

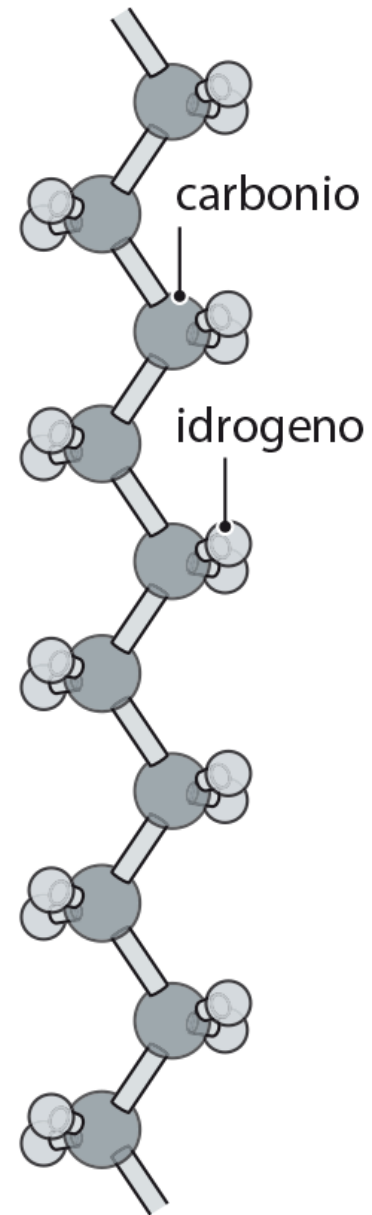
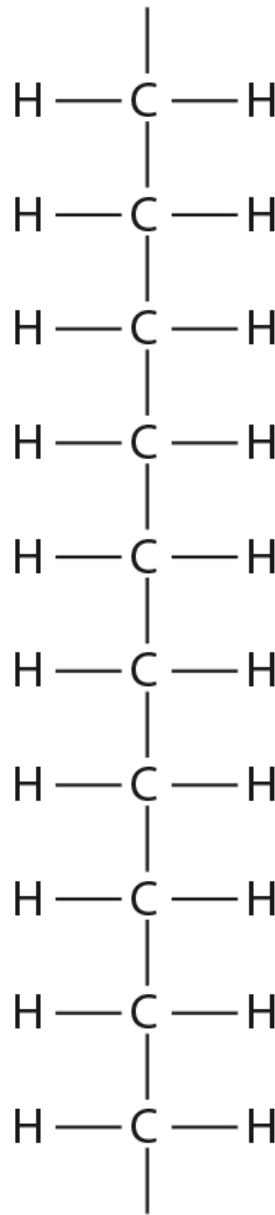
* Capitolo 5

I lipidi

OBIETTIVI

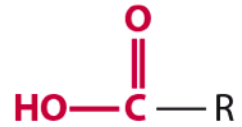
- Lipidi gruppo eterogeneo di composti con ruoli biochimici diversi
- Struttura di base di un acido grasso
- Acidi grassi saturi e insaturi
- Acidi grassi in combinazione per produrre triacilgliceroli
- Derivati degli acidi grassi: glicerofosfolipidi e sfingolipidi
- Terpeni, steroli e steroidi
- Funzione eicosanodi e vitamine liposolubili

Porzione di catena idrocarburica

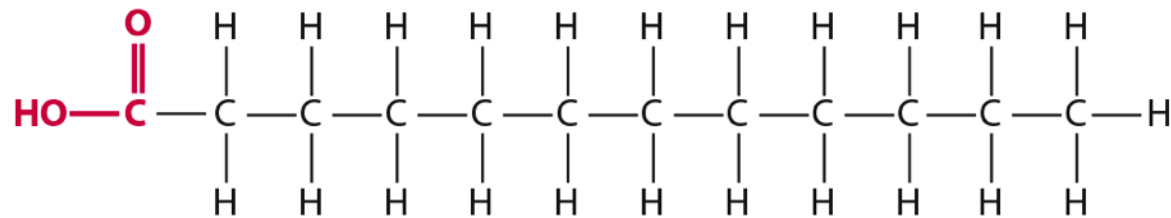


STRUTTURA DI UN ACIDO GRASSO

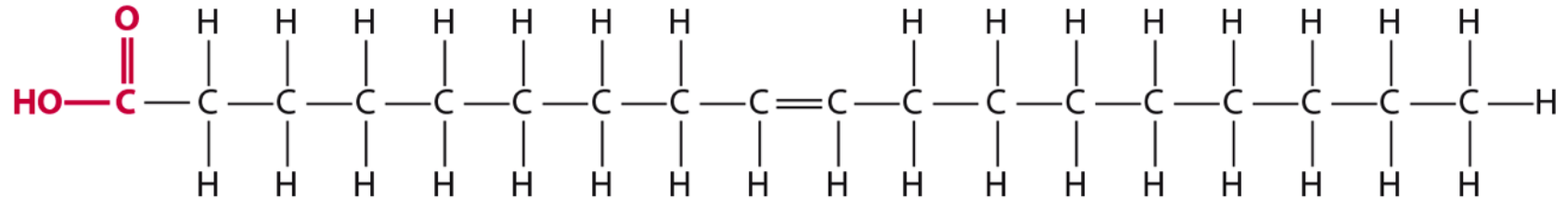
(A) struttura generale di un acido carbossilico



