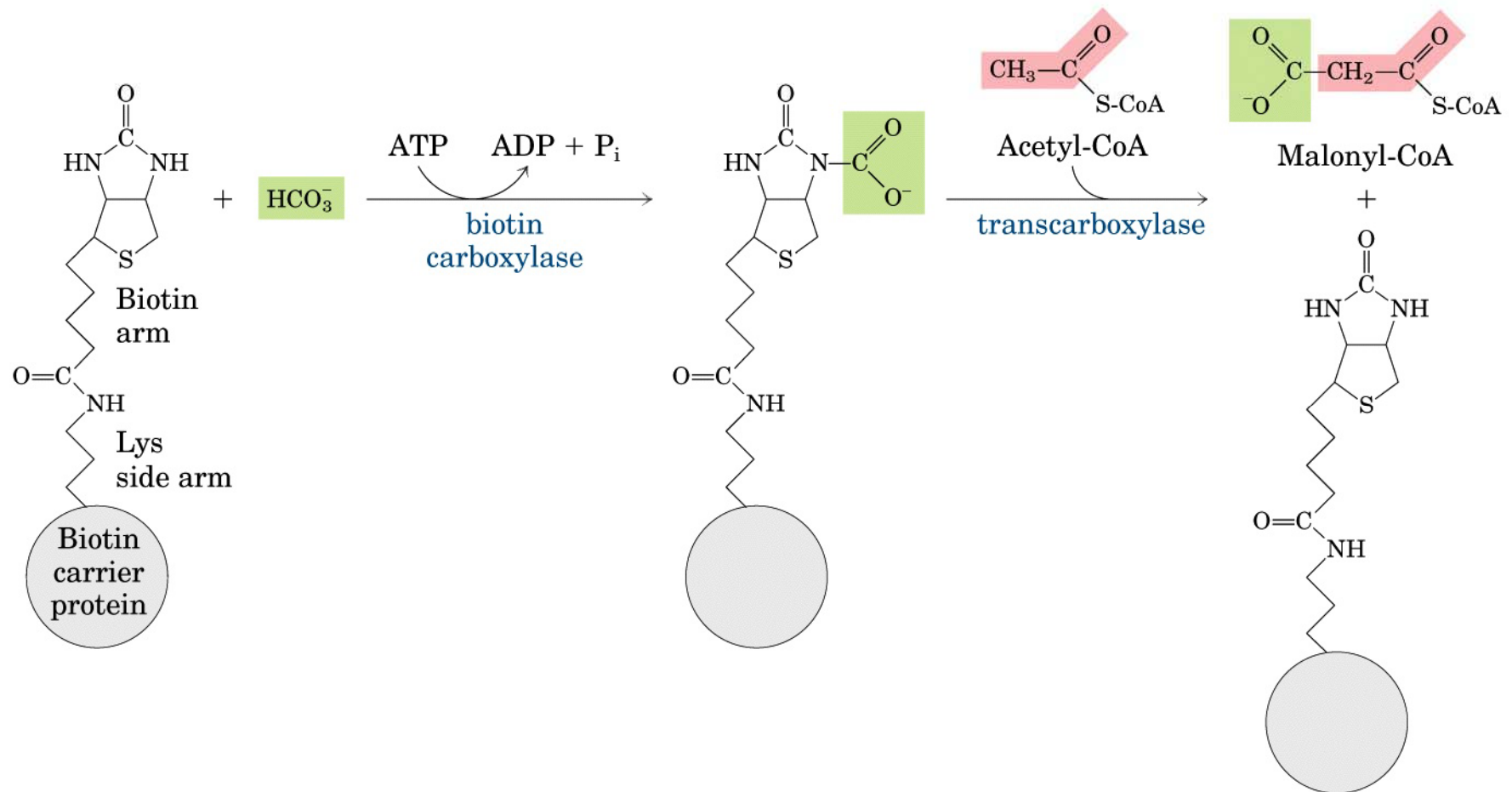


L'acetil-CoA usato per la biosintesi degli acidi grassi non deriva dal loro catabolismo!

Acetil-CoA carbossilasi



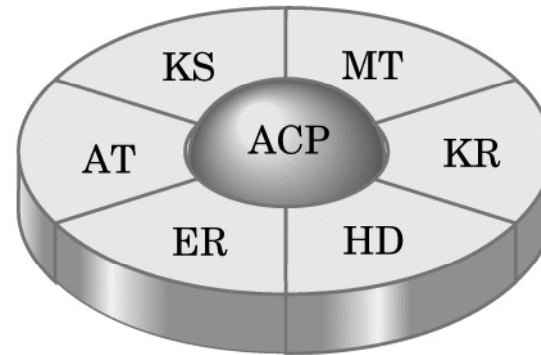
Acetil-CoA carbossilasi



- Gli acidi grassi vengono sintetizzati mediante una sequenza di reazioni ripetute, realizzate dal complesso dell'acido grasso sintetasi

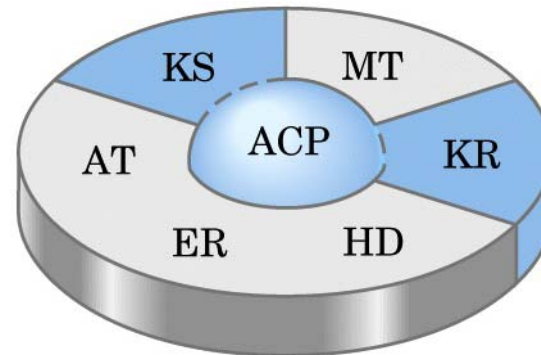
Bacteria, Plants

Seven activities
in seven separate
polypeptides



Yeast

Seven activities
in two separate
polypeptides



Vertebrates

Seven activities
in one large
polypeptide

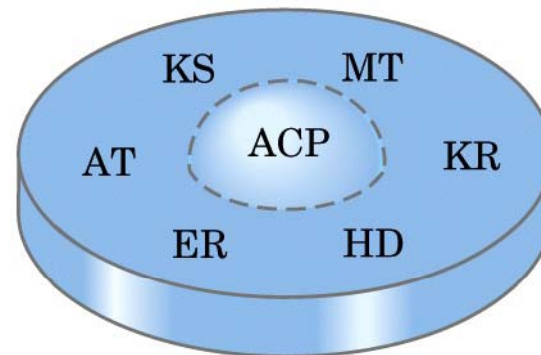
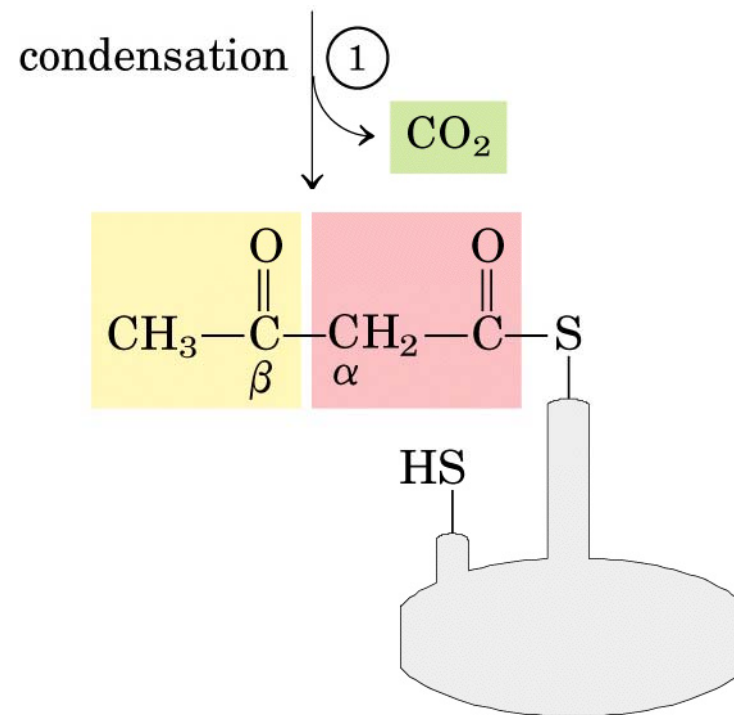
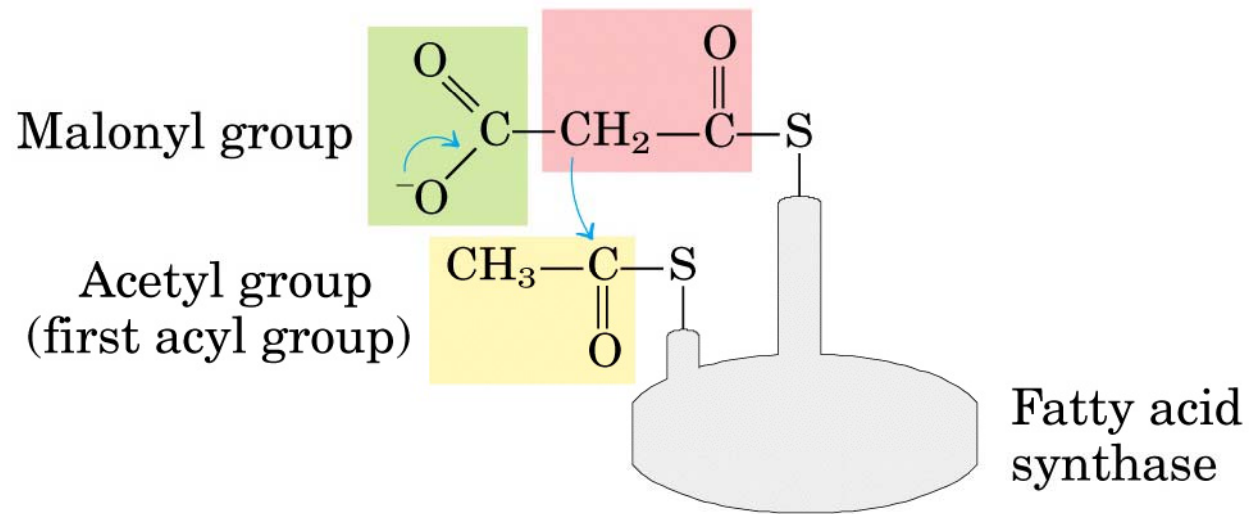
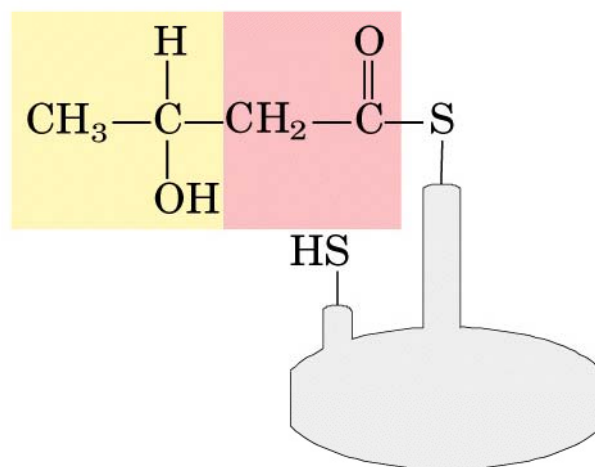
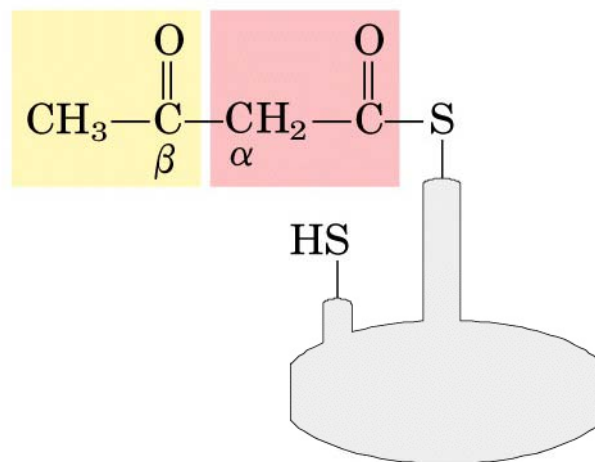


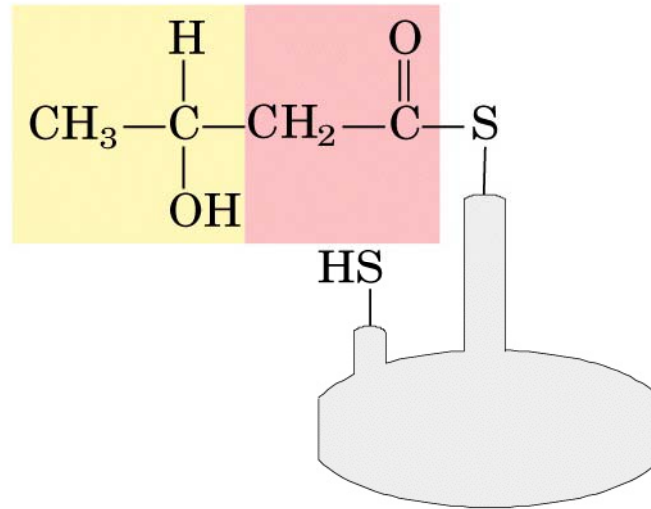
table 21–1

Proteins of the Fatty Acid Synthase Complex of *E. coli*

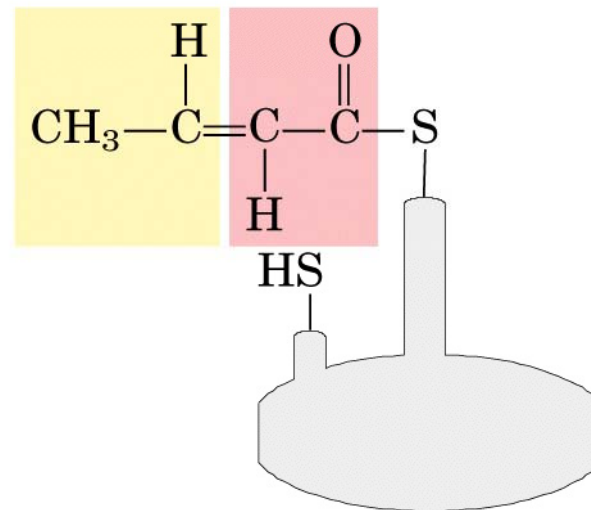
Protein	Role
Acyl carrier protein (ACP)	Carries acyl groups in thioester linkage
Acetyl-CoA–ACP transacetylase (AT)	Transfers acyl group from CoA to Cys residue of KS
β -Ketoacyl-ACP synthase (KS)	Condenses acyl and malonyl groups (there are at least three isozymes of KS)
Malonyl-CoA–ACP transferase (MT)	Transfers malonyl group from CoA to ACP
β -Ketoacyl-ACP reductase (KR)	Reduces β -keto group to β -hydroxy group
β -Hydroxyacyl-ACP dehydratase (HD)	Removes H ₂ O from β -hydroxyacyl-ACP, creating double bond
Enoyl-ACP reductase (ER)	Reduces double bond, forming saturated acyl-ACP

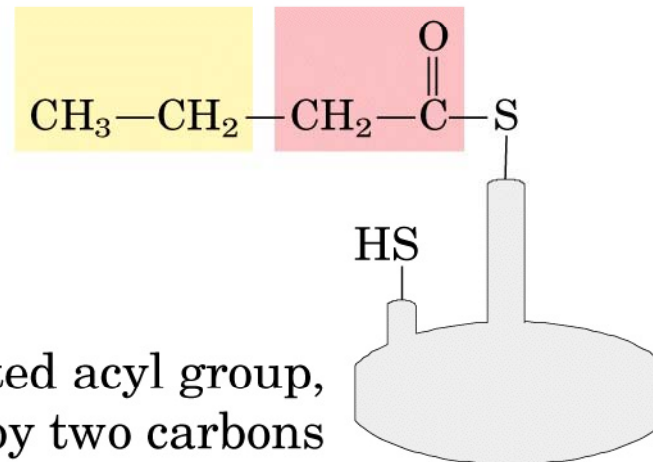
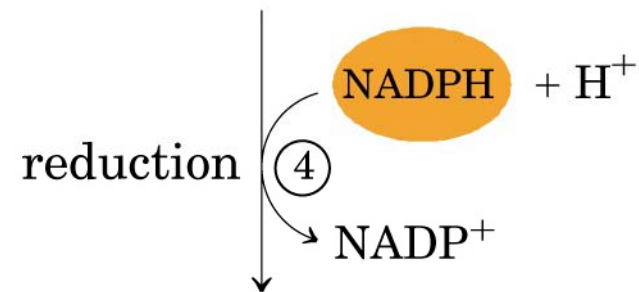
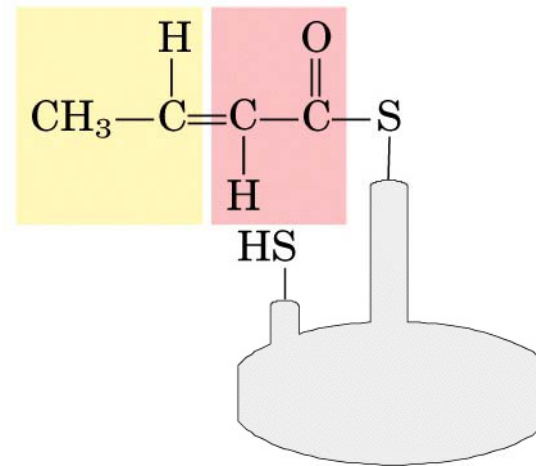






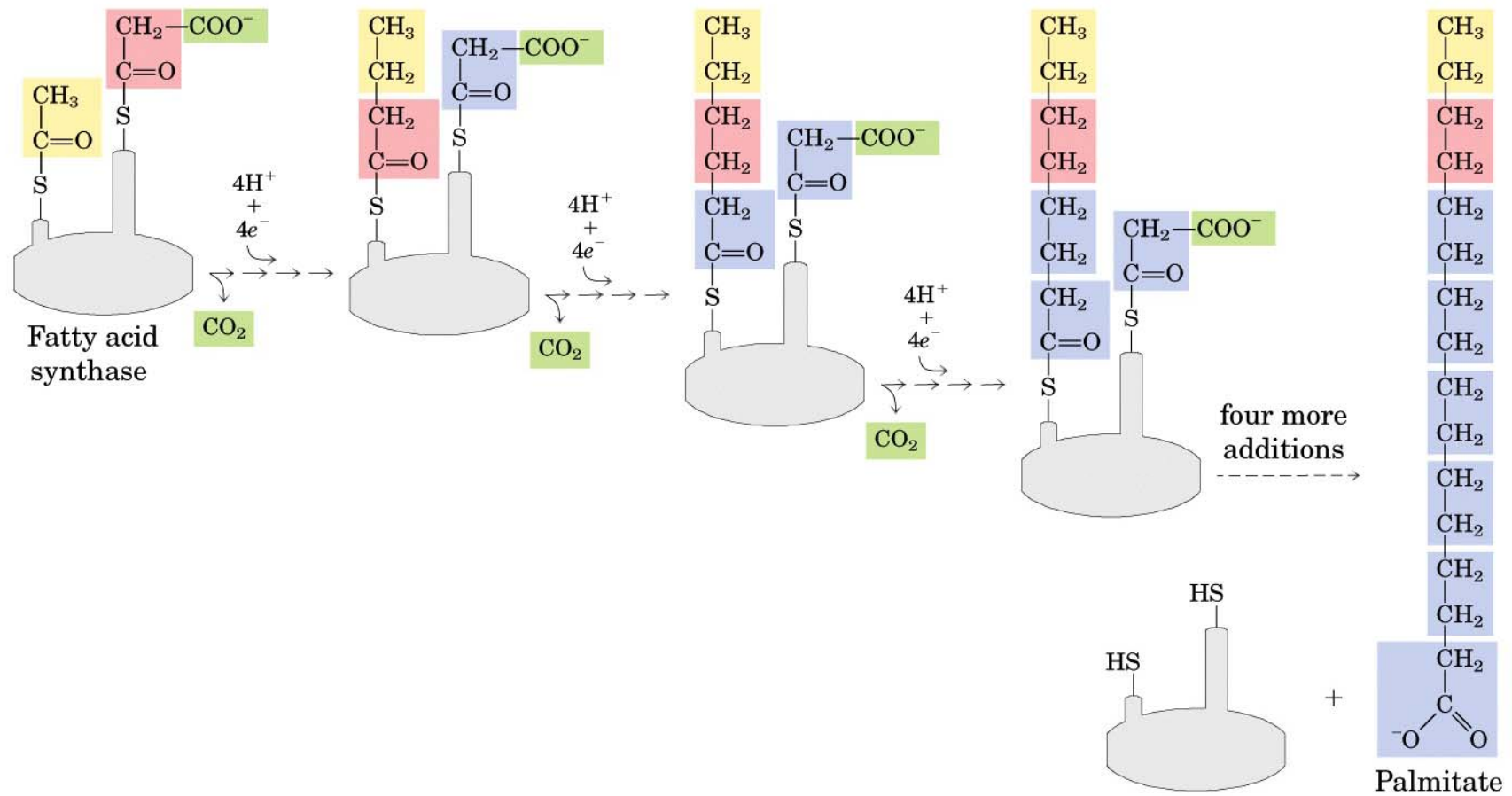
dehydration (3) $\rightarrow \text{H}_2\text{O}$