(B) un acido grasso saturo: l'acido laurico

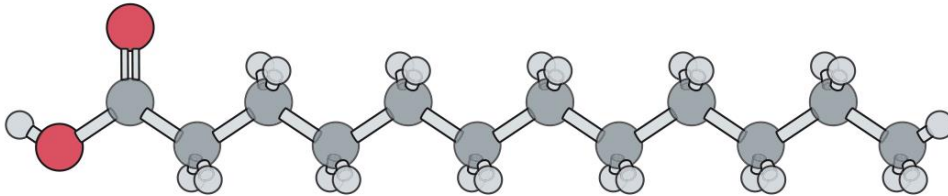


(C) un acido grasso insaturo: l'acido oleico

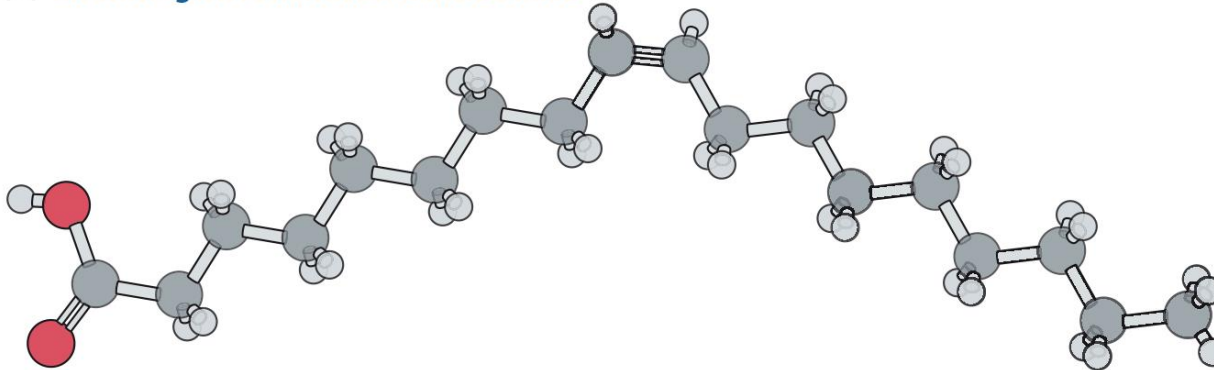


CONFORMAZIONI DI UN ACIDO GRASSO SATURO E UN ACIDO GRASSO INSATURO

(A) un acido grasso saturo: l'acido laurico



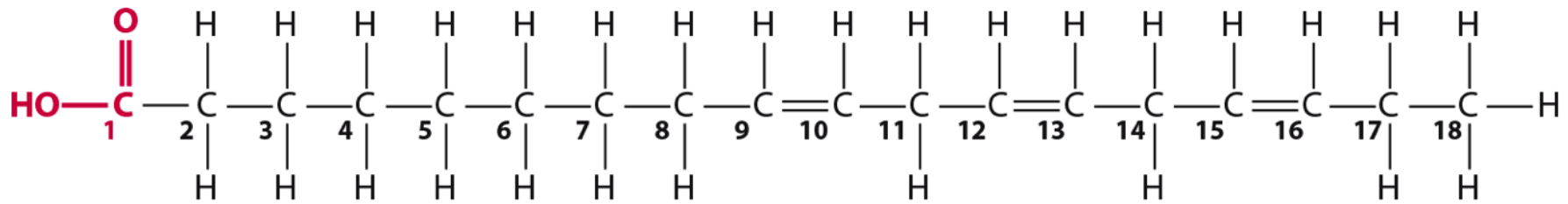
(B) un acido grasso insaturo: l'acido oleico



PUNTO DI FUSIONE
SUPERIORI A 40° C
SOLIDI

LIQUIDI

NUMERAZIONE DEGLI ATOMI DI CARBONIO DI UN ACIDO GRASSO



Gli acidi grassi più comuni di tipo biologico

TABELLA 9.1 Comuni acidi grassi di tipo biologico

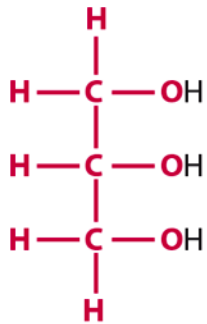
Simbolo ^a	Nome comune	Nome sistematico	Struttura	pf (°C)
Acidi grassi saturi				
12:0	Acido laurico	Acido dodecanoico	CH ₃ (CH ₂) ₁₀ COOH	44,2
14:0	Acido miristico	Acido tetradecanoico	CH ₃ (CH ₂) ₁₂ COOH	53,9
16:0	Acido palmitico	Acido esadecanoico	CH ₃ (CH ₂) ₁₄ COOH	63,1
18:0	Acido stearico	Acido ottadecanoico	CH ₃ (CH ₂) ₁₆ COOH	69,6
20:0	Acido arachidico	Acido eicosanoico	CH ₃ (CH ₂) ₁₈ COOH	77
22:0	Acido behenico	Acido docosanoico	CH ₃ (CH ₂) ₂₀ COOH	81,5
24:0	Acido lignoceric	Acido tetracosanoico	CH ₃ (CH ₂) ₂₂ COOH	88
Acidi grassi insaturi (tutti i doppi legami sono in cis)				
16:1 _{n-7}	Acido palmitoleico	Acido 9-esadecanoico	CH ₃ (CH ₂) ₅ CH=CH(CH ₂) ₇ COOH	-0,5
18:1 _{n-9}	Acido oleico	Acido 9-ottadecanoico	CH ₃ (CH ₂) ₇ CH=CH(CH ₂) ₇ COOH	12
18:2 _{n-6}	Acido linoleico	Acido 9,12-ottadecadienoico	CH ₃ (CH ₂) ₄ (CH=CHCH ₂) ₂ (CH ₂) ₆ COOH	-5
18:3 _{n-3}	Acido α-linolenico	Acido 9,12,15-ottadecatrienoico	CH ₃ CH ₂ (CH=CHCH ₂) ₃ (CH ₂) ₆ COOH	-11
18:3 _{n-6}	Acido γ-linolenico	Acido 6,9,12-ottadecatrienoico	CH ₃ (CH ₂) ₄ (CH=CHCH ₂) ₃ (CH ₂) ₃ COOH	-11
20:4 _{n-6}	Acido arachidonico	Acido 5,8,11,14-eicosatetranoico	CH ₃ (CH ₂) ₄ (CH=CHCH ₂) ₄ (CH ₂) ₂ COOH	-49,5
20:5 _{n-3}	EPA	Acido 5,8,11,14,17-eicosapentanoico	CH ₃ CH ₂ (CH=CHCH ₂) ₅ (CH ₂) ₂ COOH	-54
22:6 _{n-3}	DHA	Acido 4,7,10,13,16,19-docosaesanoico	CH ₃ CH ₂ (CH=CHCH ₂) ₆ CH ₂ COOH	-44
24:1 _{n-9}	Acido nervonico	Acido 15-tetracosenoico	CH ₃ (CH ₂) ₇ CH=CH(CH ₂) ₁₃ COOH	39

^a Numero di atomi di carbonio:numero di doppi legami. Per gli acidi grassi insaturi, la quantità «n-x» indica la posizione dell'ultimo doppio legame dell'acido grasso, dove n è il suo numero di atomi di C, mentre x è la posizione dell'ultimo atomo di C unito da doppio legame contando a partire dall'estremità metil-terminale (ω).

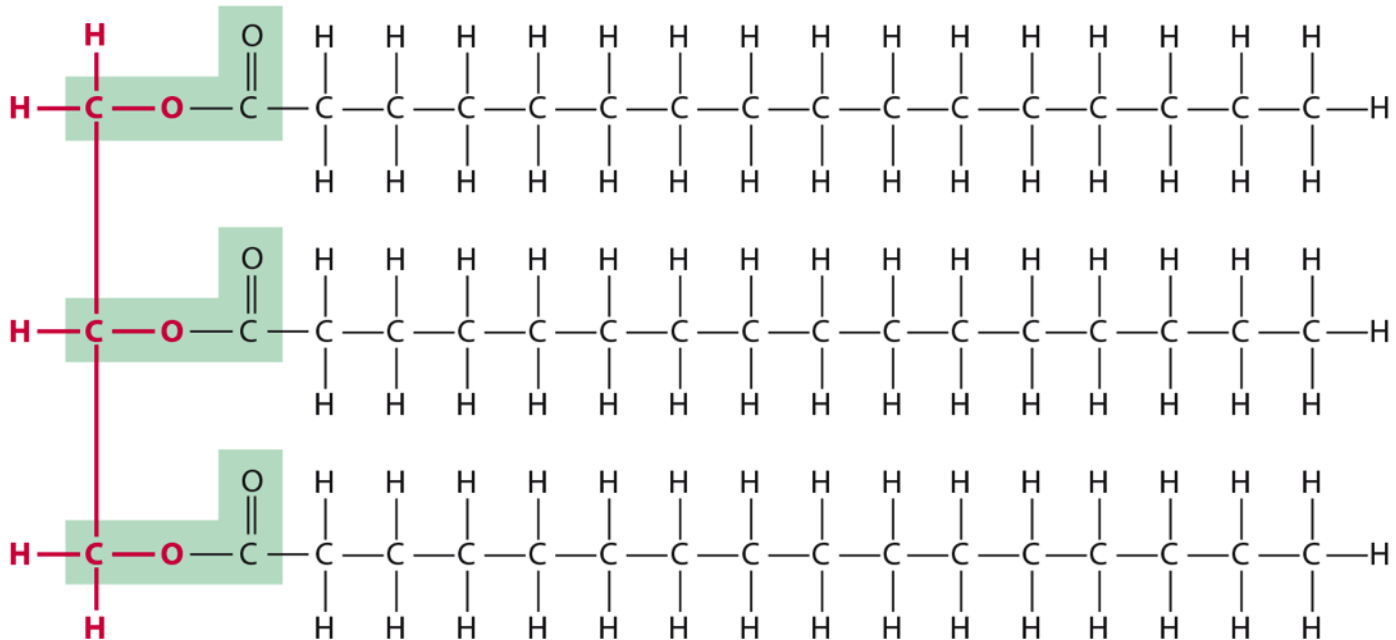
Fonte: LipidBank (<http://www.lipidbank.jp>).

STRUTTURA DI UN TRIACILGLICEROLO

(A) glicerolo



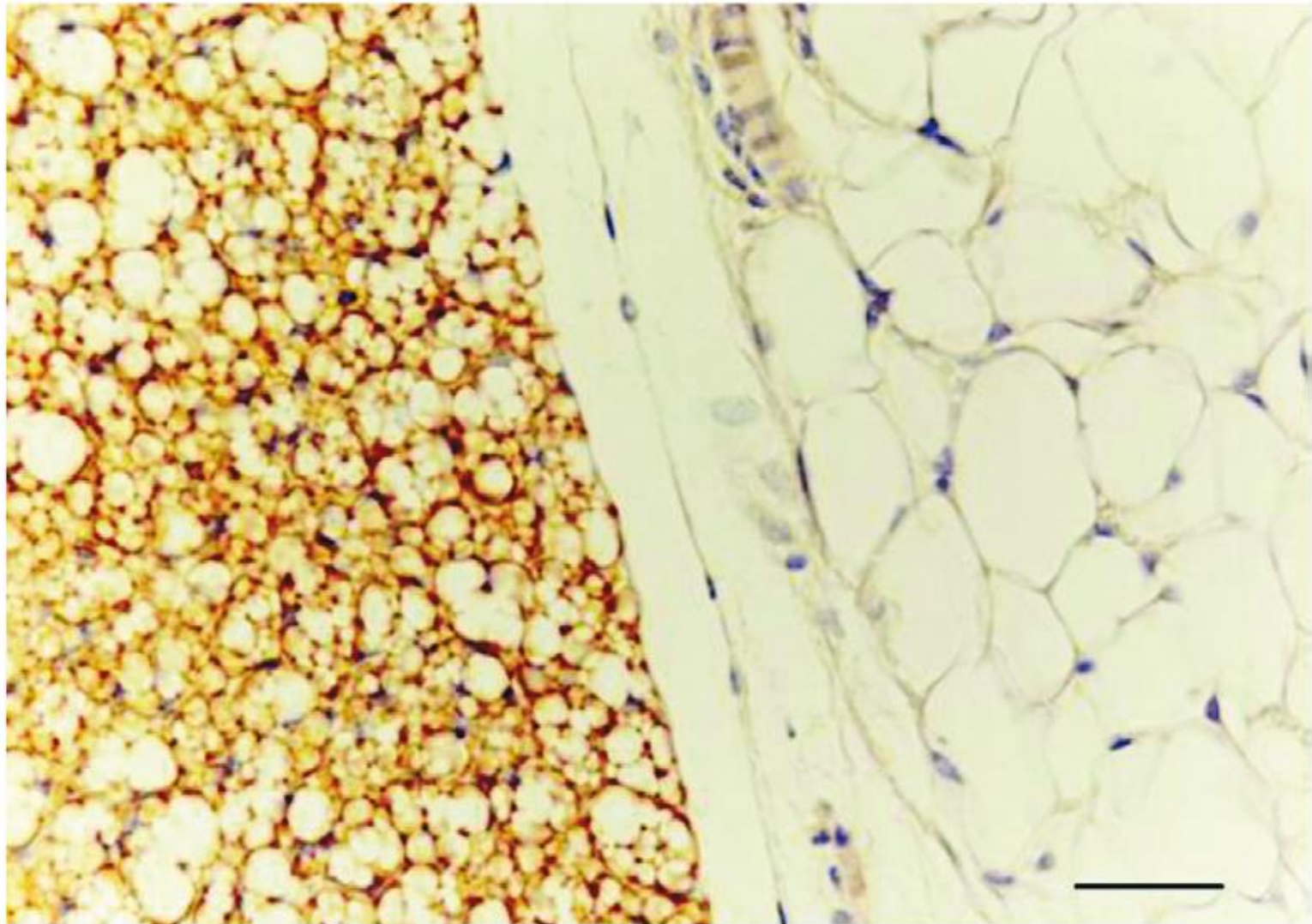
(B) un triacilglicerolo semplice: la tripalmitina