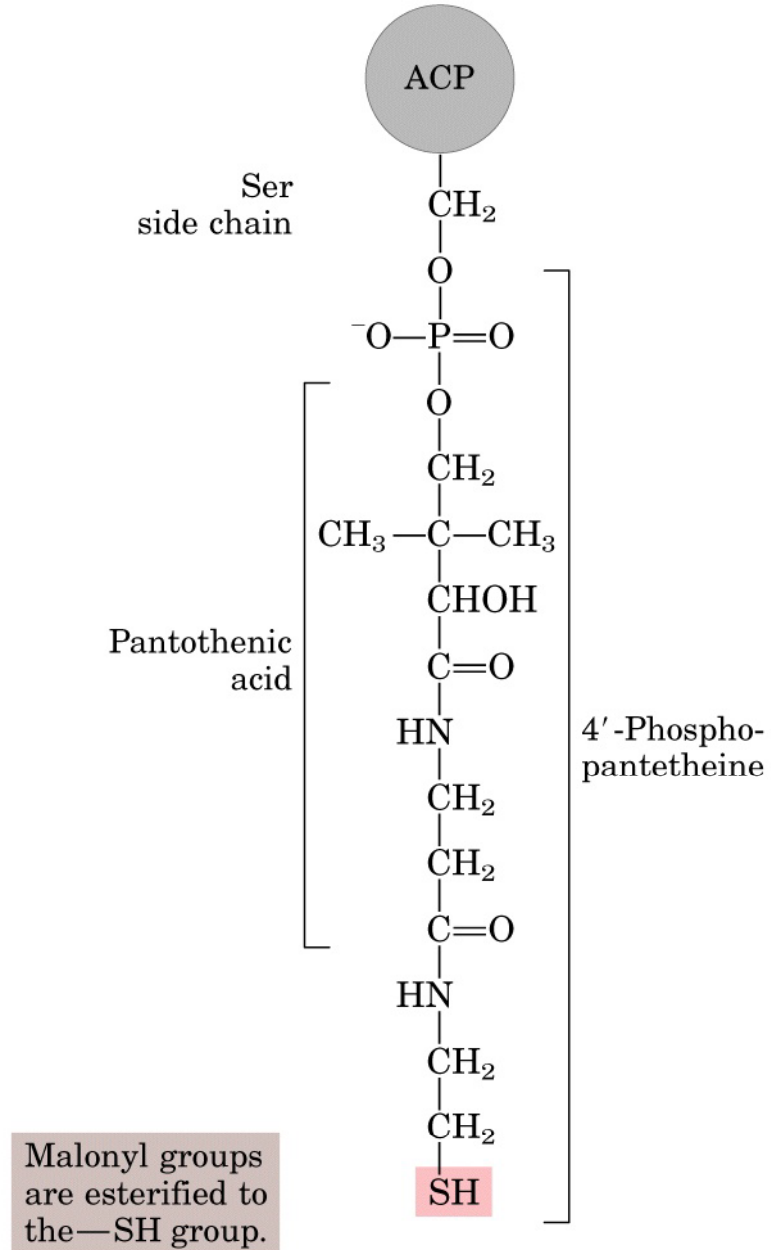


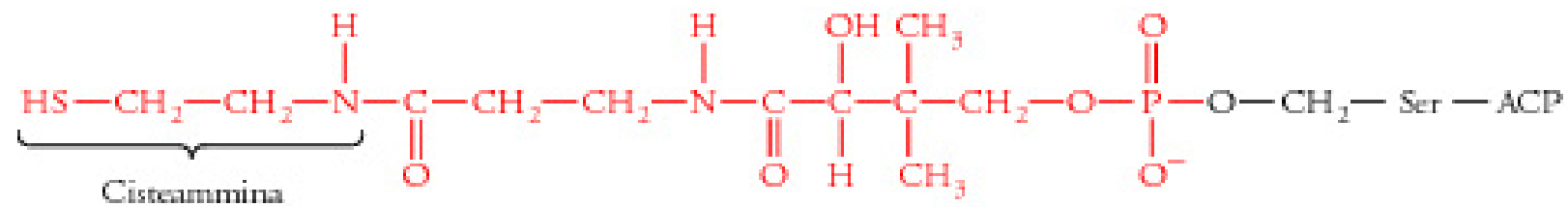


Saturated acyl group,
lengthened by two carbons

La sintesi del palmitato



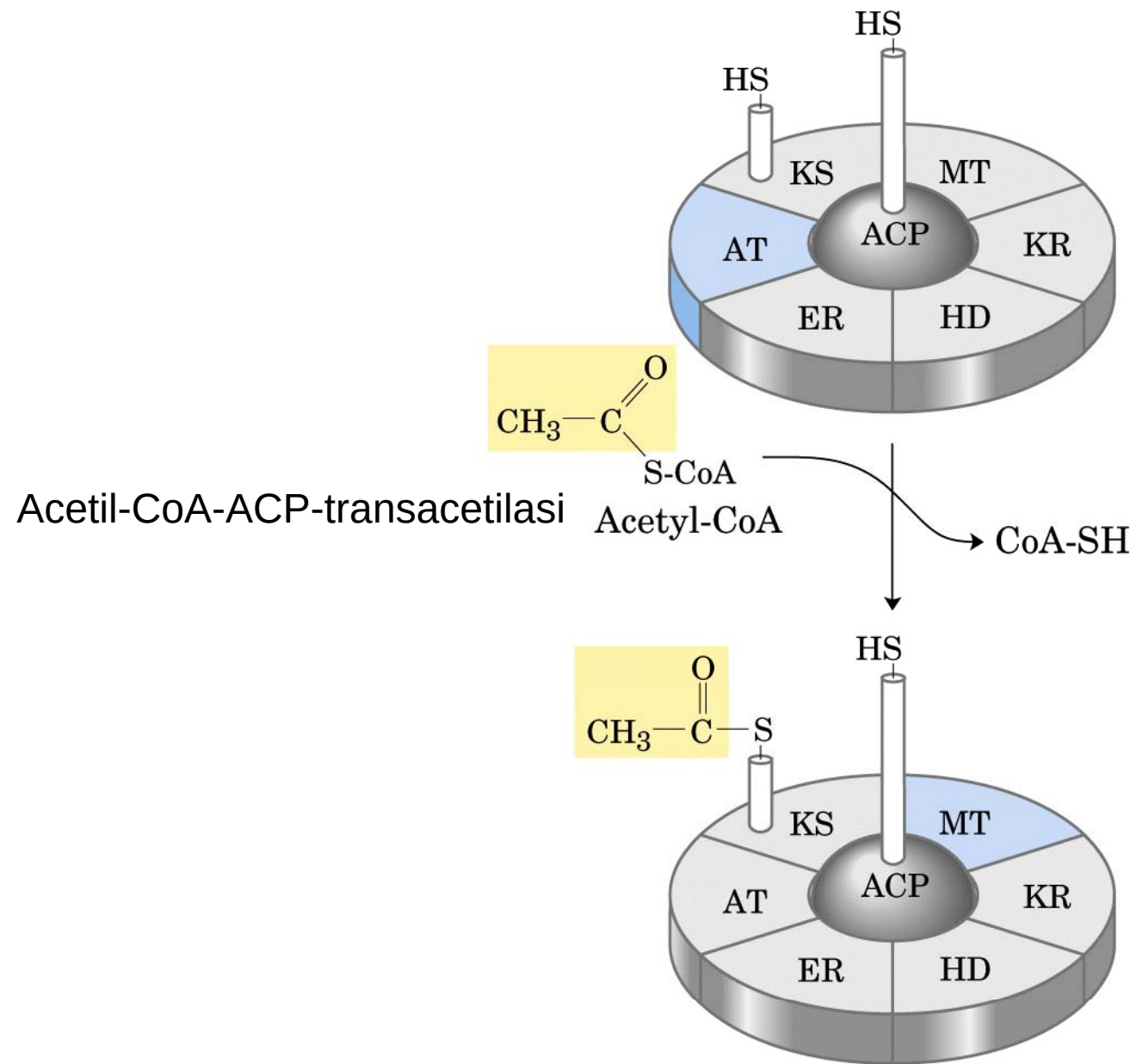


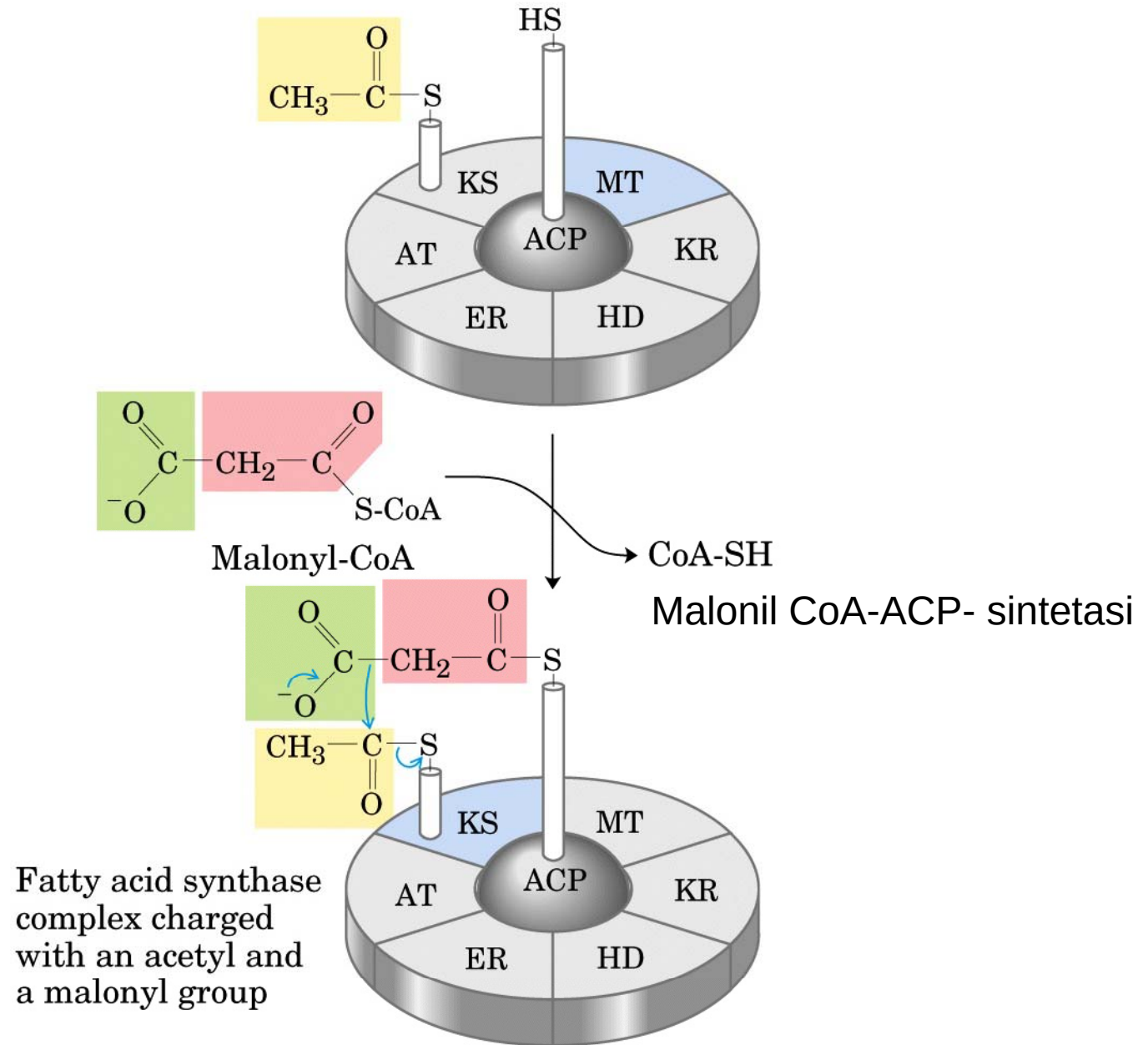


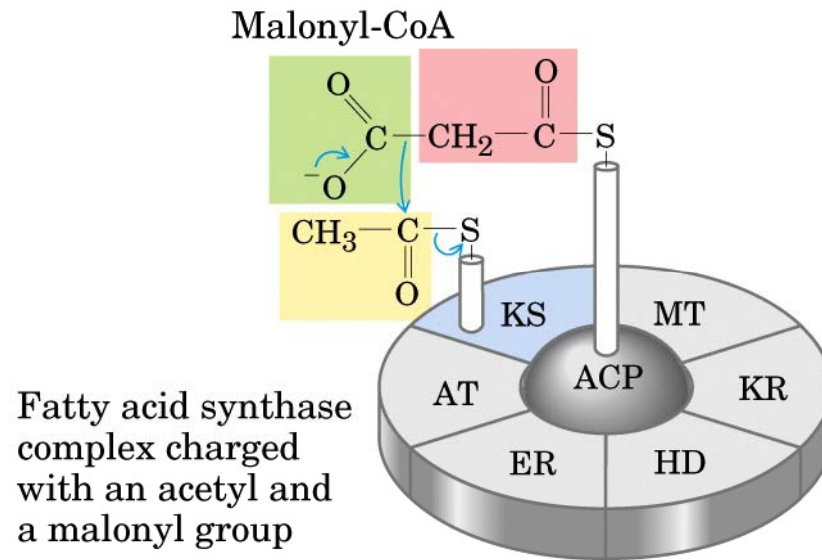
Gruppo prostetico fosfopanteteina dell'ACP