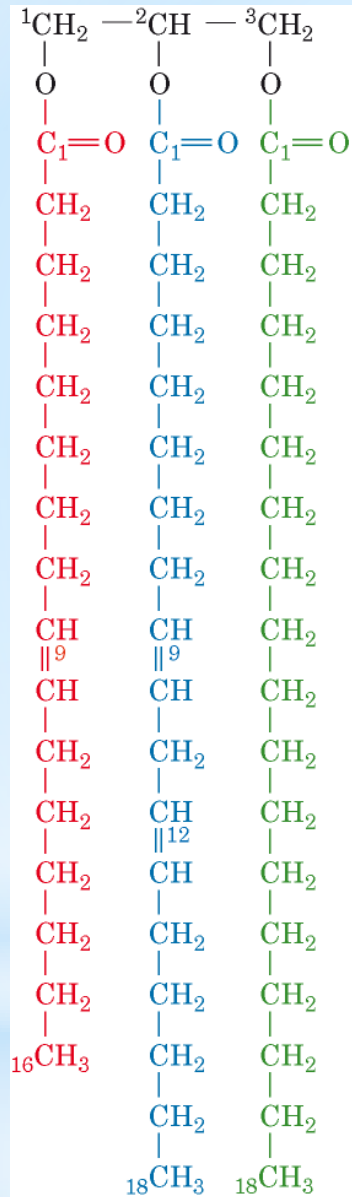


Molecole di deposito energetico per la maggior parte di animali e piante

tessuto adiposo bruno

tessuto adiposo bianco

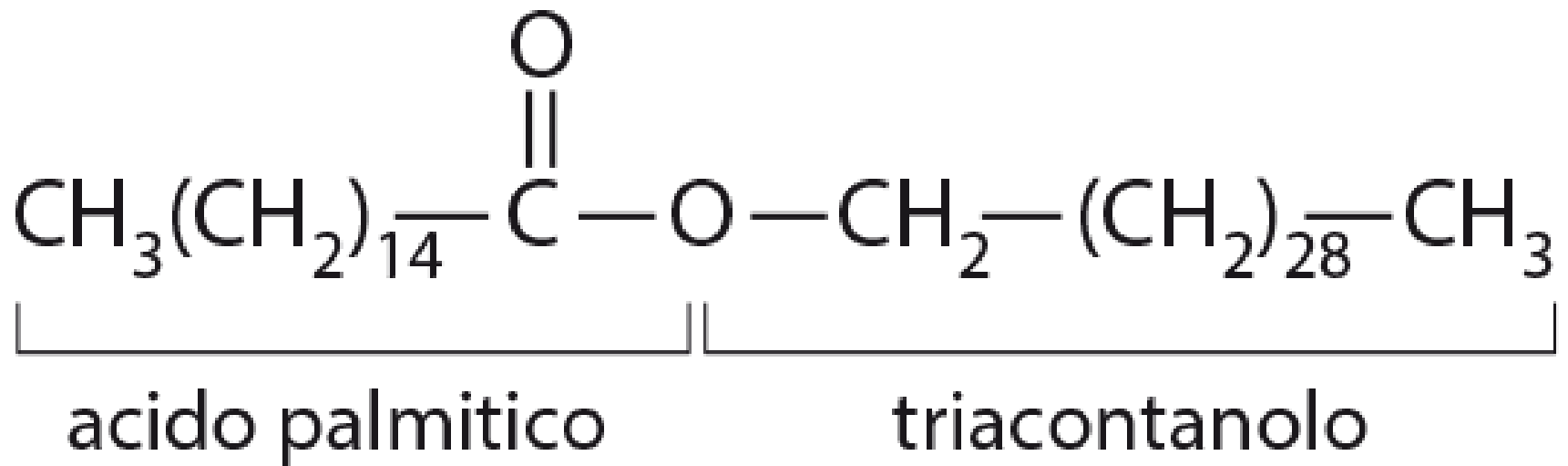




**1-Palmitoleil-2-linoleil-
3-stearil-glicerolo**

NOMENCLATURA DEI TRIACILGLIECEROLI

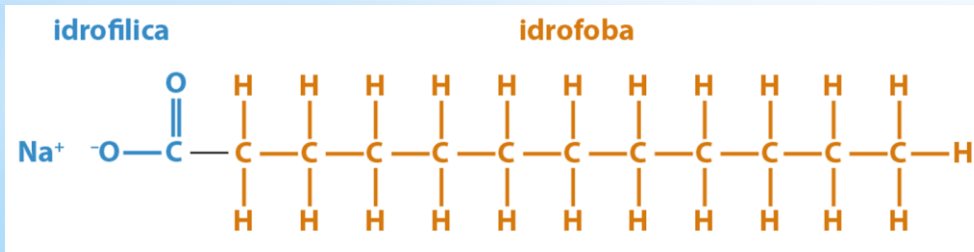
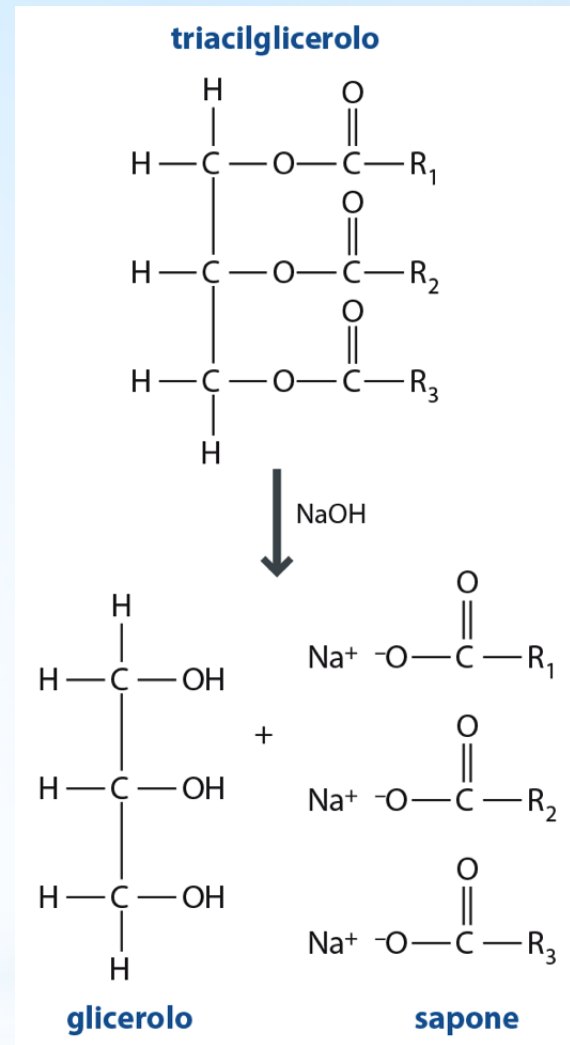
CERA D'API



REAZIONE TRA UN ALCOL E UN ACIDO GRASSO

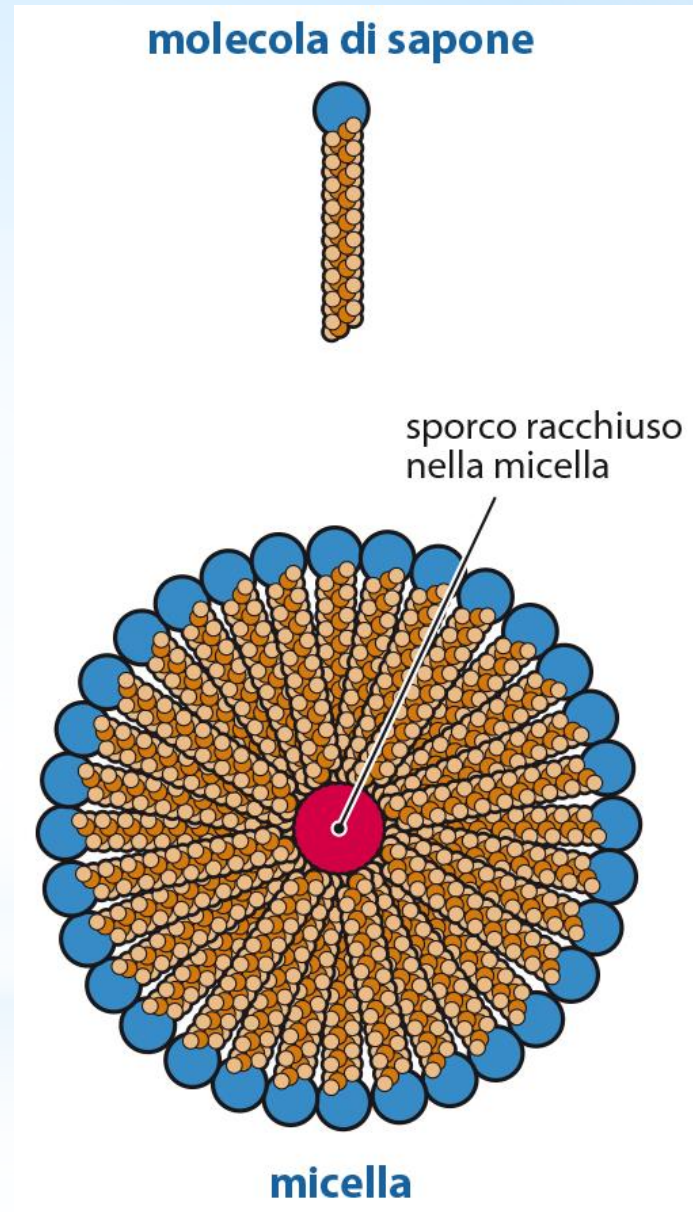
LA REAZIONE DI SAPONIFICAZIONE

I saponi sono derivati degli ac grassi che si formano per riscaldamento di un trigliceride in presenza di una base forte come NaOH