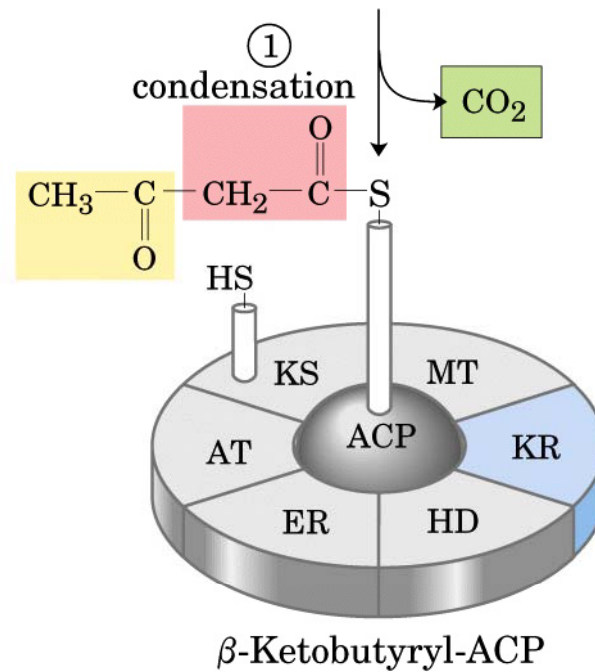
Gruppo fosfopanteteina del CoA

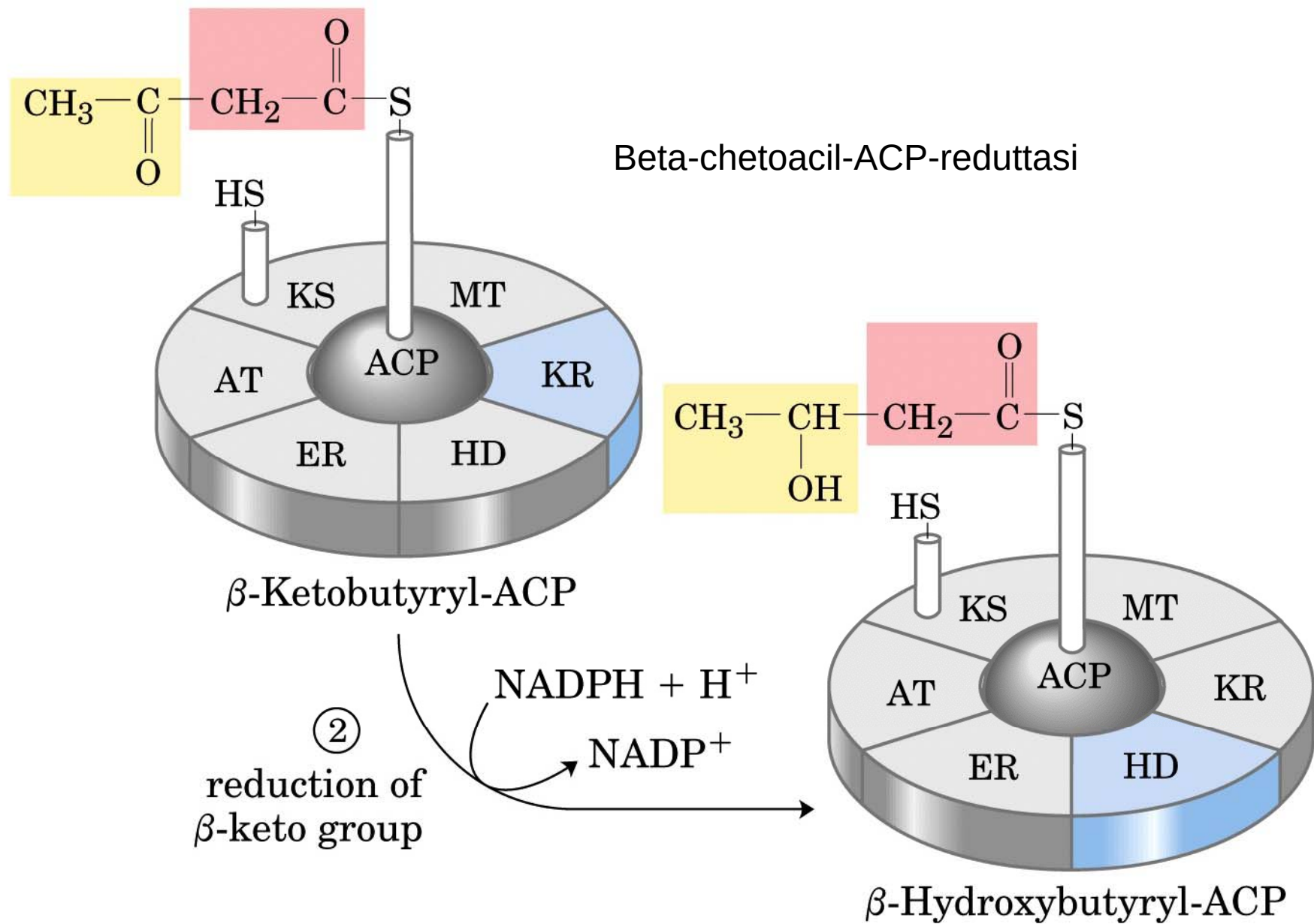




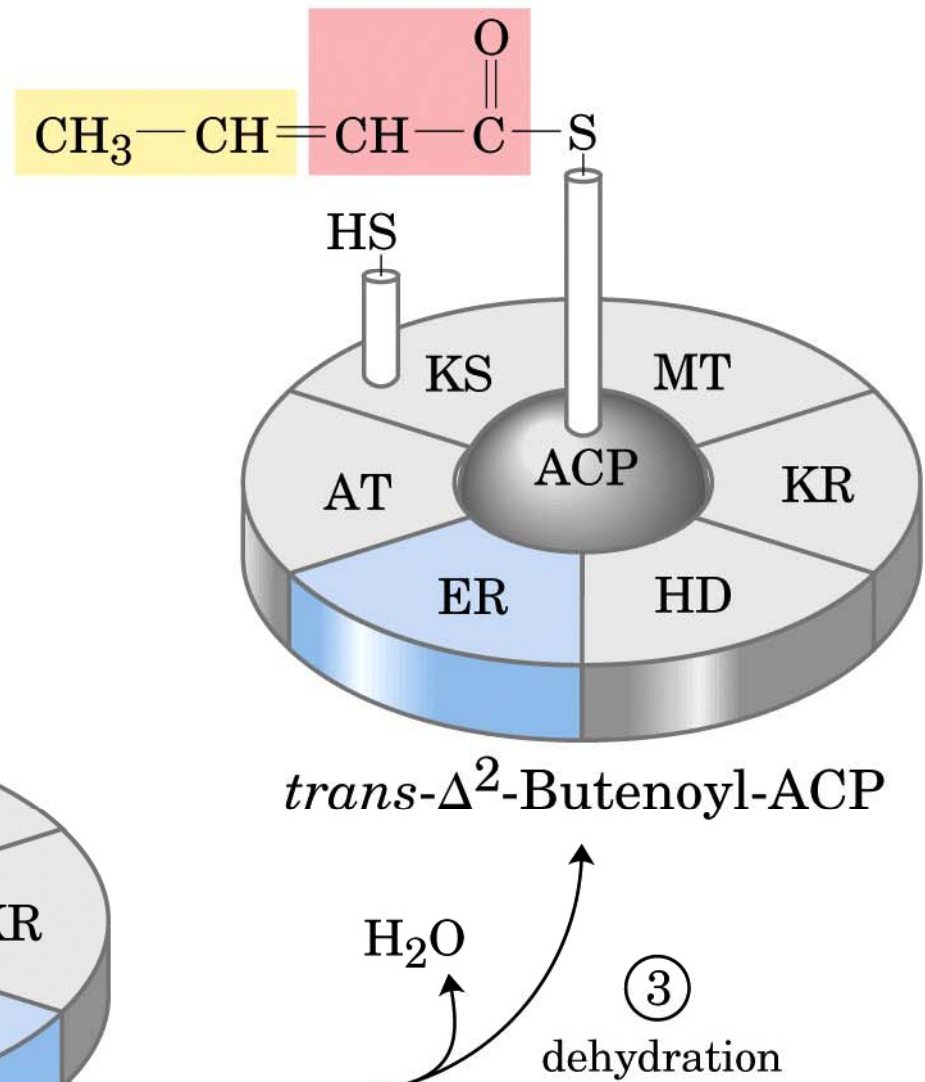
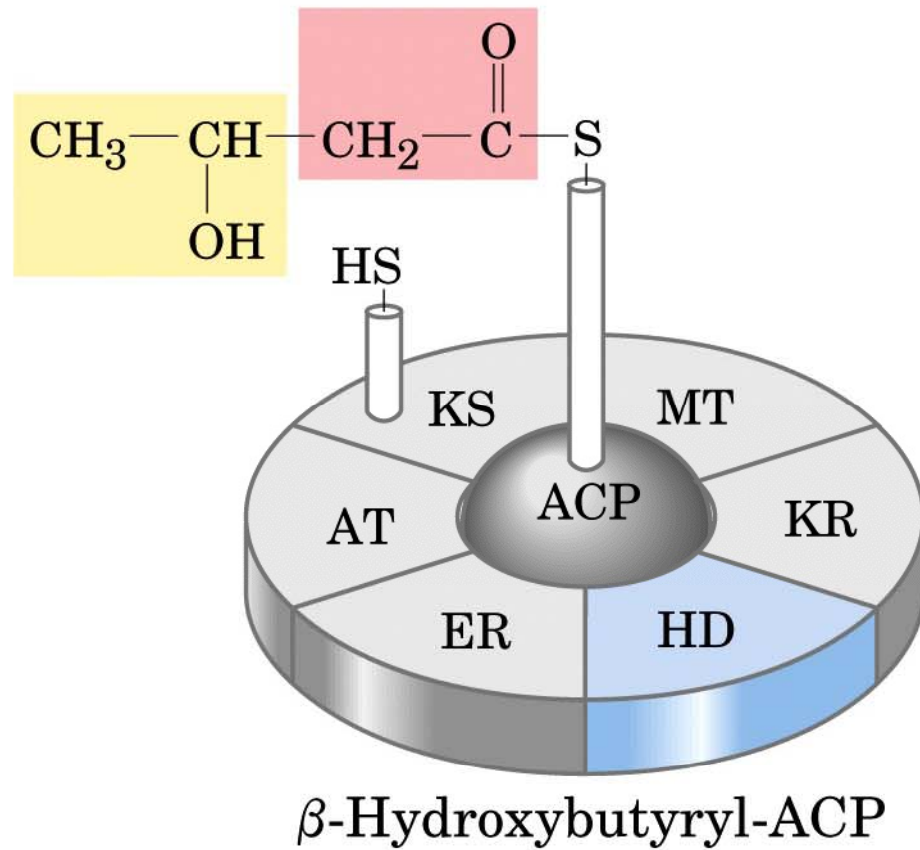


Beta-ketoacyl-ACPsintetasi

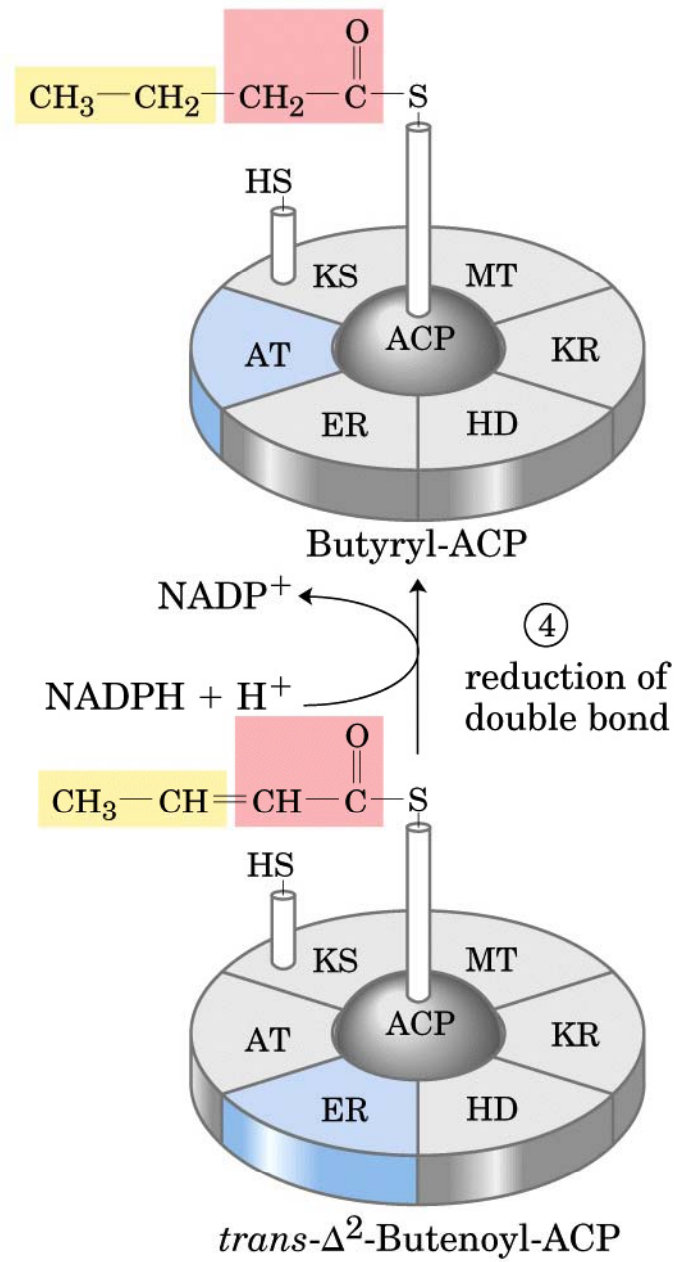


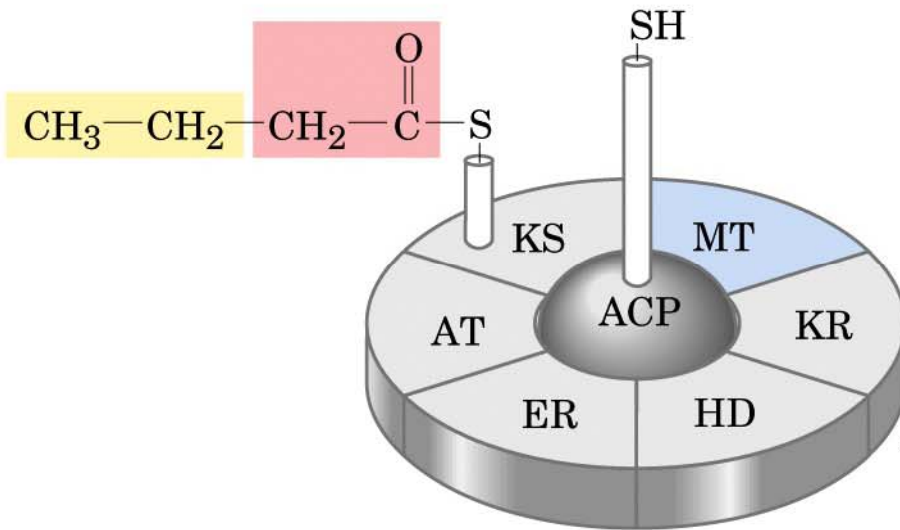


Beta-idrossiacil-ACP -deidratasi



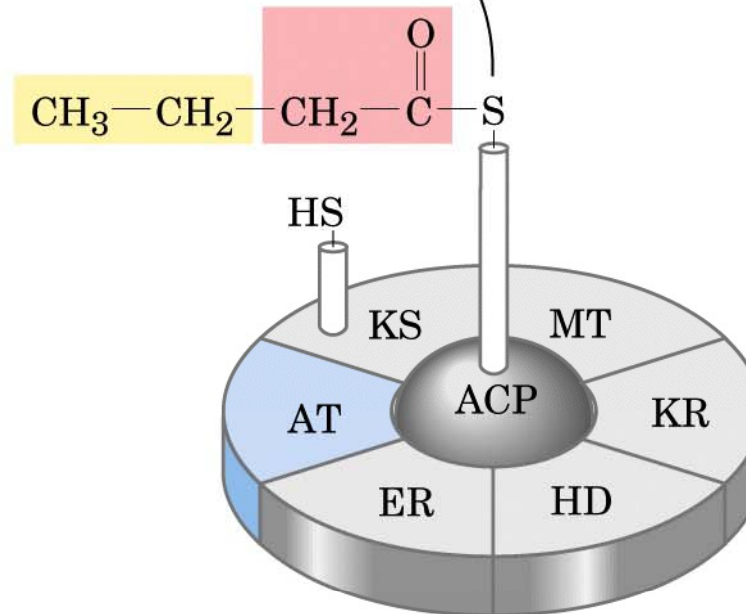
Enoil-ACP reduttasi





translocation of butyryl group to Cys on β -ketoacyl-ACP synthase (KS)

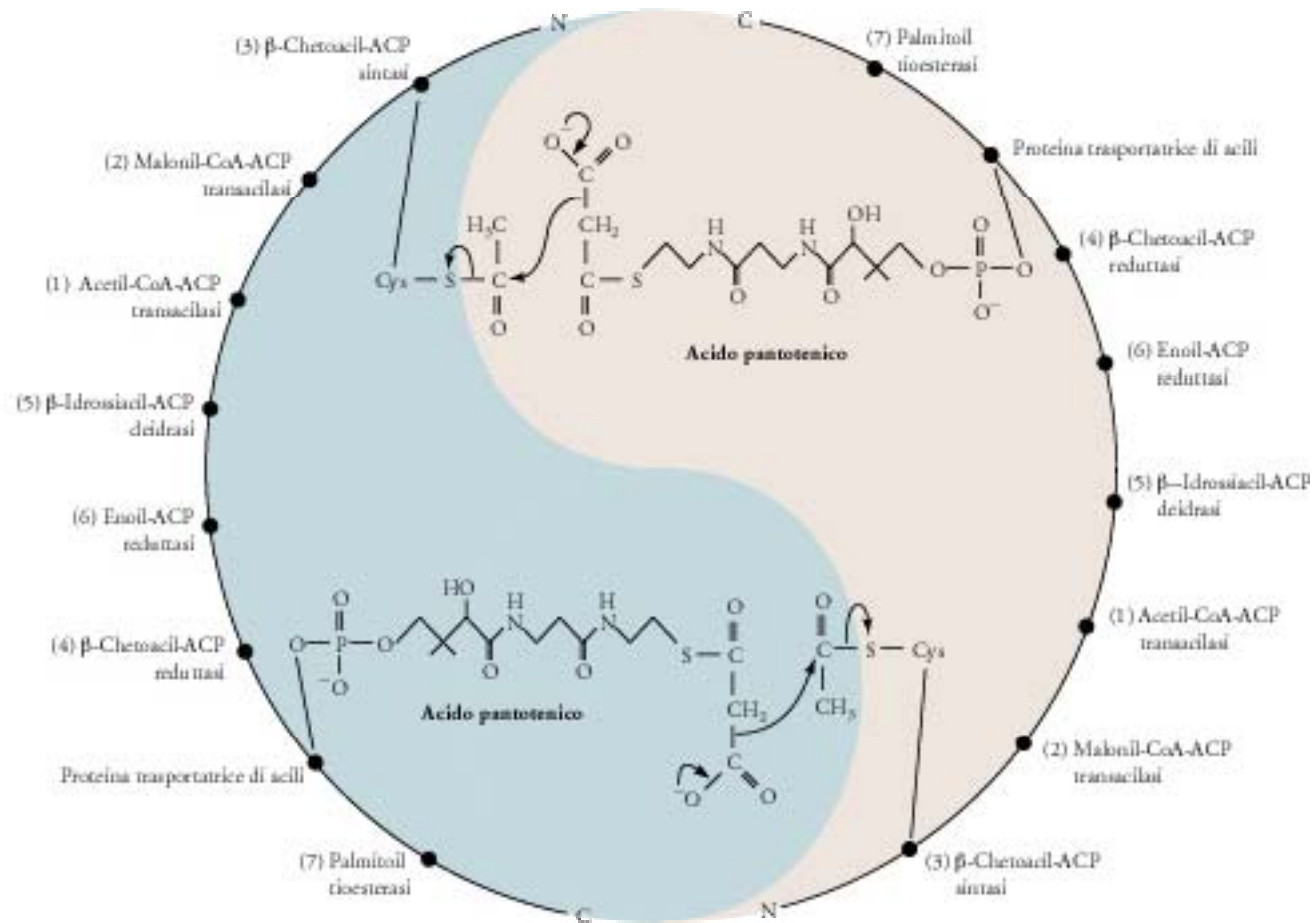
Acetyl-CoA-ACP-transacetylasi



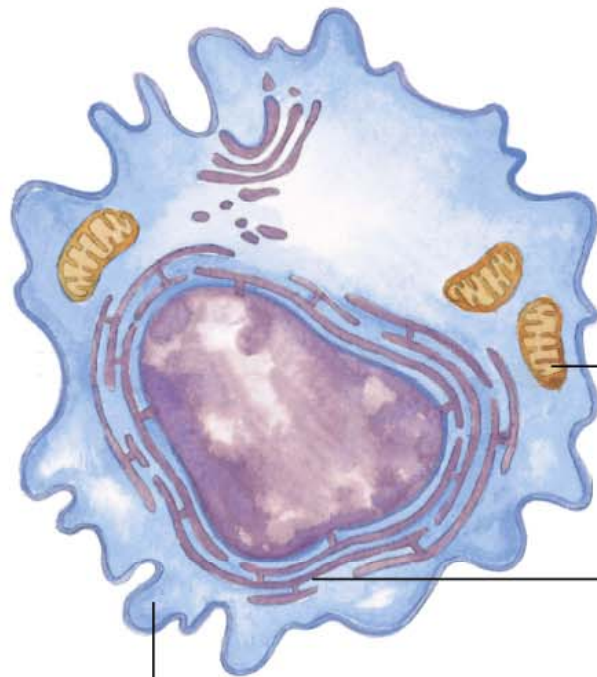
Butyryl-ACP

- $7 \text{ AcetylCoA} + 7\text{Co}_2 + 7\text{ATP} \rightarrow 7 \text{ malonil CoA} + 7 \text{ ADP} + 7 \text{ Pi} + 7\text{H}^+$
- $\text{AcetylCoA} + 7 \text{ Malonil CoA} + 14 \text{ NADPH} + 14 \text{ H}^+ \rightarrow \text{palmitato} + 7\text{Co}_2 + 14 \text{ NADP} + 8 \text{ CoA} + 6\text{H}_2\text{O}$
- **$8 \text{ ACetil CoA} + 14\text{NADPH} + 7\text{ATP} + 7\text{H}^+ \rightarrow \text{Palmitato} + 14 \text{ NADH} + 7 \text{ ADP} + 8 \text{ CoA} + 6 \text{ H}_2\text{O} + 7 \text{ Pi}$**

Acido grasso sintetasi animale



Animal cells, yeast cells



Cytosol

- NADPH production (pentose phosphate pathway; malic enzyme)
- $[NADPH]/[NADP^+]$ high
- Isoprenoid and sterol synthesis (early stages)
- Fatty acid synthesis

Mitochondria

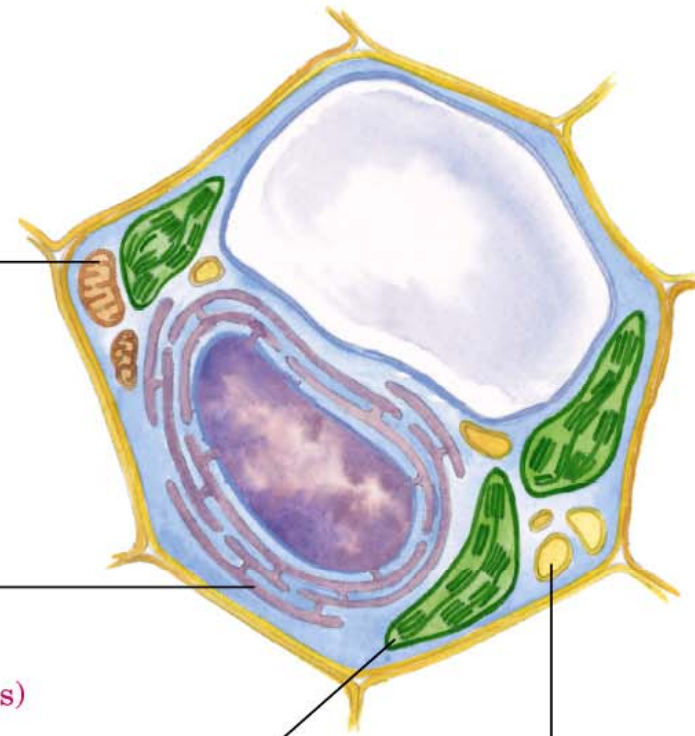
- No fatty acid oxidation

- Fatty acid oxidation
- Acetyl-CoA production
- Ketone body synthesis
- Fatty acid elongation

Endoplasmic reticulum

- Phospholipid synthesis
- Sterol synthesis (late stages)
- Fatty acid elongation
- Fatty acid desaturation

Plant cells

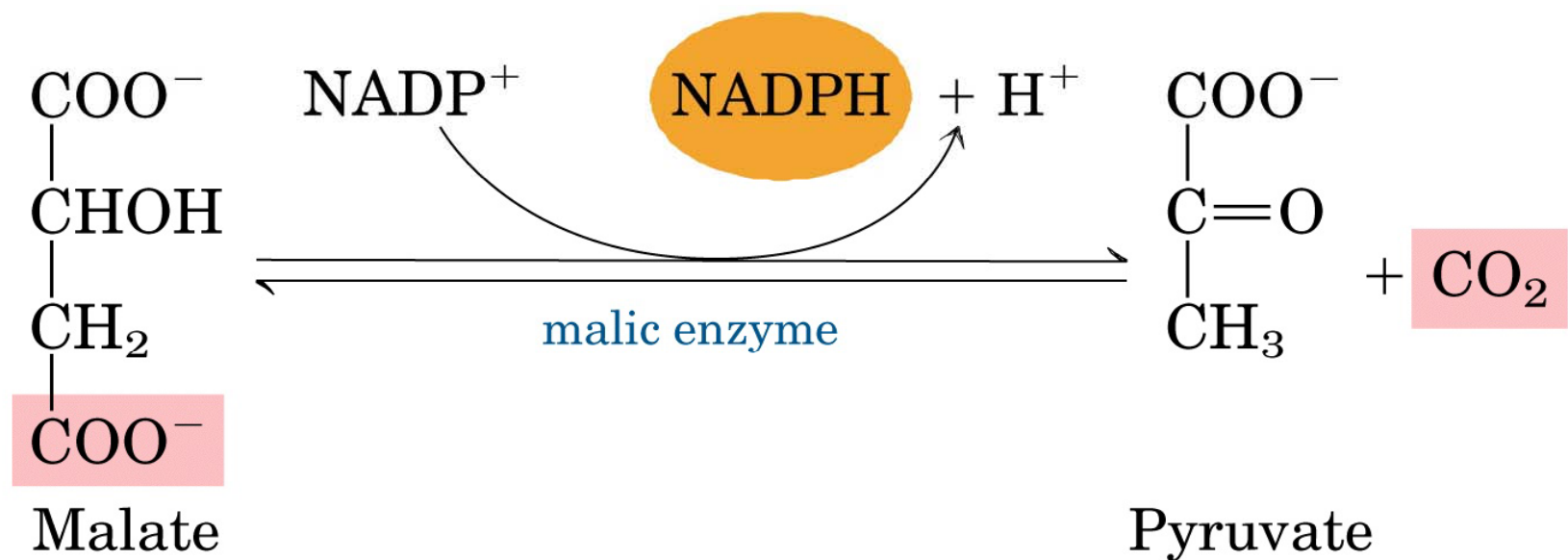


Chloroplasts

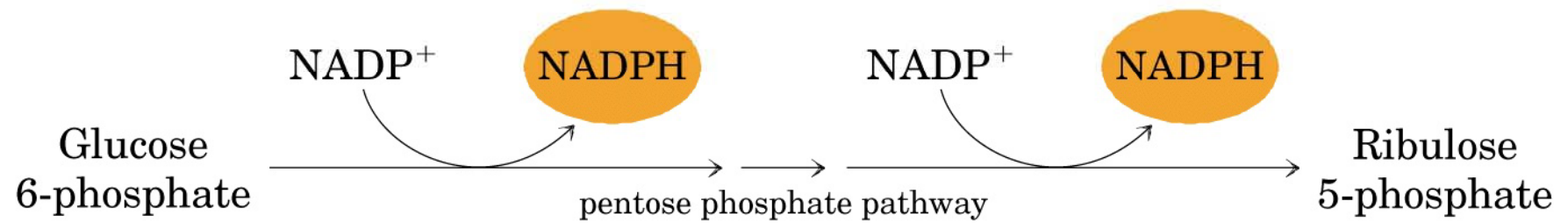
- NADPH, ATP production
- $[NADPH]/[NADP^+]$ high
- Fatty acid synthesis

Peroxisomes

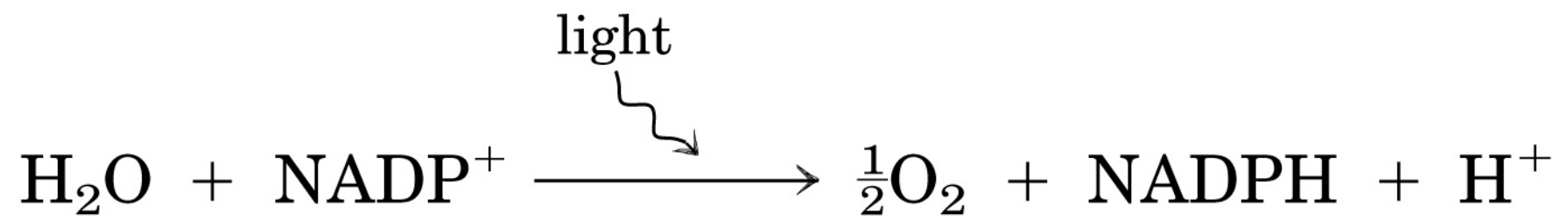
- Fatty acid oxidation ($\longrightarrow H_2O_2$)
- Catalase, peroxidase:
 $H_2O_2 \longrightarrow H_2O$

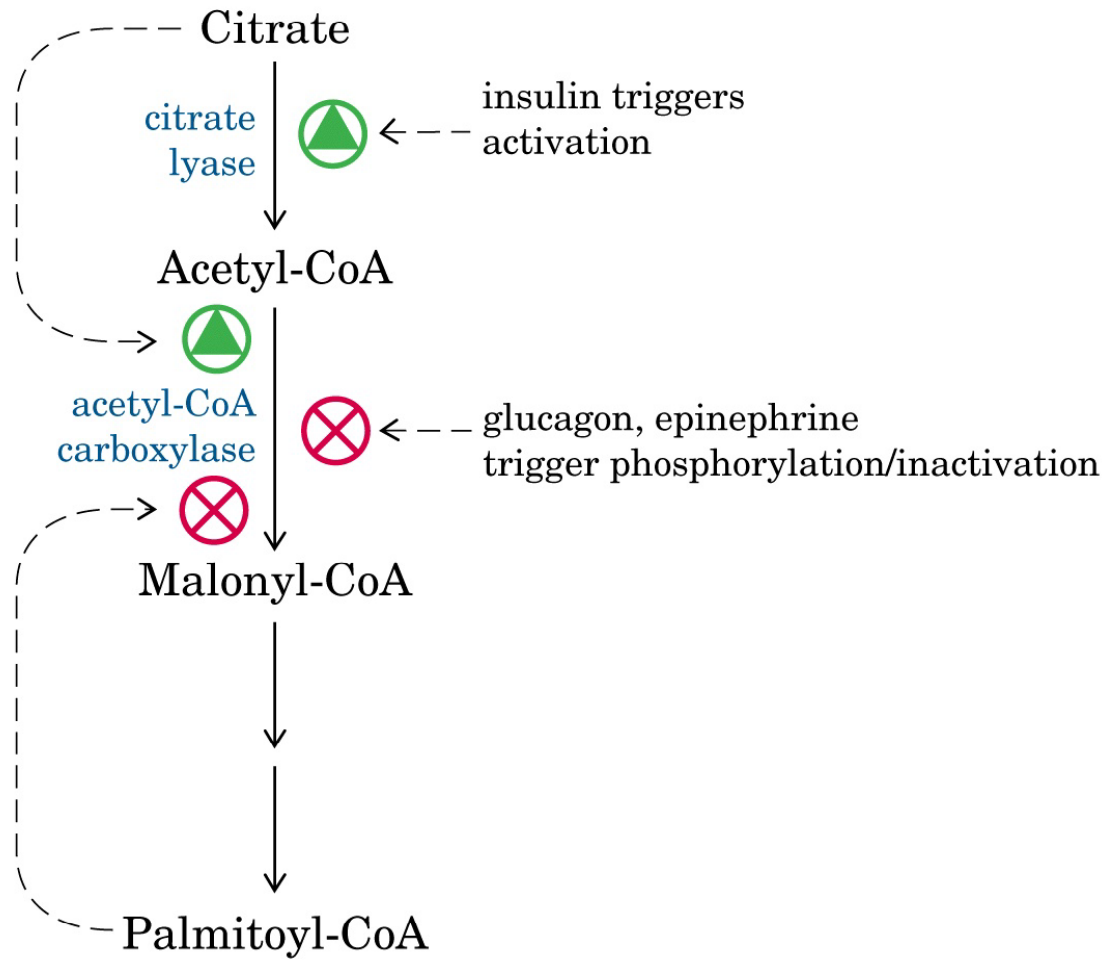


(a)

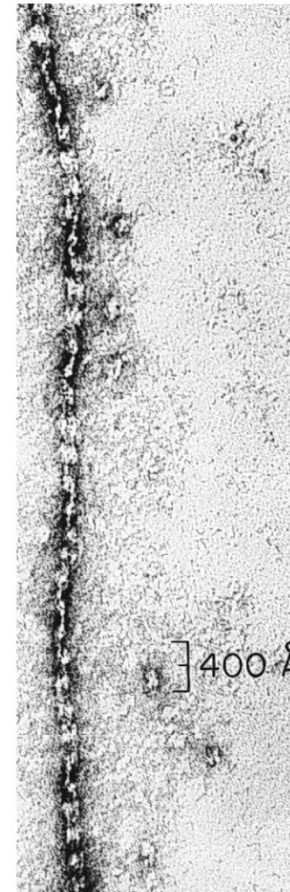


(b)

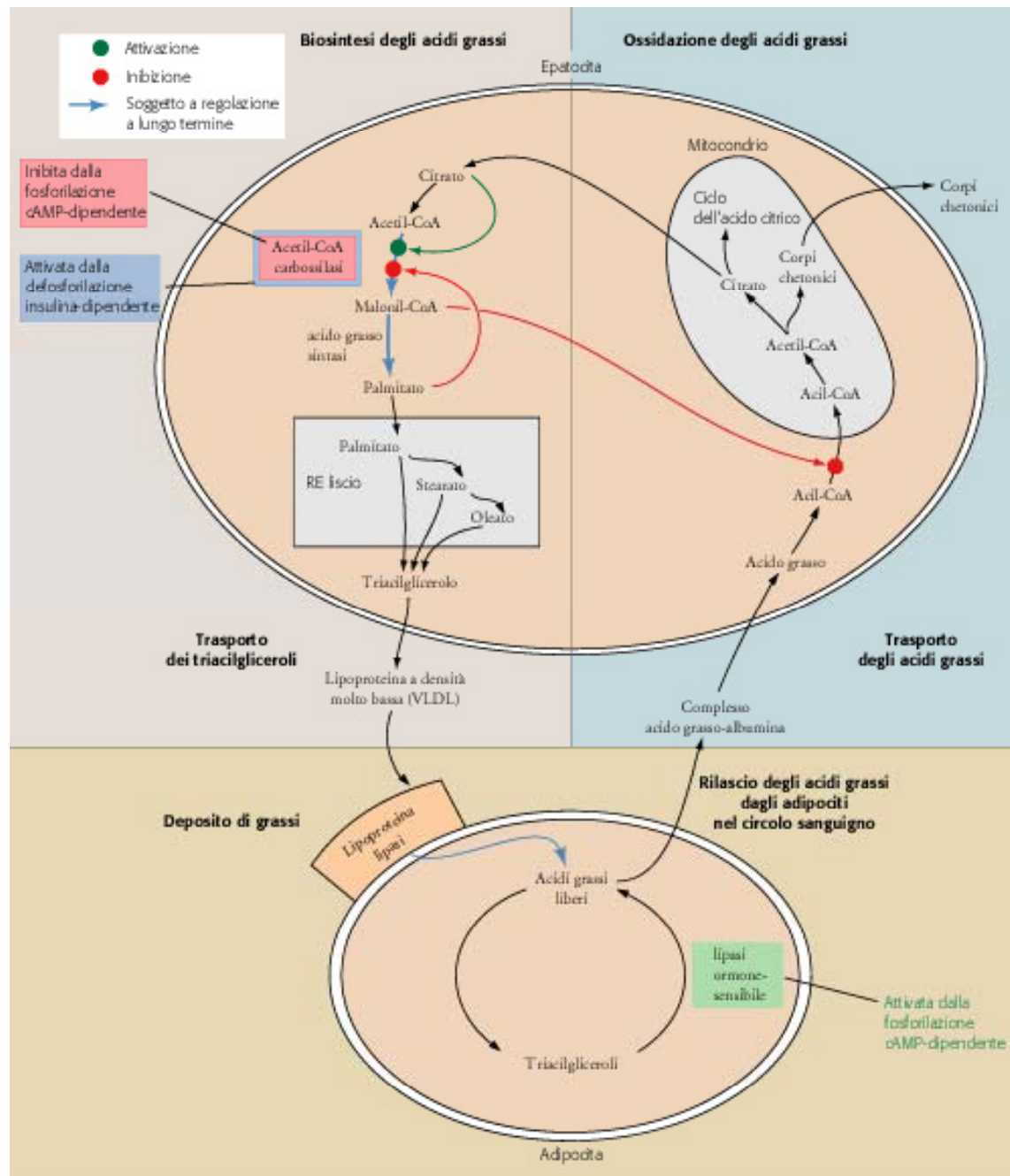


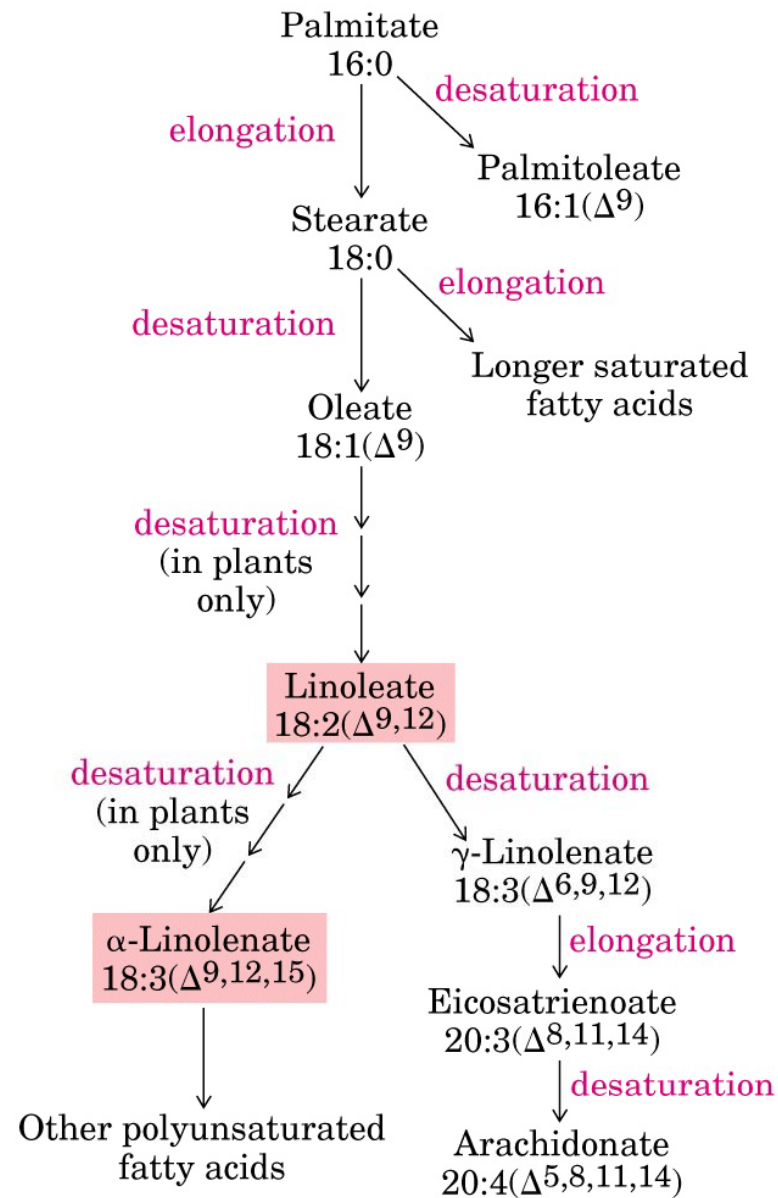


(a)

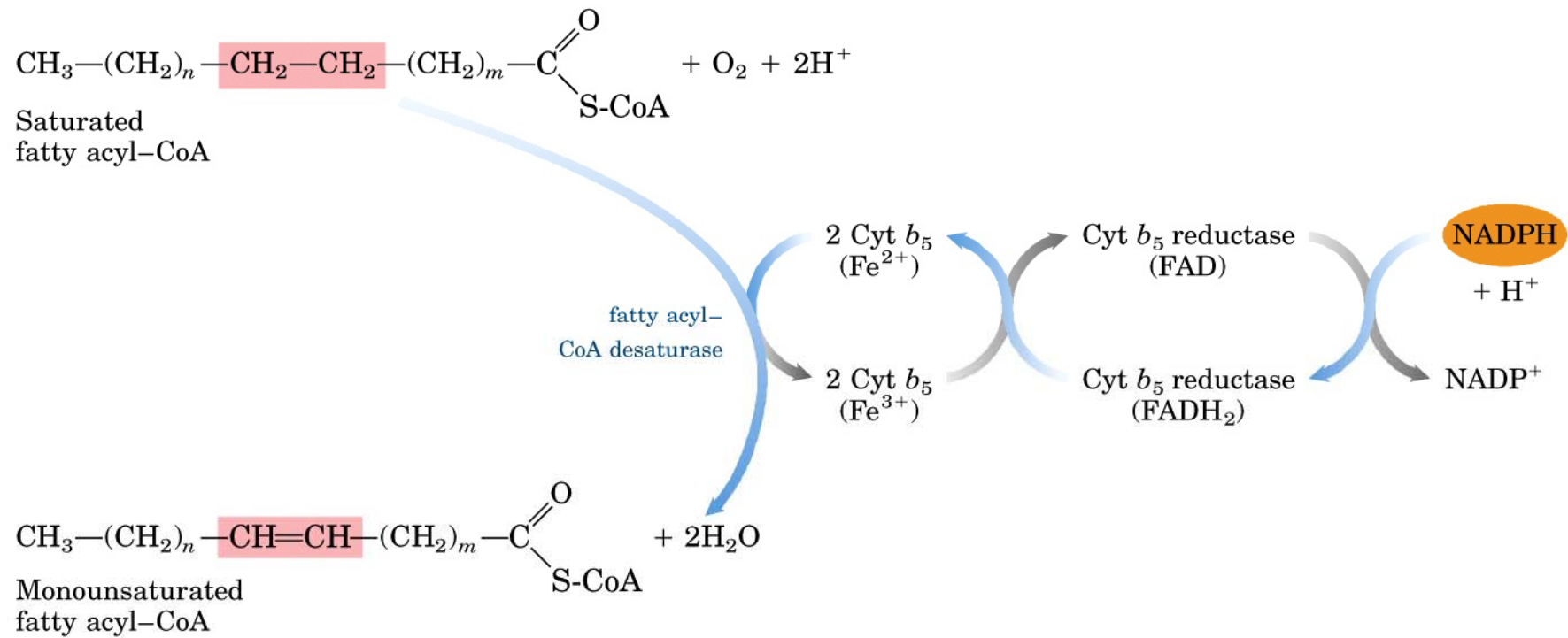


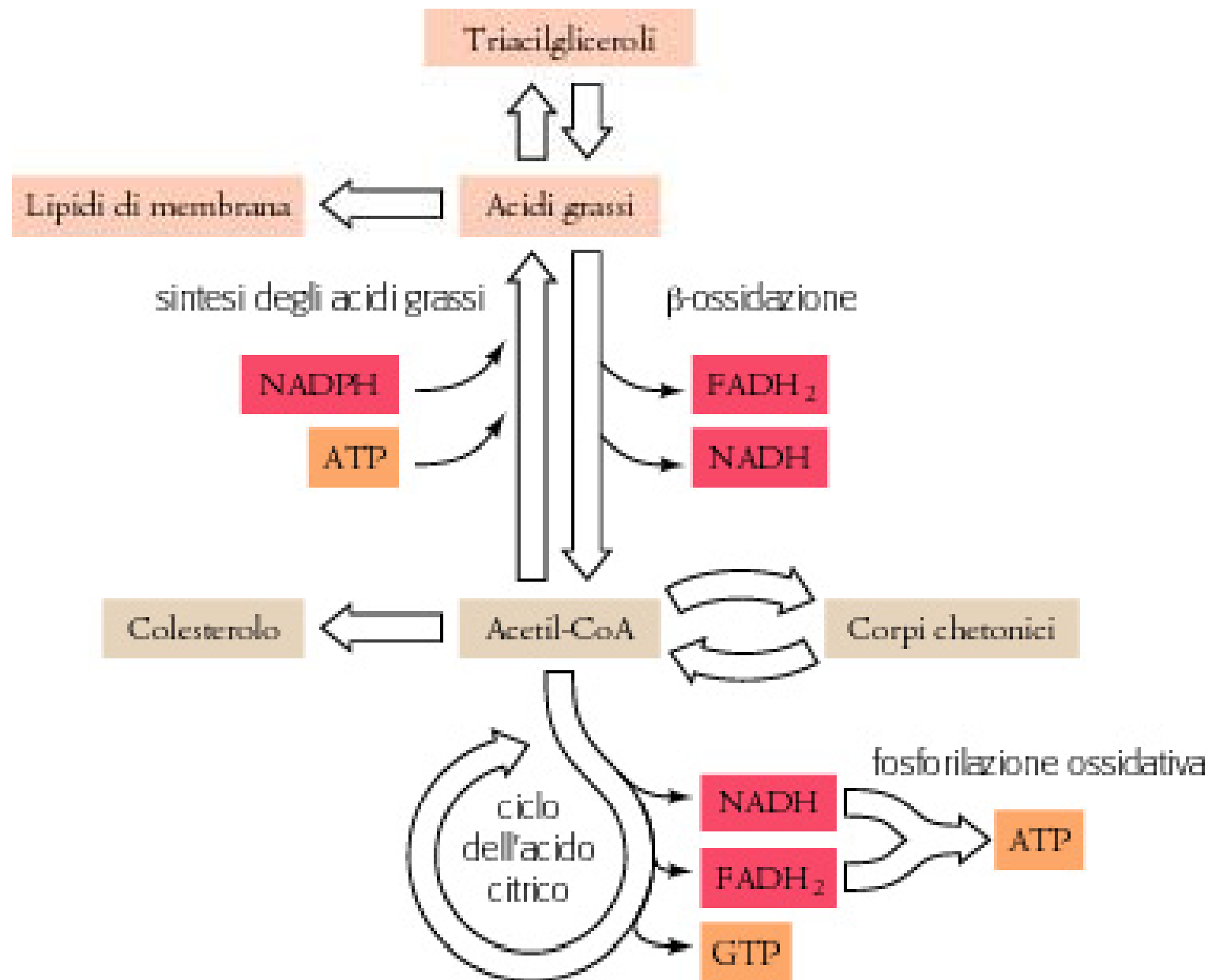
(b)