MOLECOLA DI SAPONE ANFIPATICA

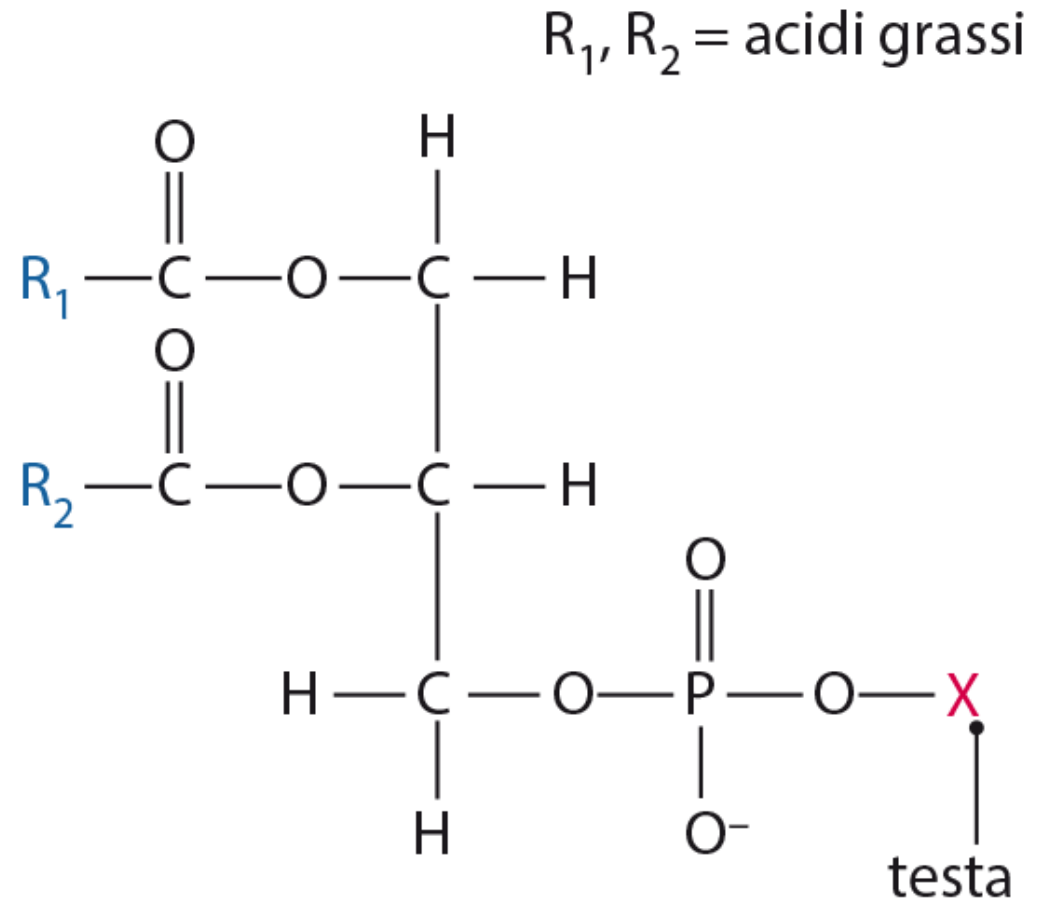
**Le molecole di sapone
possono formare
micelle**



STRUTTURA GENERALE DI UN GLICEROFOSFOLIPIDE

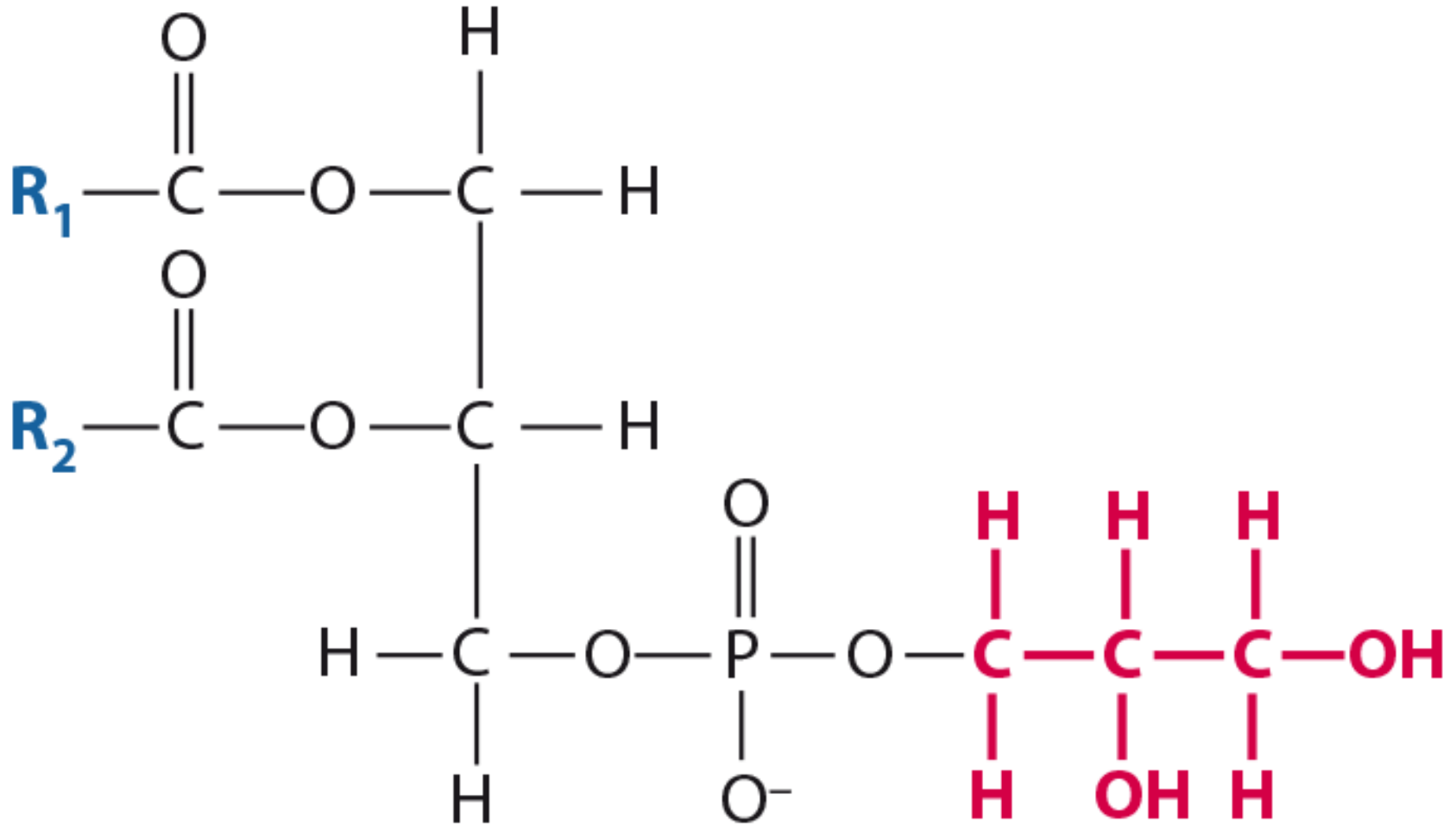
Un ac. grasso sostituito da un gruppo idrofilo legato al glicerolo mediante un legame fosfodiester