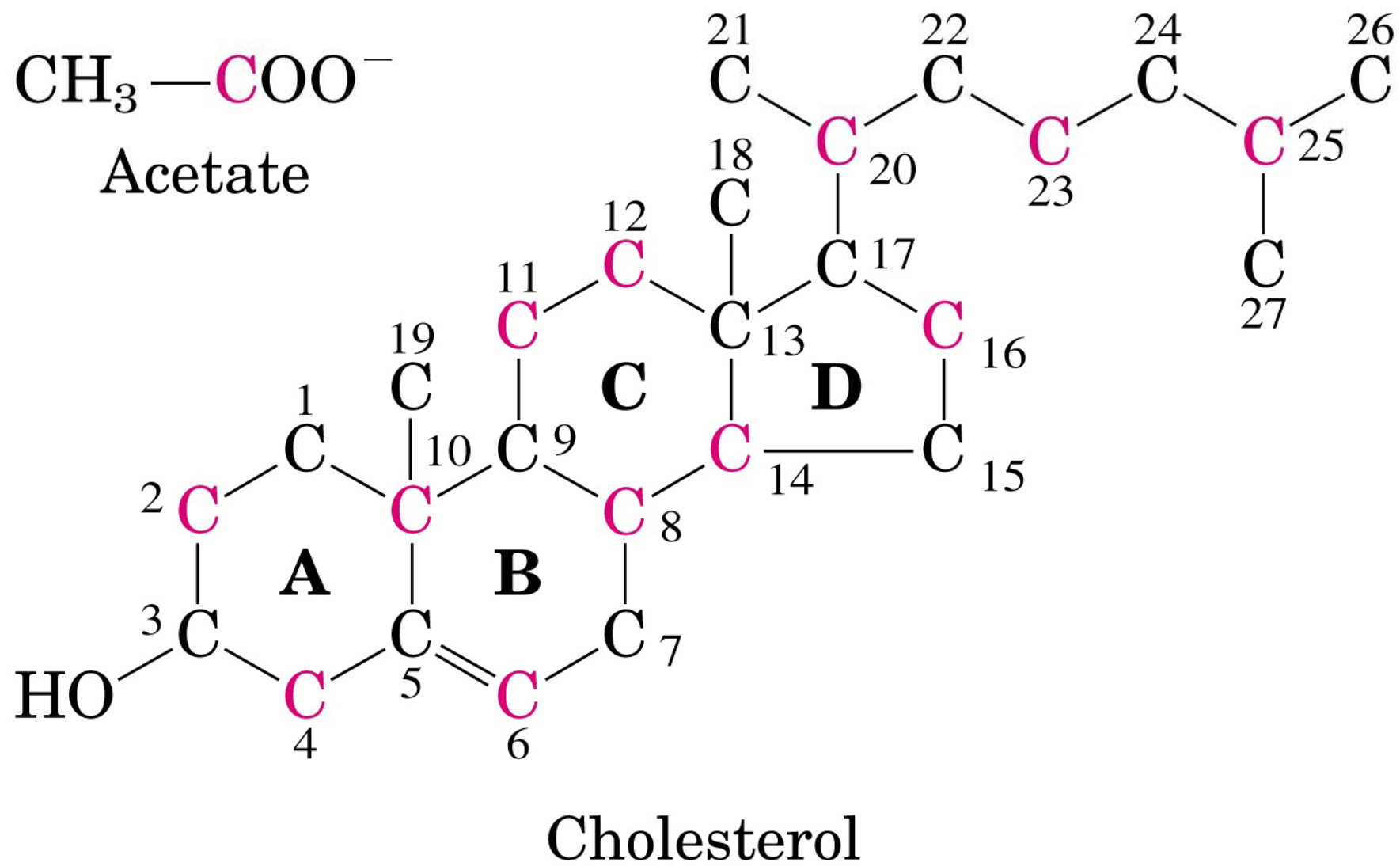


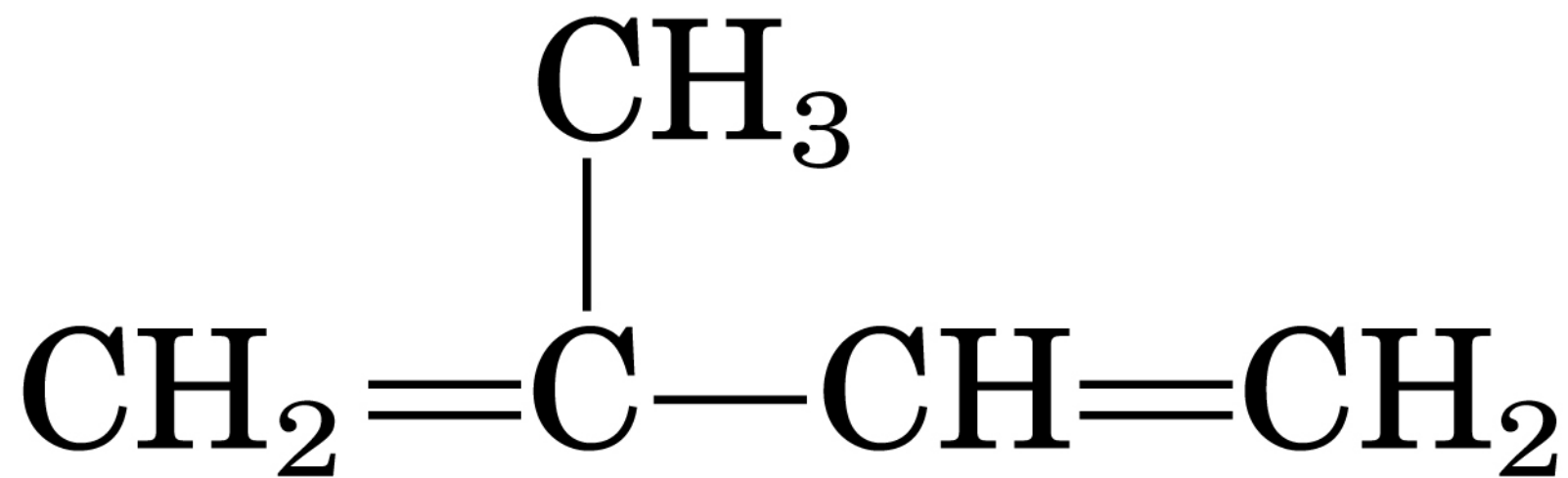
I doppi legami vengono introdotti da desaturasi





Biosintesi del colesterolo

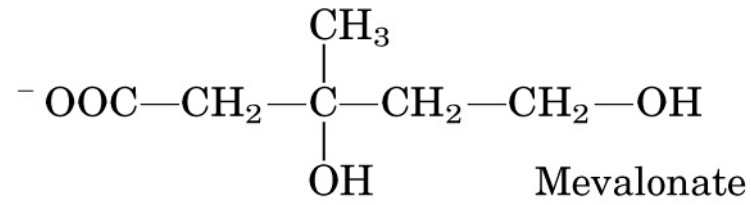




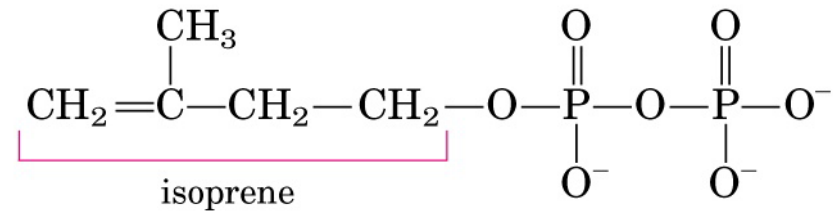
Isoprene

3 CH₃—COO[−] Acetate

① ↓

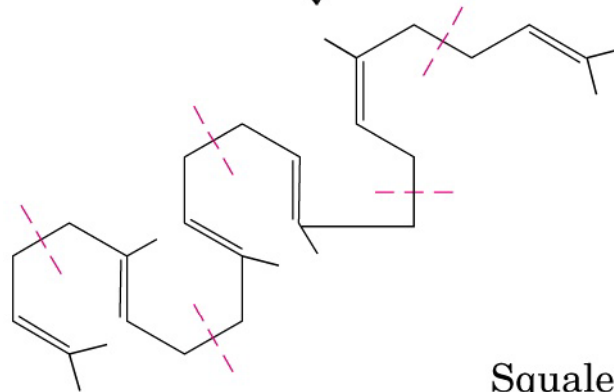


② ↓

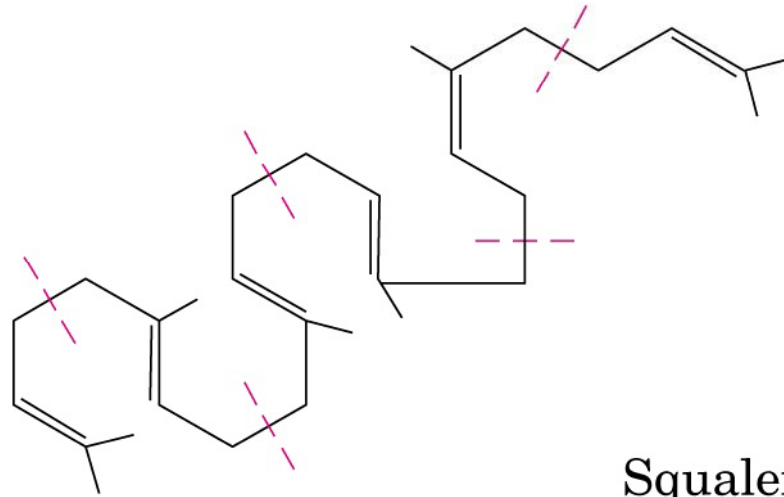


Activated isoprene

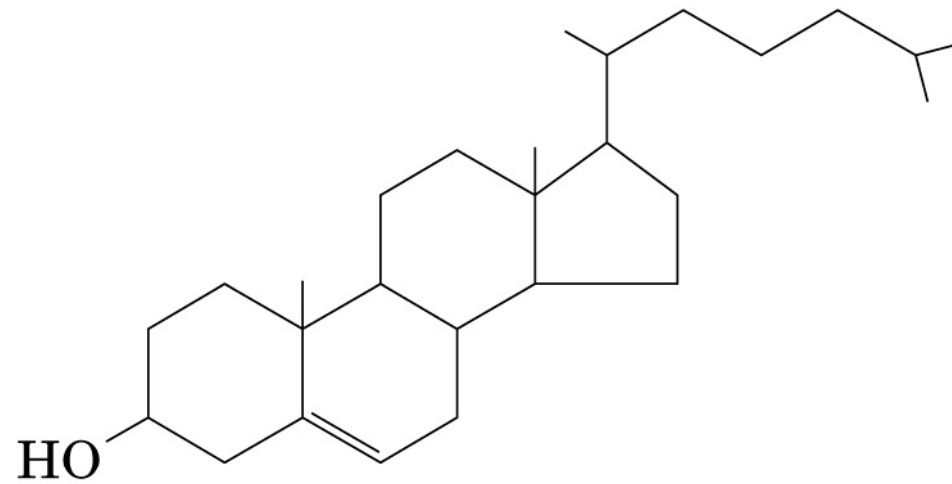
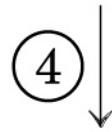
③ ↓