Es: X=H acido fosfatidico

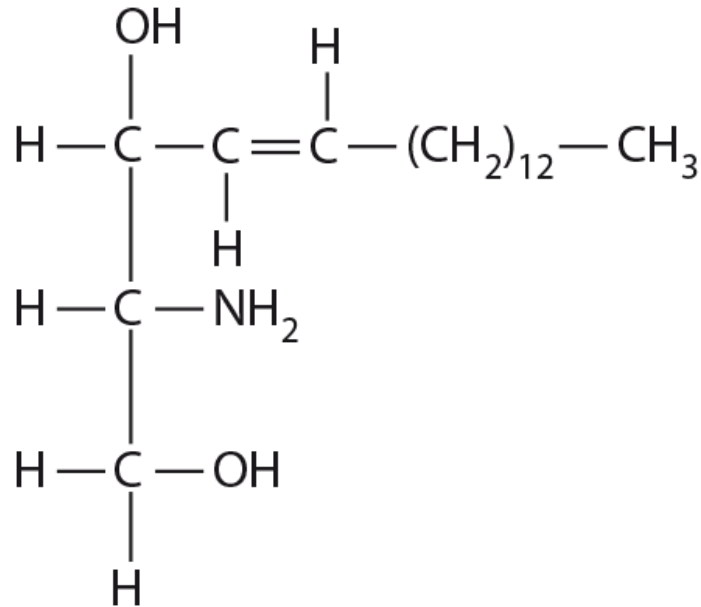


FOSFATIDILGLICEROLO

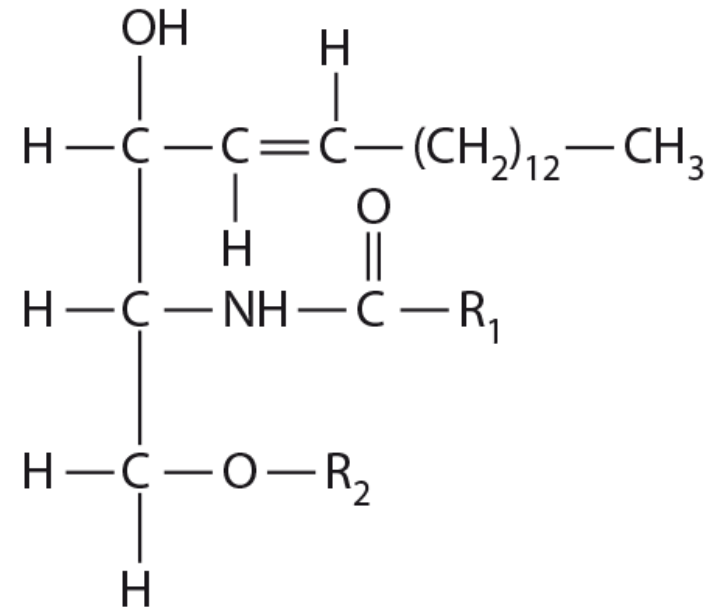
$R_1, R_2 = \text{acidi grassi}$



(A) sfingosina



(B) sfingolipide



R_1 = acido grasso
 R_2 = testa idrofila

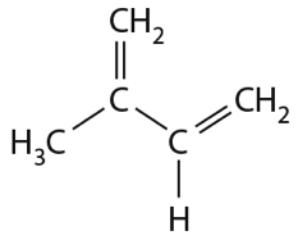
R_2 = fosfato FOSFOCOLINA

R_2 = zucchero semplice CEREBROSIDI

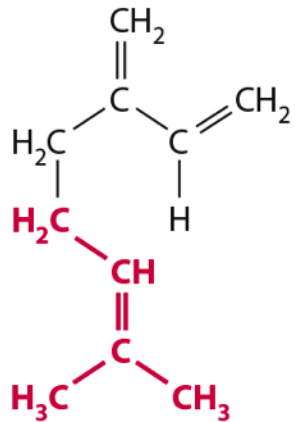
R_2 = catene glicidiche complesse GANGLIOSIDI

TERPENI: in gran parte prodotti dalle piante

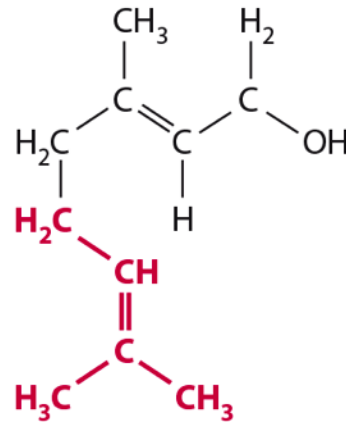
(A) isoprene



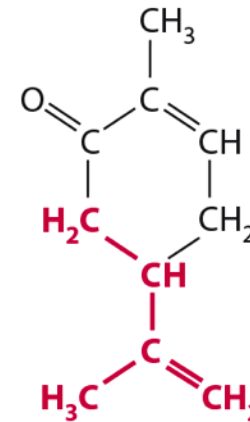
(B) terpeni



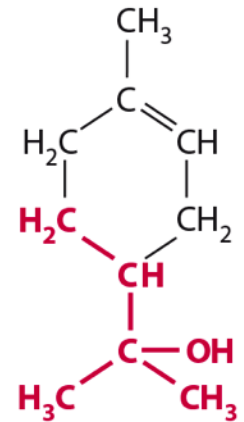
mircene



geraniolo

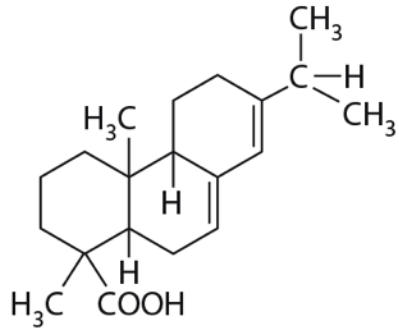


carvone

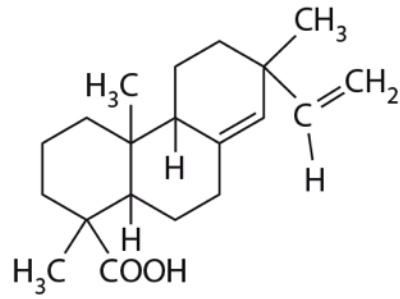


terpineolo

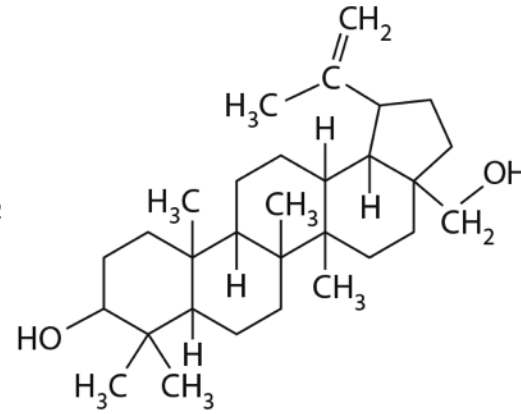
TERPENI ISOLATI DALLE RESINE DEGLI ALBERI