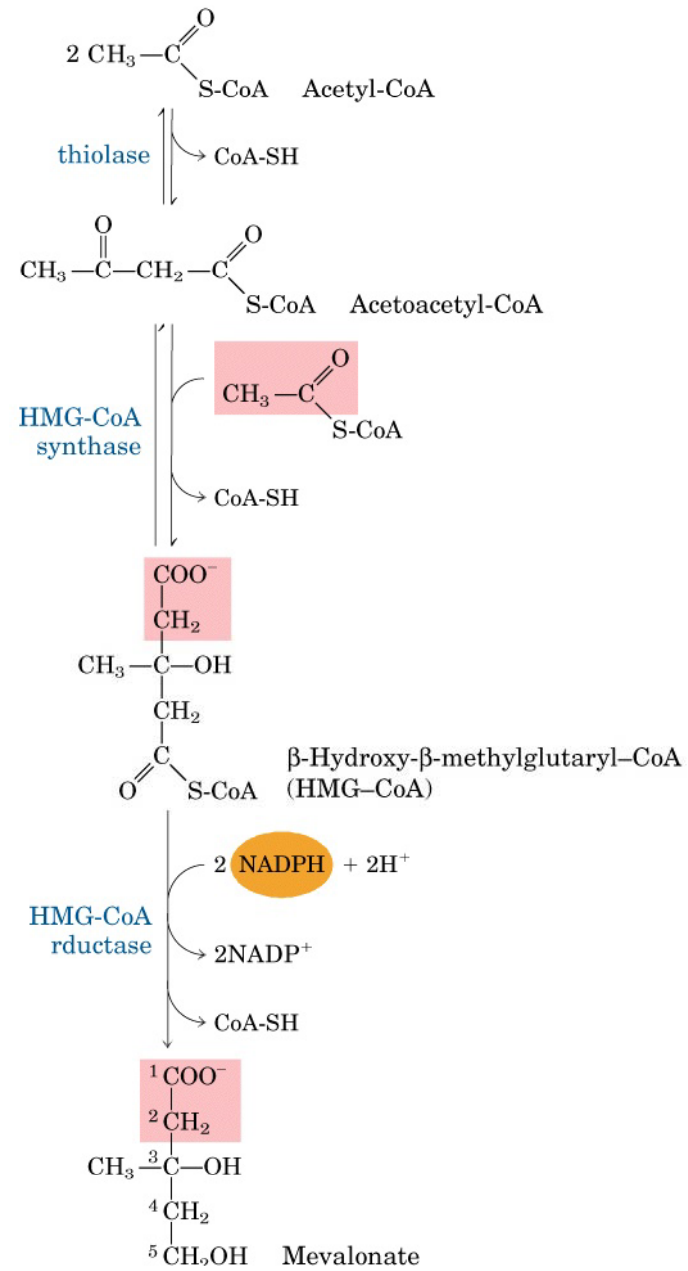
Squalene

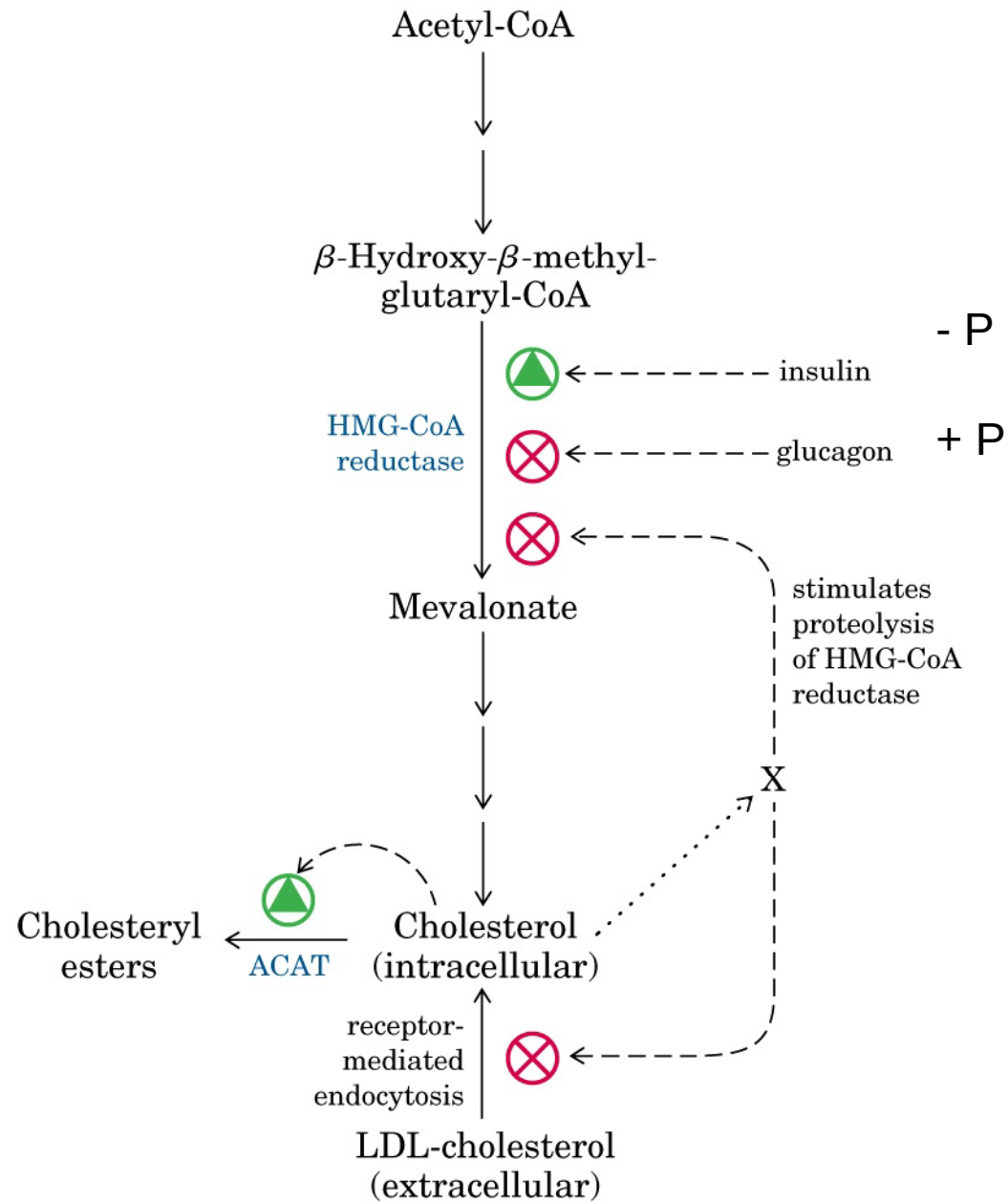


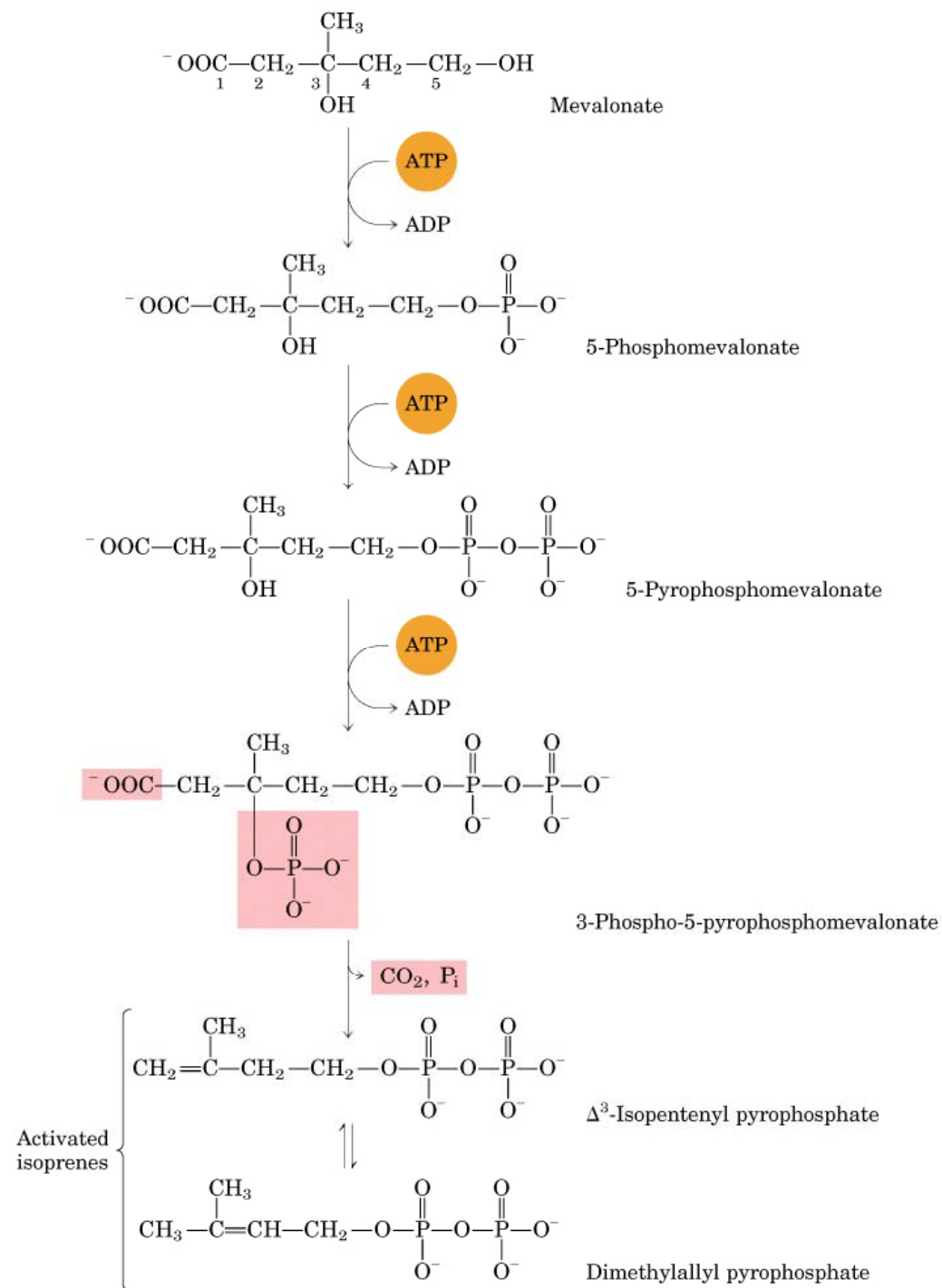
Squalene

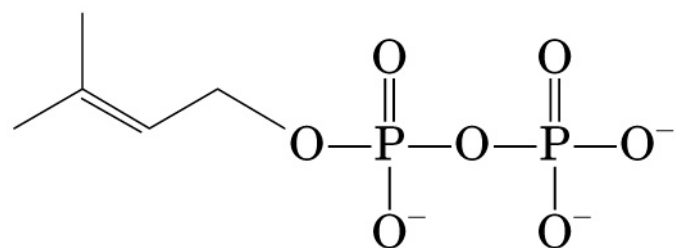


Cholesterol



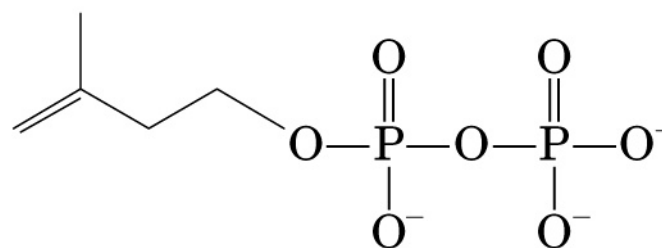






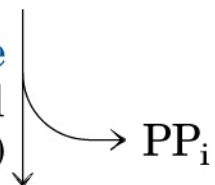
Dimethylallyl pyrophosphate

+

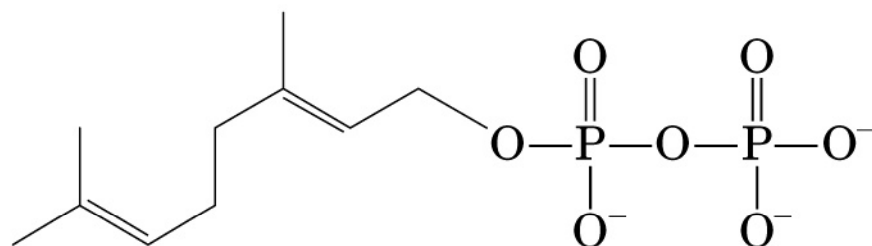


Δ^3 -Isopentenyl pyrophosphate

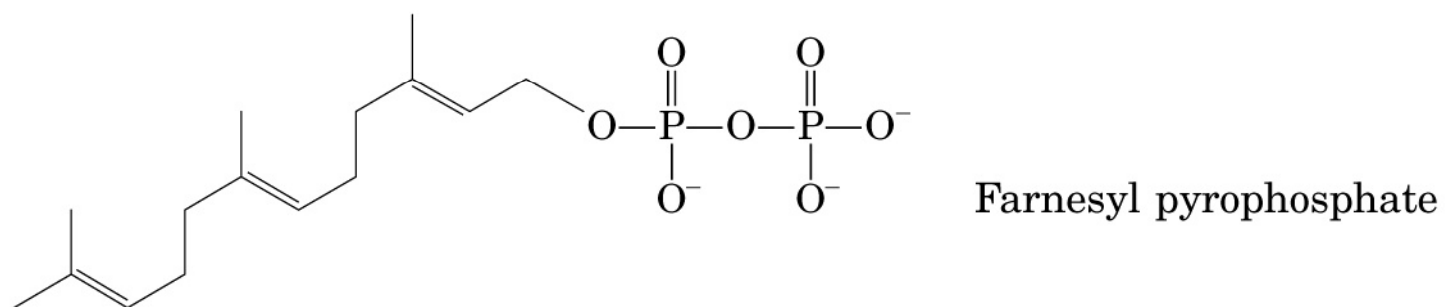
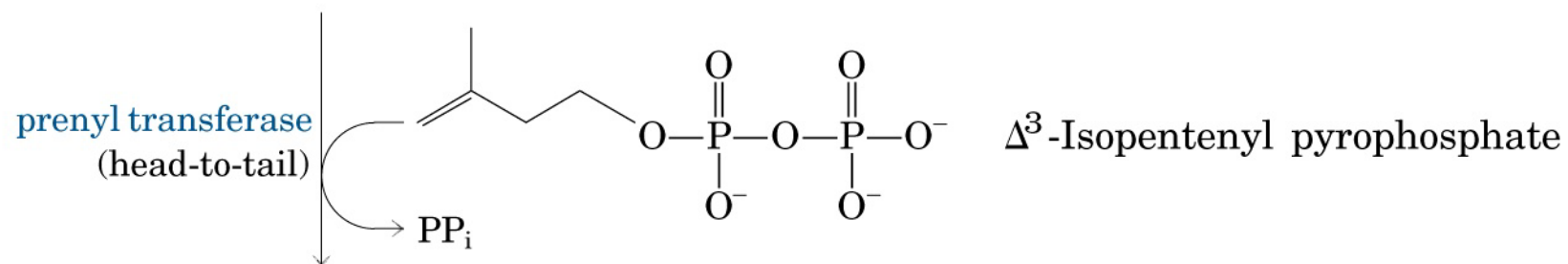
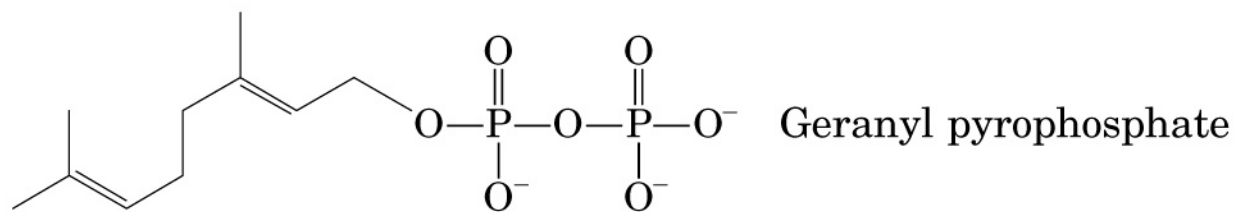
prenyl transferase
(head-to-tail
condensation)

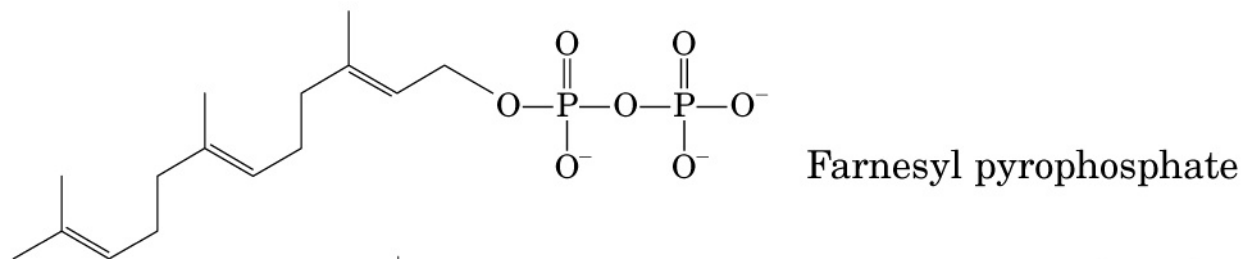


PP_i

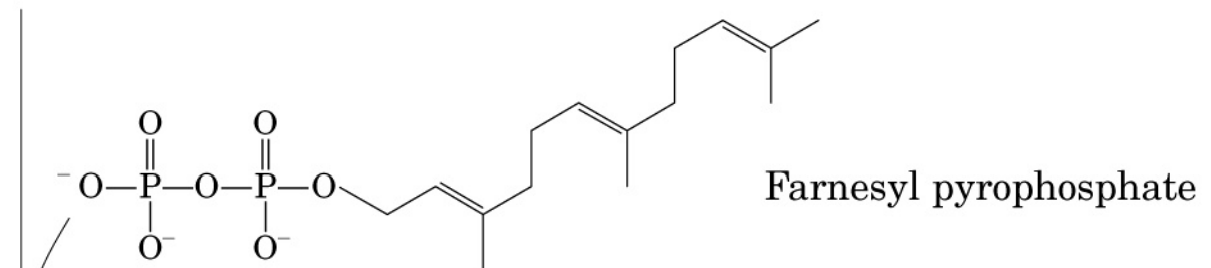


Geranyl pyrophosphate





Farnesyl pyrophosphate



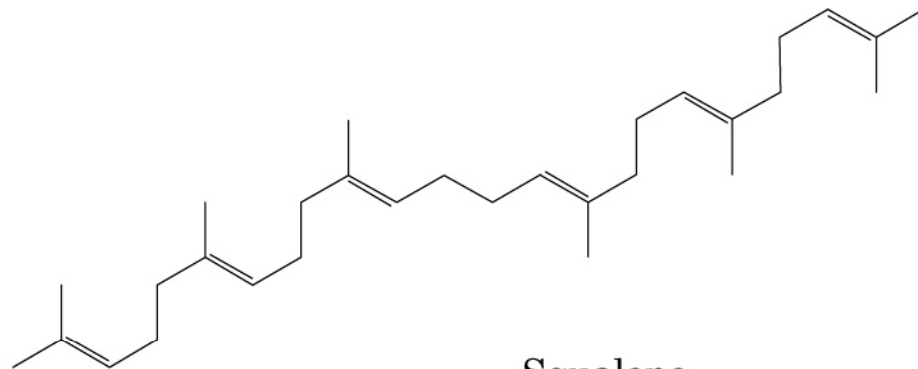
Farnesyl pyrophosphate

squalene synthase
(head-to-head)

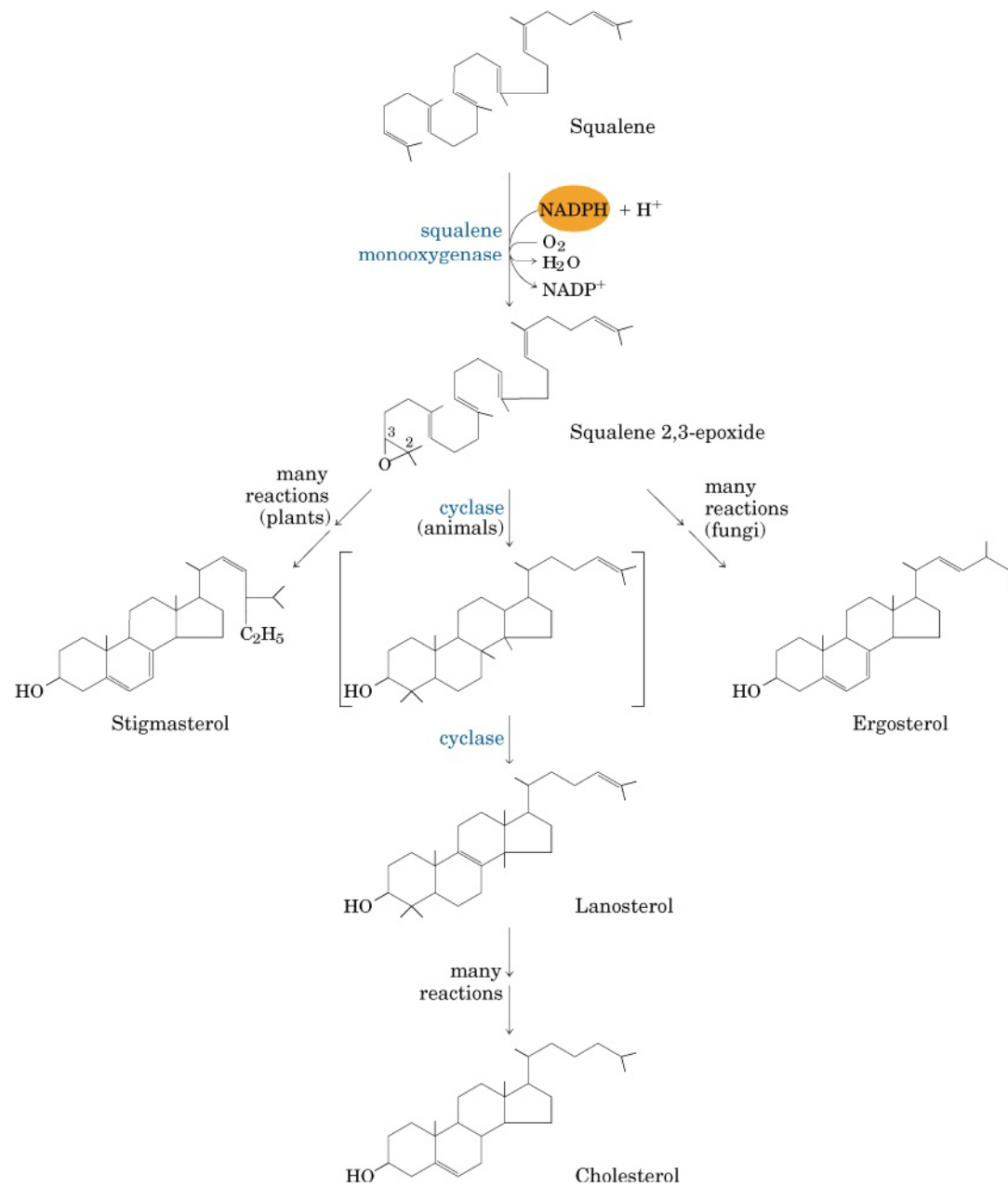
NADPH + H⁺

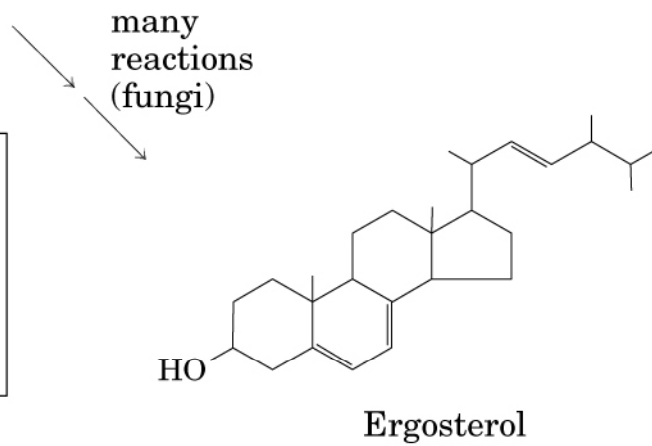
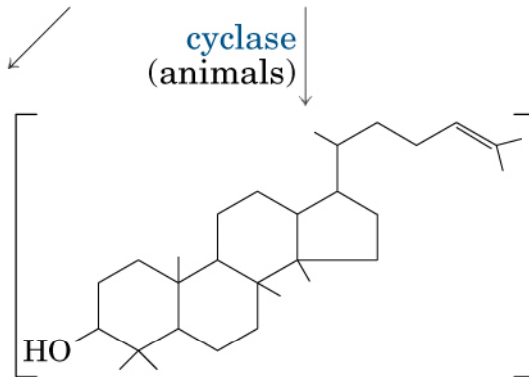
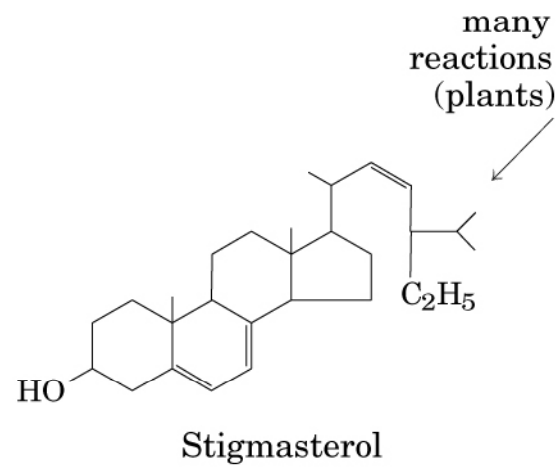
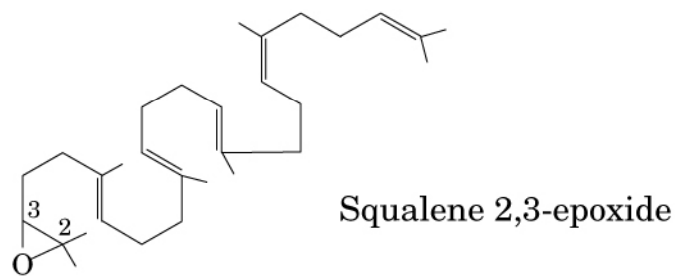
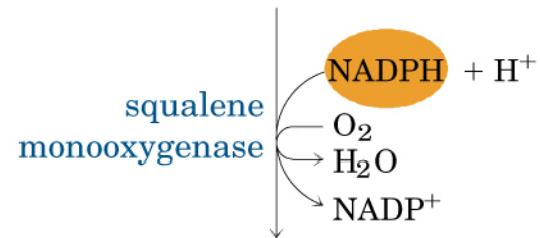
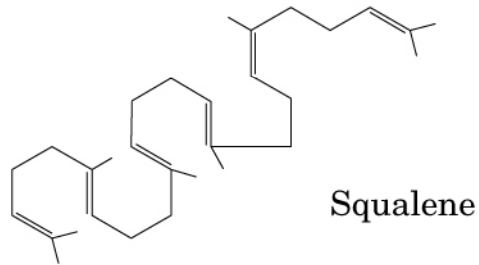
NADP⁺