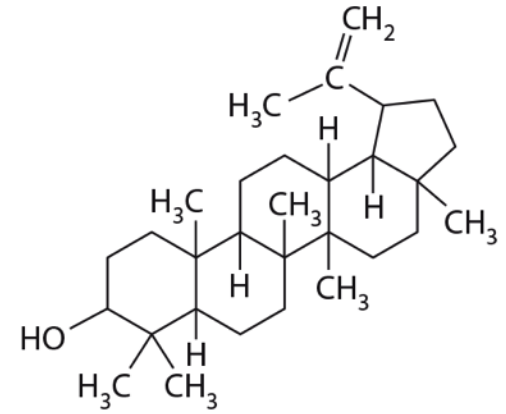
acido abietico



acido pimarico

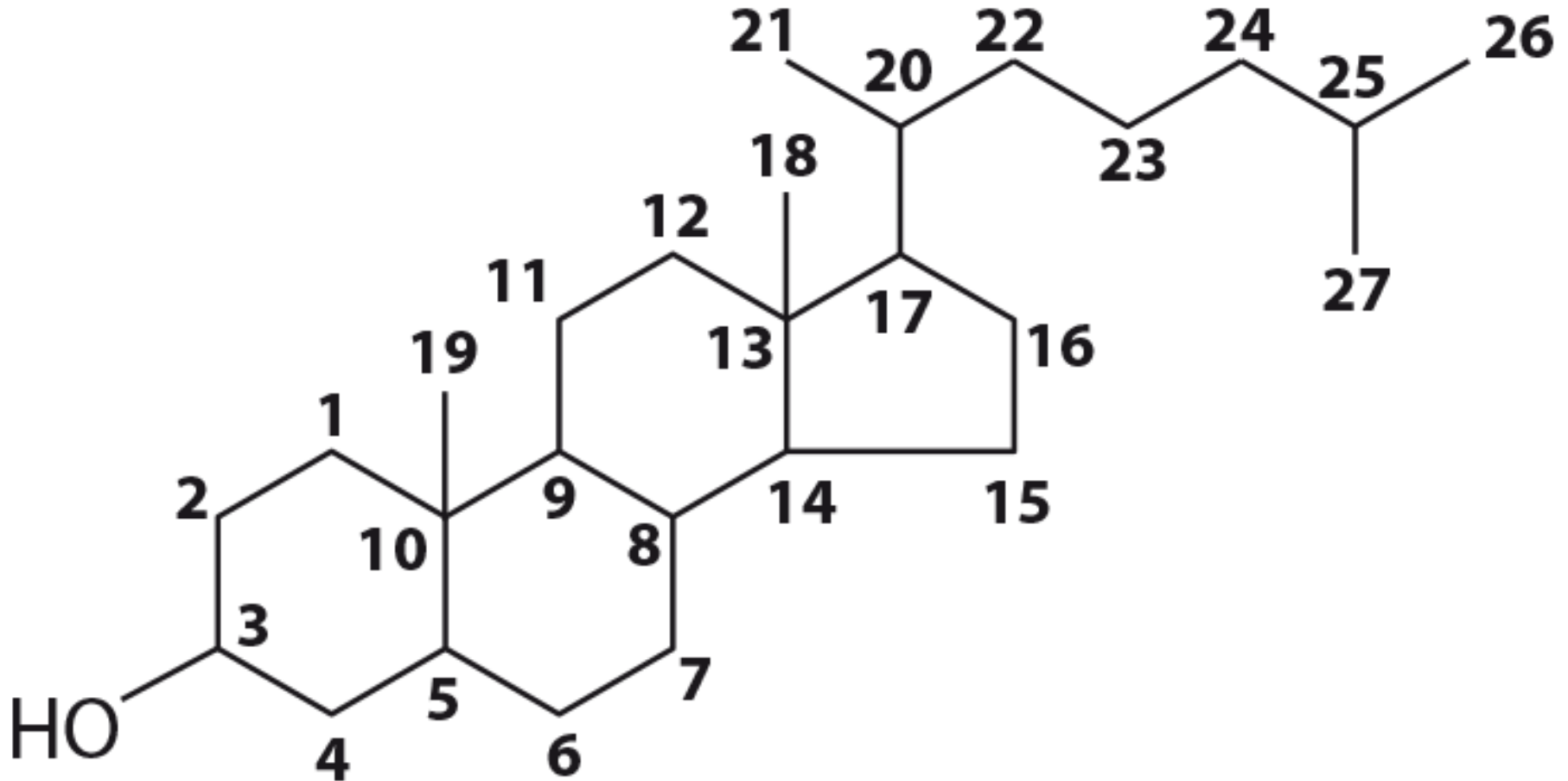


betulina

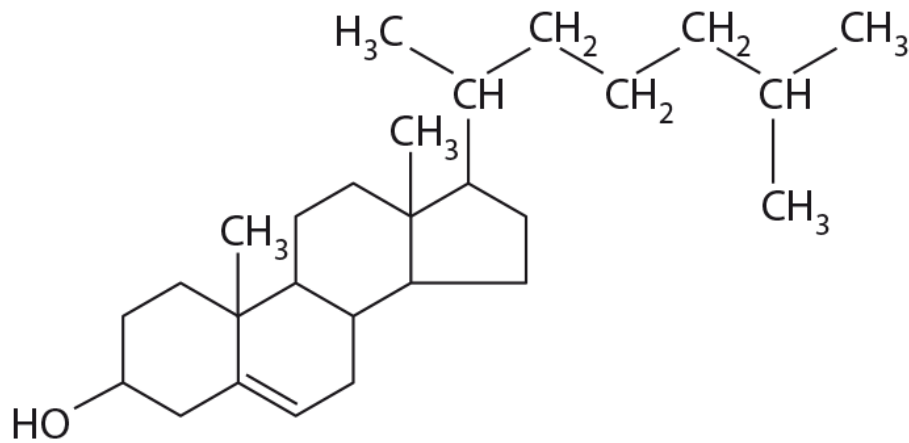


lupeolo

STRUTTURA DI BASE DI UNO STEROLO

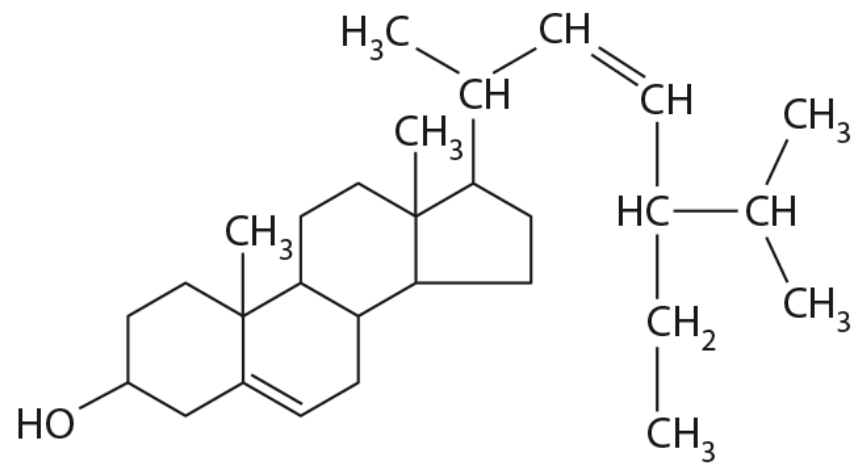


Gli steroli sono formati dalla ciclizzazione dello squalene, un triterpene costituito da sei unità isopreniche