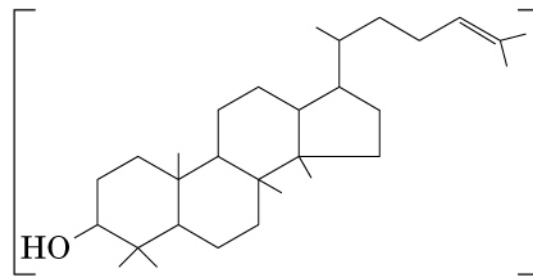
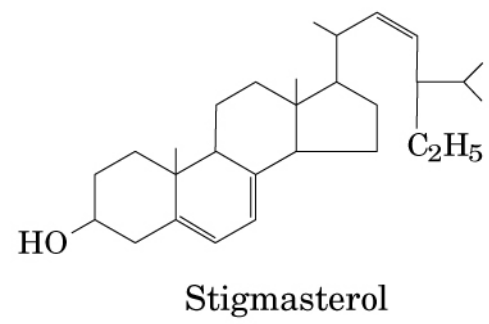
2 PP_i



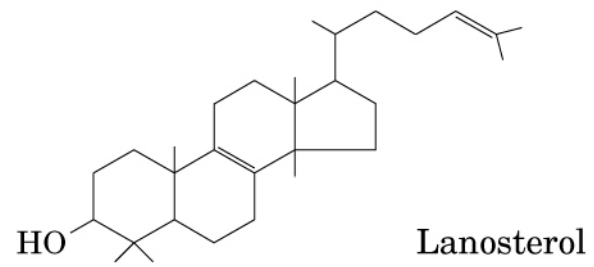
Squalene



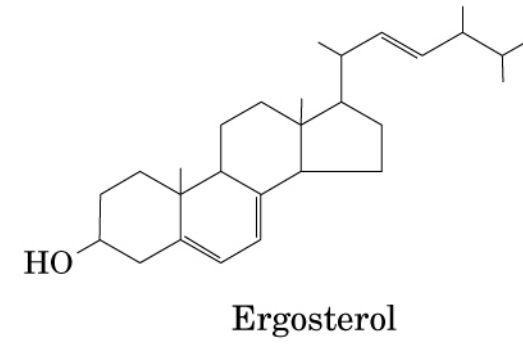
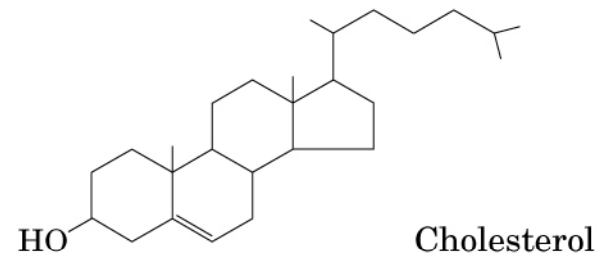


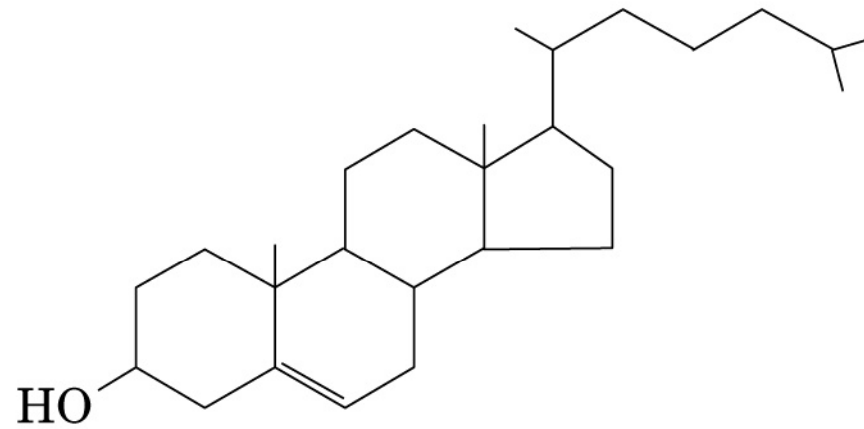


cyclase

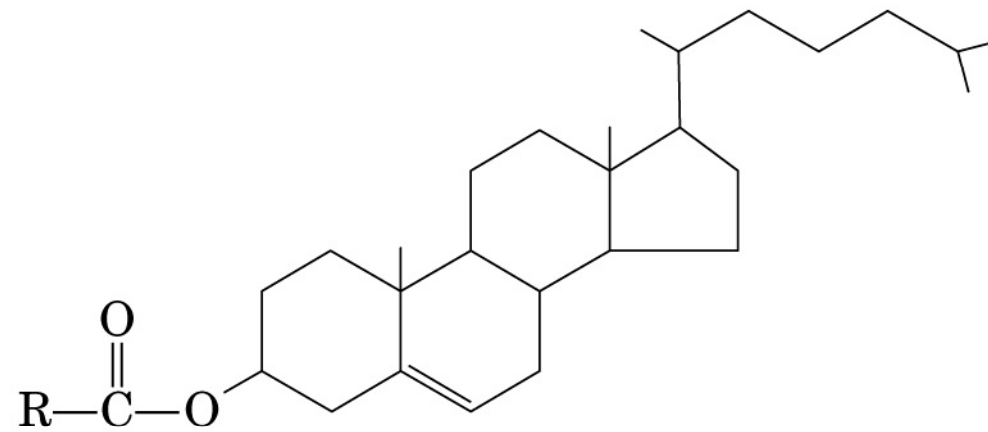
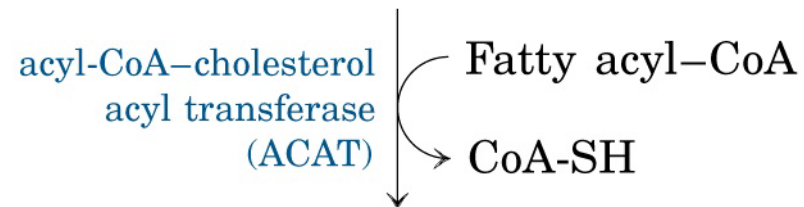


many
reactions

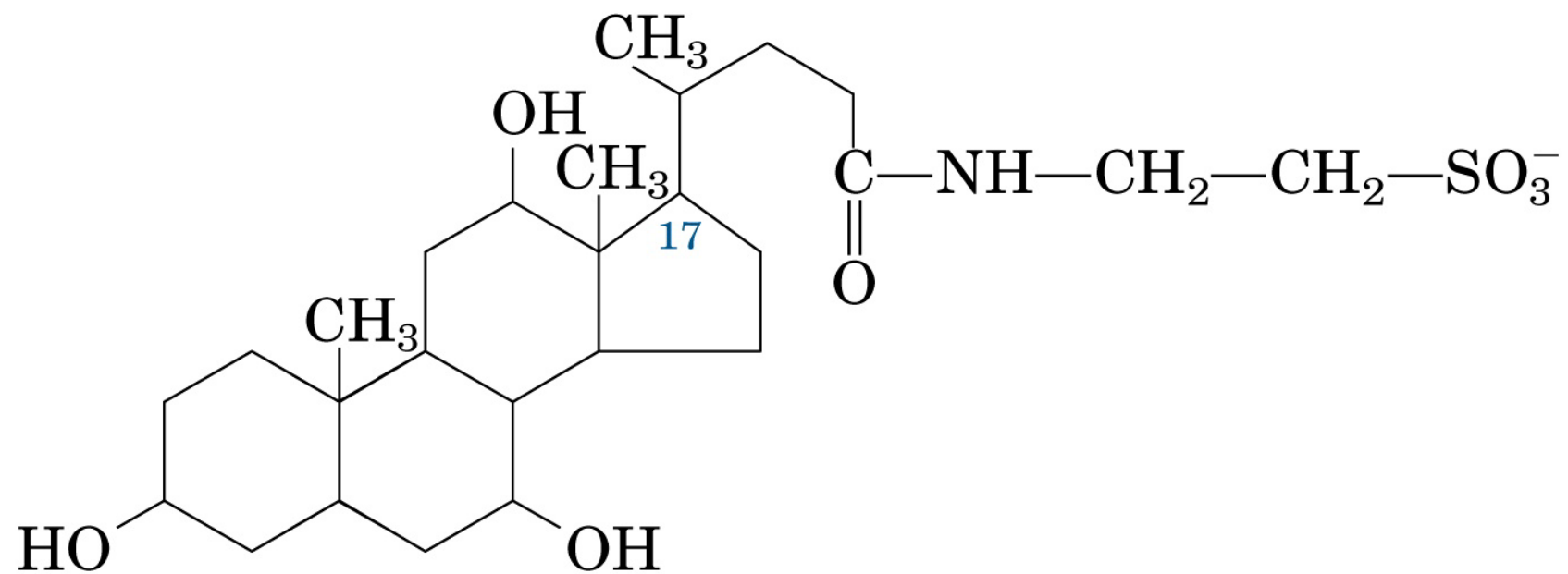




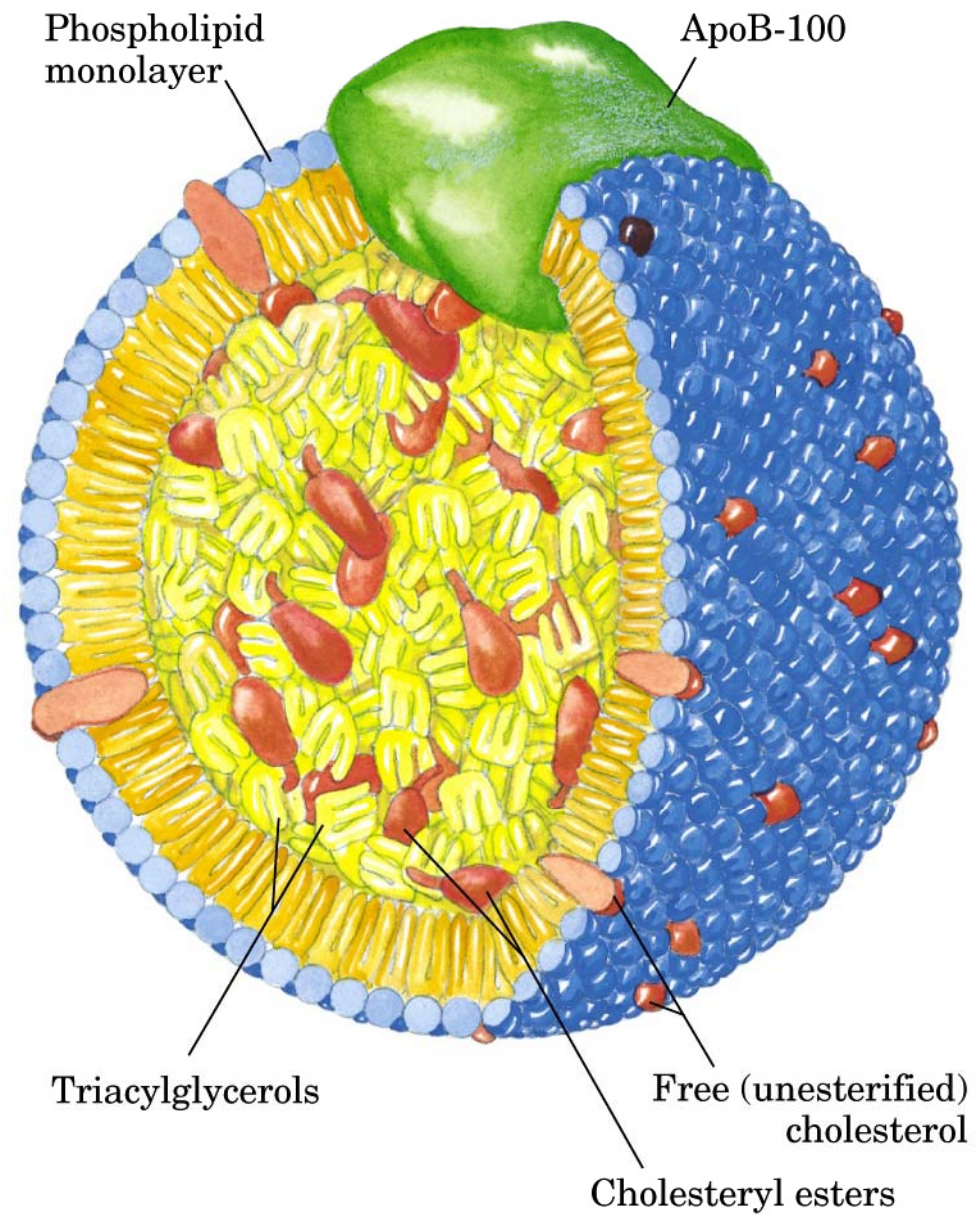
Cholesterol

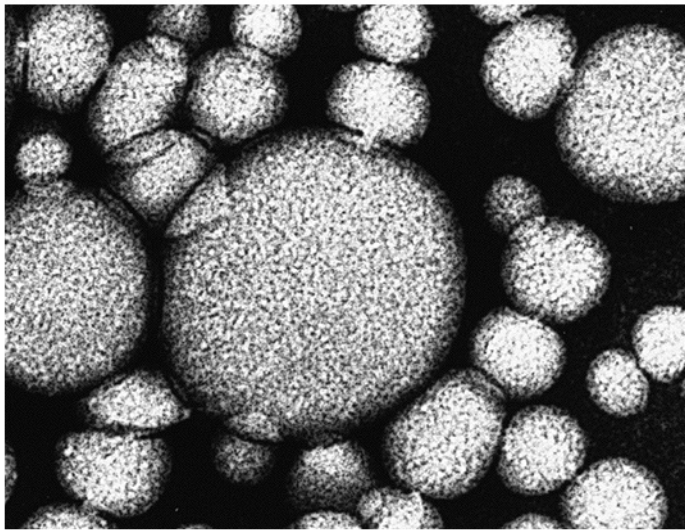


Cholesteryl ester

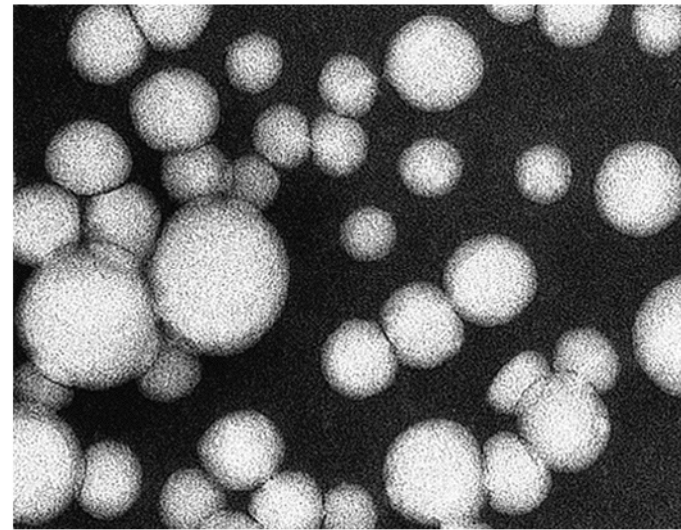


Taurocholic acid
(a bile acid)

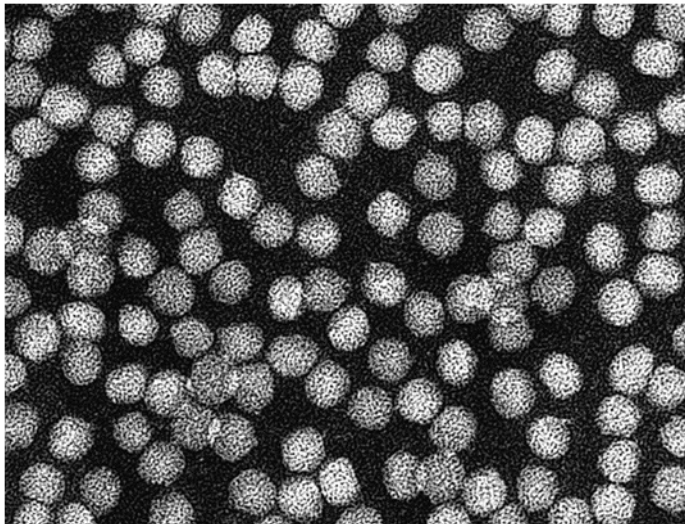




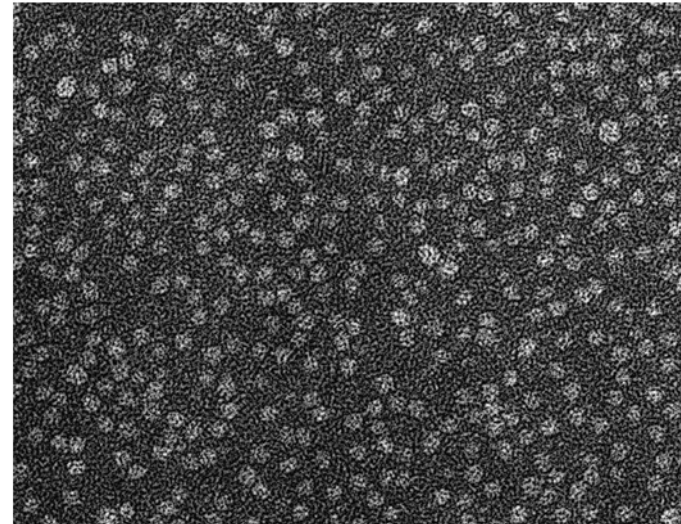
Chylomicrons (x60,000)



VLDL (x180,000)



LDL (x180,000)



HDL (x180,000)

(b)

table 21–2

Major Classes of Human Plasma Lipoproteins: Some Properties						
Lipoprotein	Density (g/mL)	Composition (wt %)				
		Protein	Phospholipids	Free cholesterol	Cholesteryl esters	Triacylglycerols
Chylomicrons	<1.006	2	9	1	3	85
VLDL	0.95–1.006	10	18	7	12	50
LDL	1.006–1.063	23	20	8	37	10
HDL	1.063–1.210	55	24	2	15	4

Source: Modified from Kritchevsky, D. (1986) Atherosclerosis and nutrition. *Nutr. Int.* **2**, 290 – 297.

table 21–3

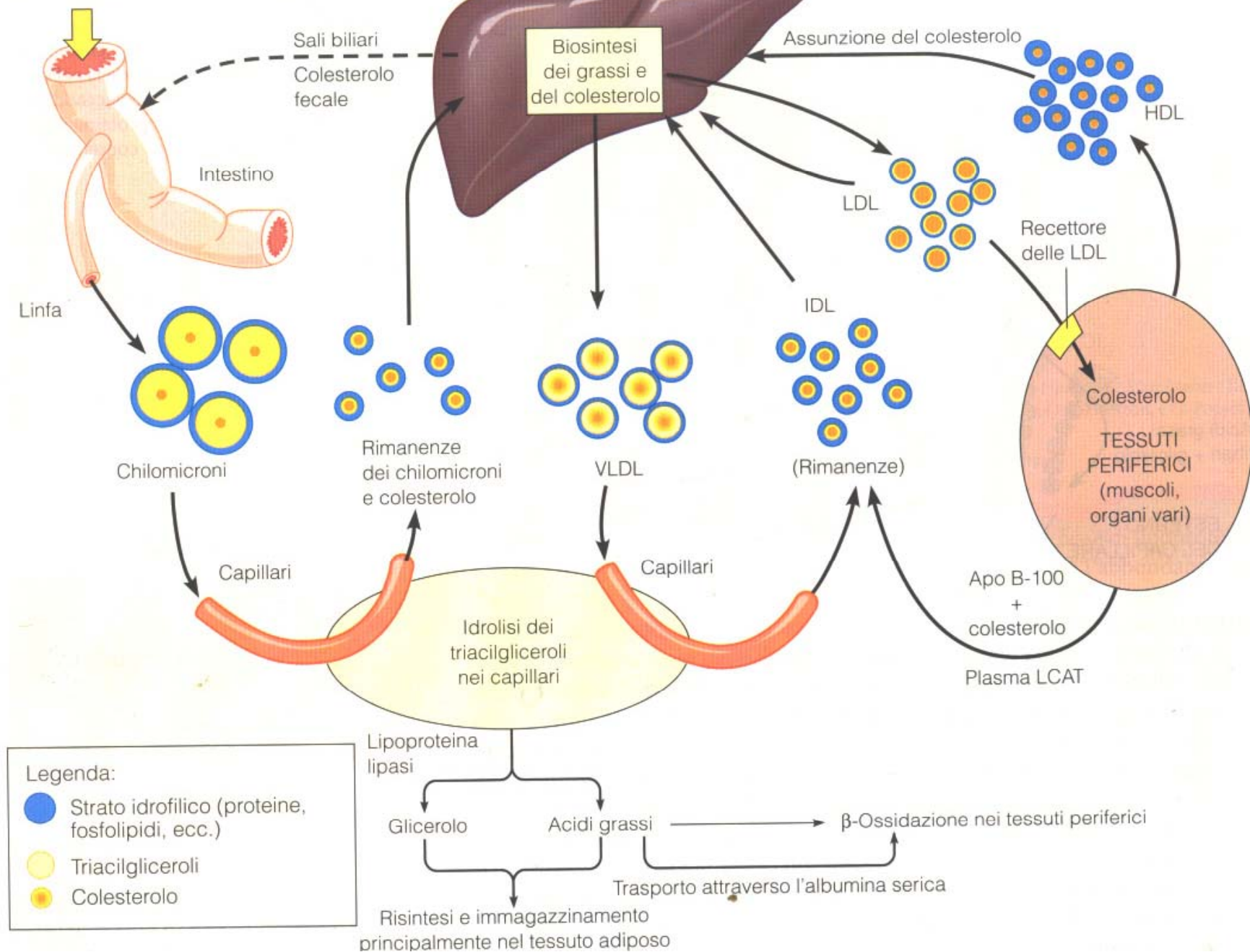
Apolipoproteins of the Human Plasma Lipoproteins

Apolipoprotein	Molecular weight	Lipoprotein association	Function (if known)
ApoA-I	28,331	HDL	Activates LCAT; interacts with ABC transporter
ApoA-II	17,380	HDL	
ApoA-IV	44,000	Chylomicrons, HDL	
ApoB-48	240,000	Chylomicrons	
ApoB-100	513,000	VLDL, LDL	Binds to LDL receptor
ApoC-I	7,000	VLDL, HDL	
ApoC-II	8,837	Chylomicrons, VLDL, HDL	Activates lipoprotein lipase
ApoC-III	8,751	Chylomicrons, VLDL, HDL	Inhibits lipoprotein lipase
ApoD	32,500	HDL	
ApoE	34,145	Chylomicrons, VLDL, HDL	Triggers clearance of VLDL and chylomicron remnants

Source: Modified from Vance, D.E. & Vance, J.E. (eds) (1985) *Biochemistry of Lipids and Membranes*. The Benjamin/Cummings Publishing Company, Menlo Park, CA.

GRASSI INTRODOTTI CON
L'ALIMENTAZIONE E COLESTEROLO

FEGATO

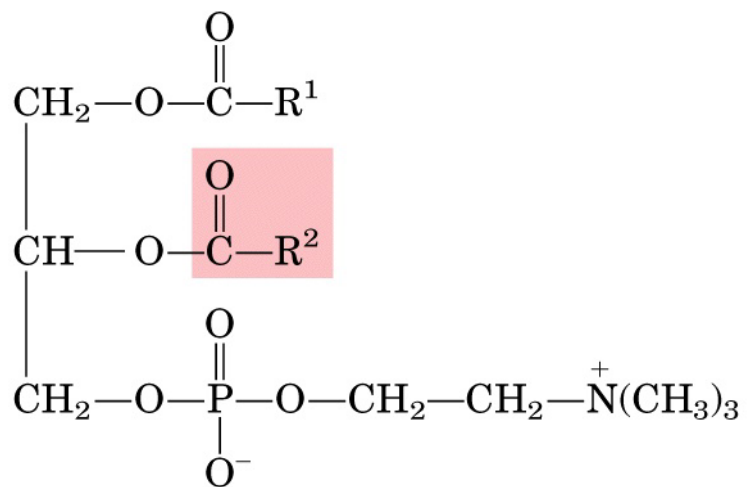




Blood plasma
after fast

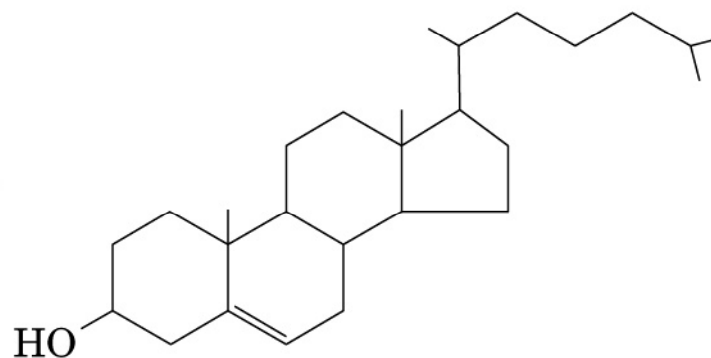
Blood plasma
after meal

(b)



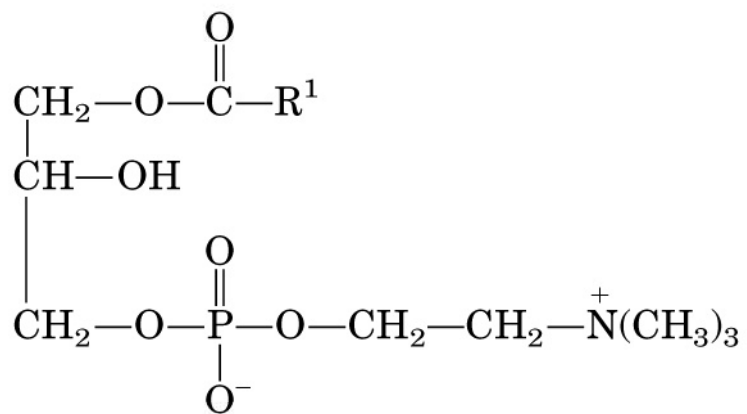
Phosphatidylcholine (lecithin)

+



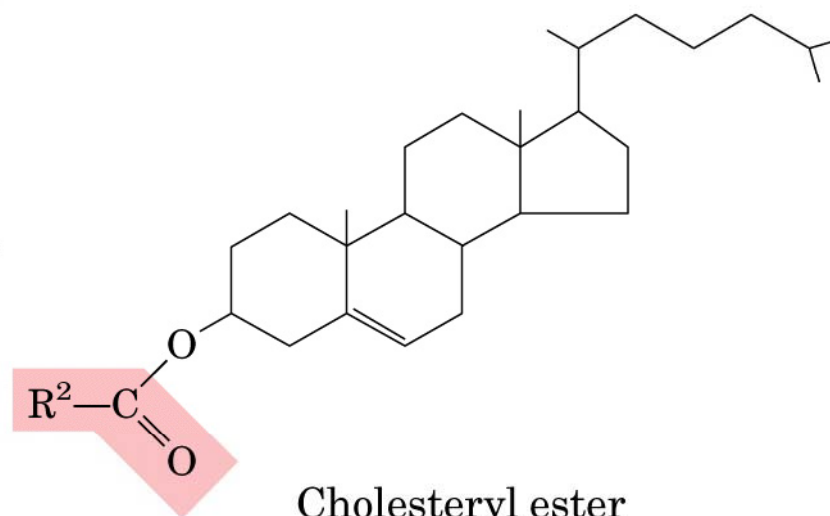
Cholesterol

lecithin-cholesterol
acyl transferase
(LCAT)

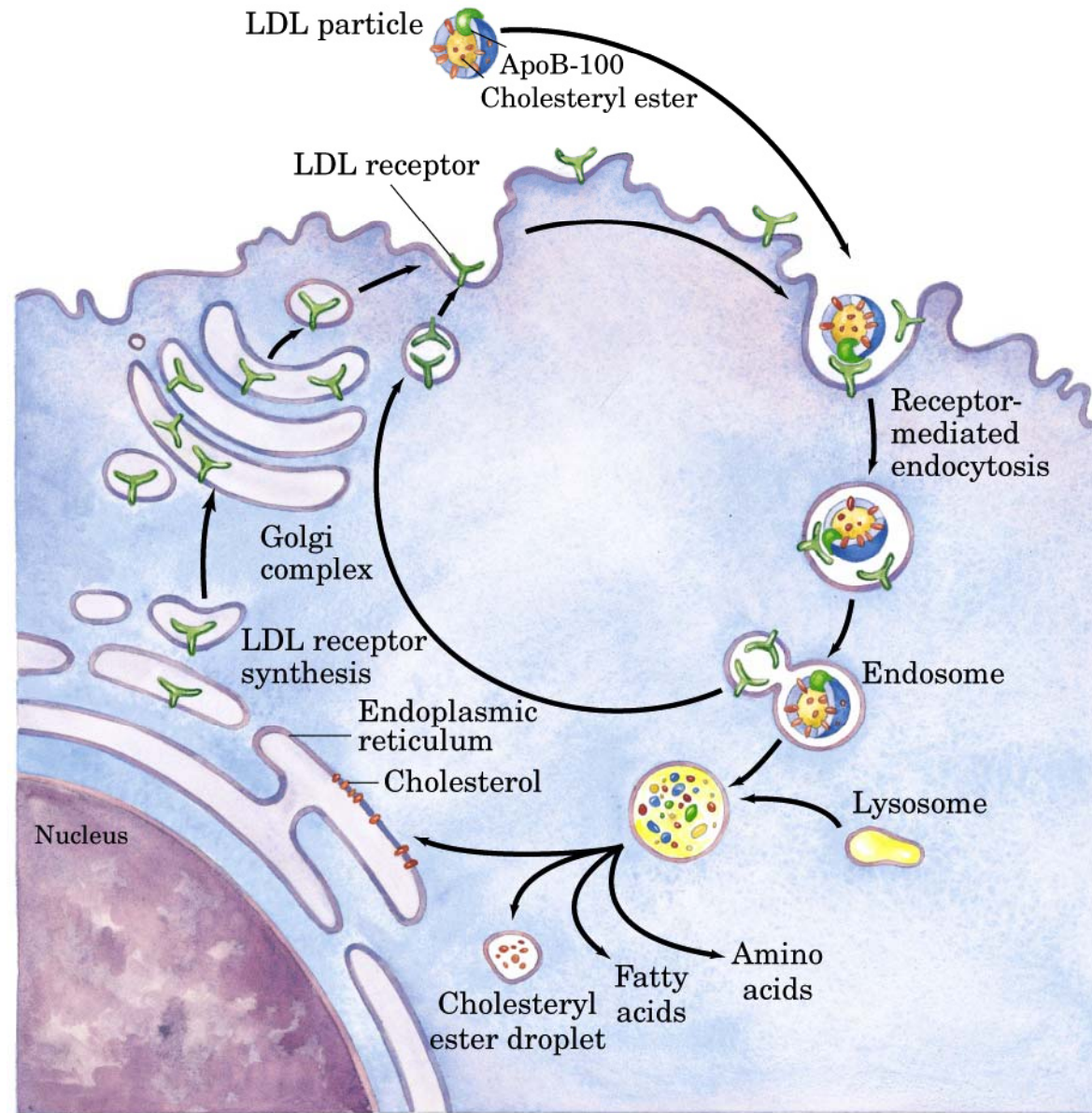


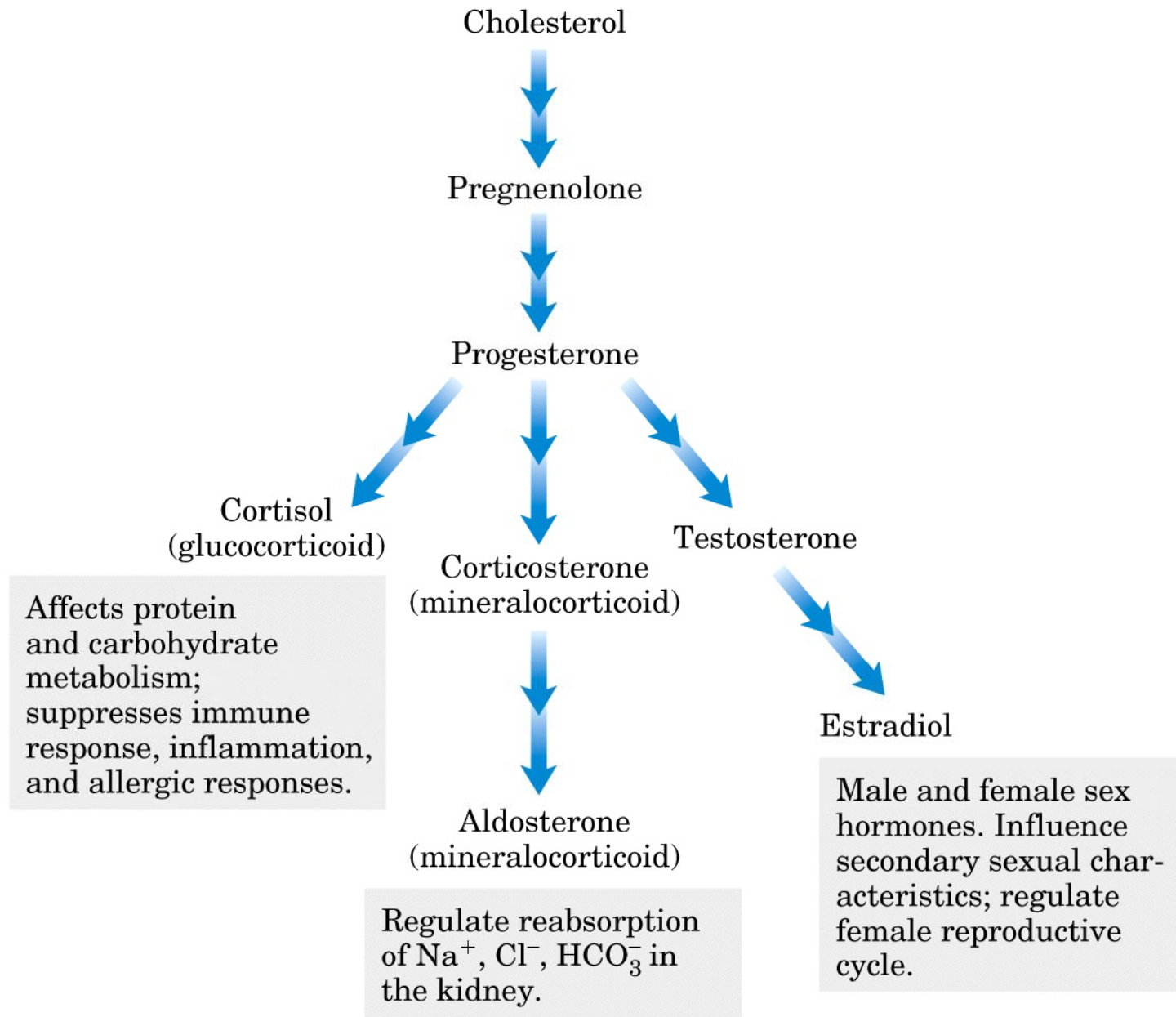
Lysolecithin

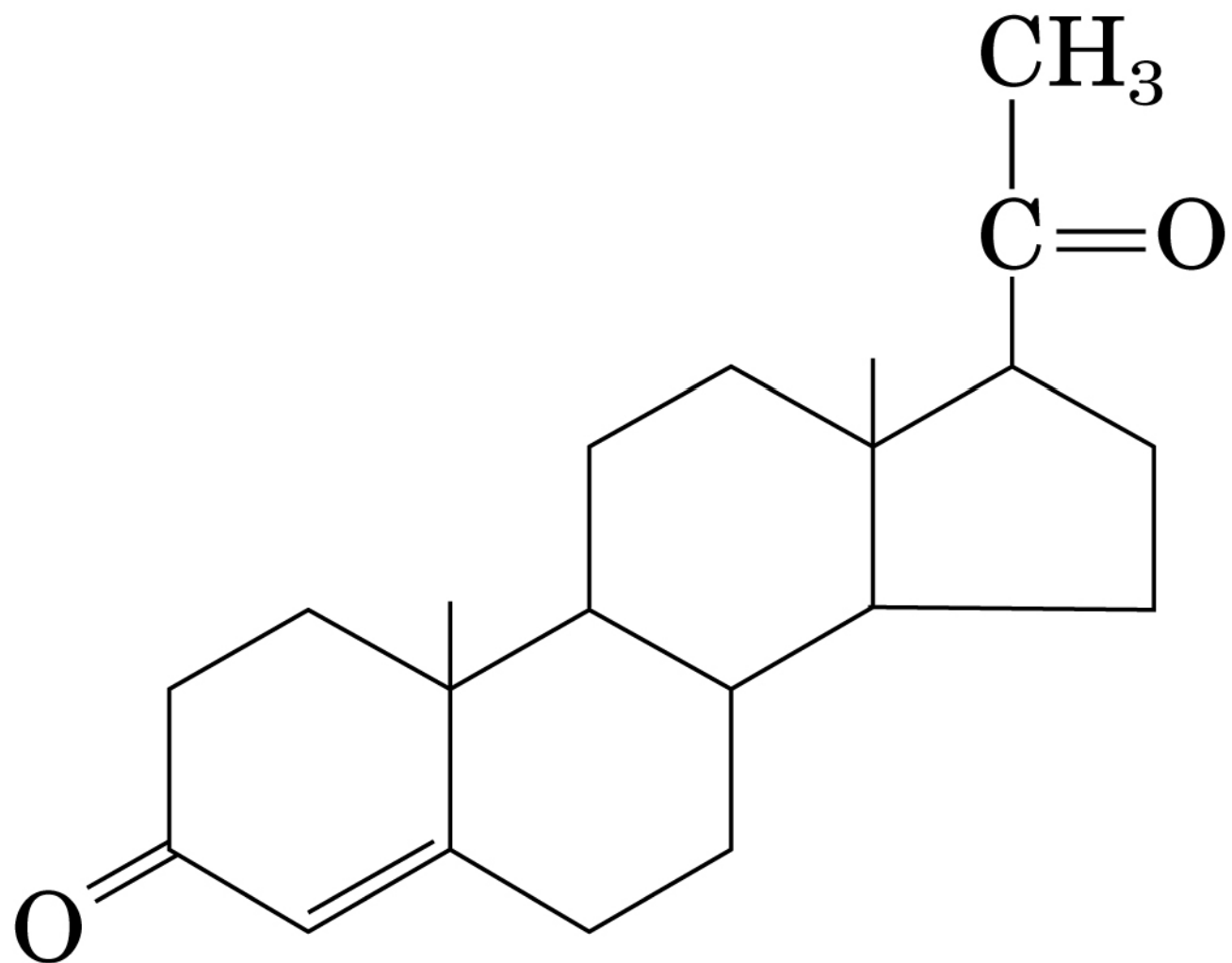
+



Cholesteryl ester







Progesterone