colesterolo

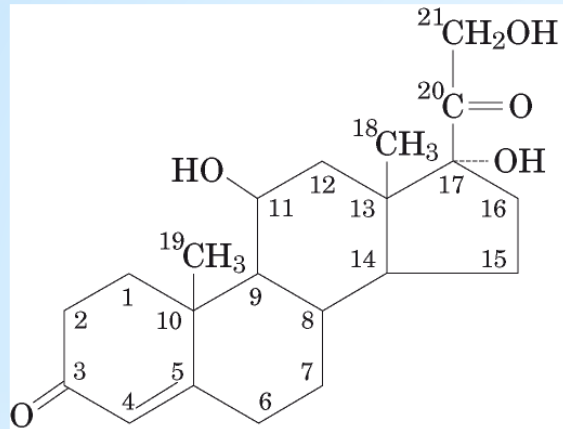
origine animale



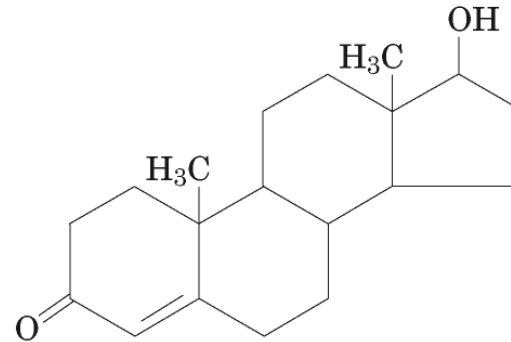
stigmasterolo

origine vegetale

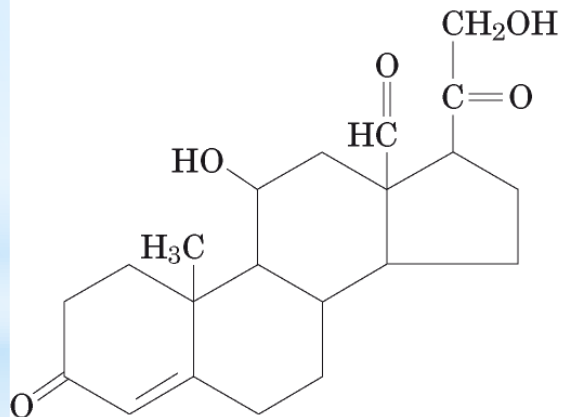
ESEMPI DI ORMONI STEROIDEI



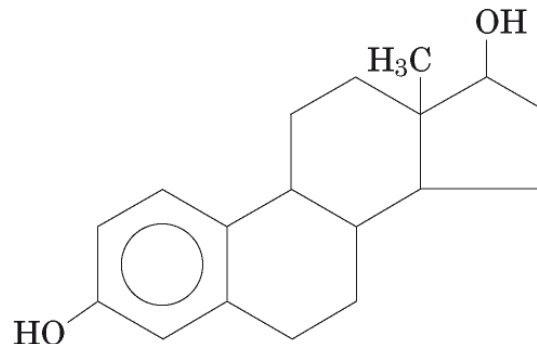
Cortisolo (idrocortisone)
(un glucocorticoide)



Testosterone
(un androgeno)

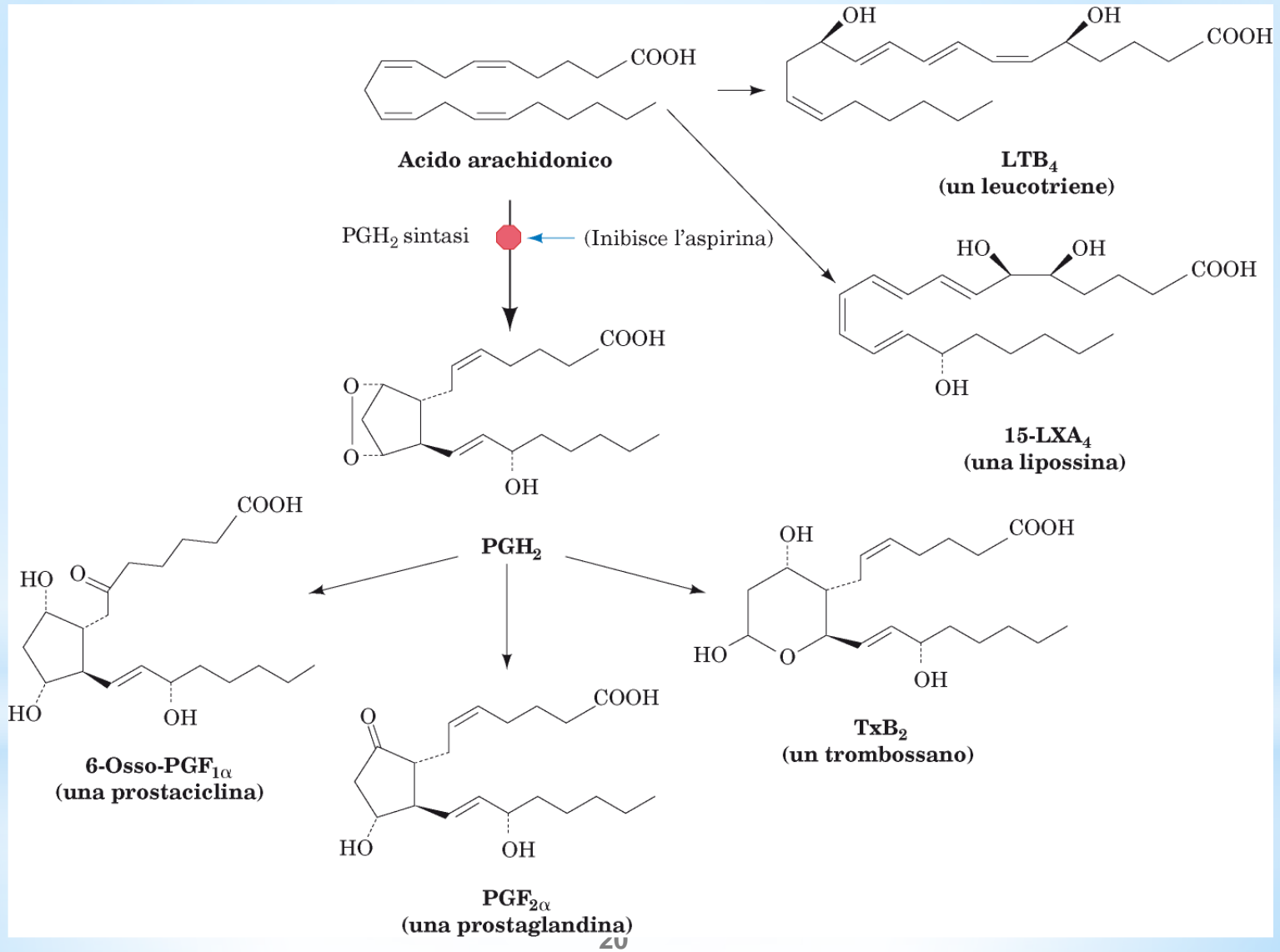


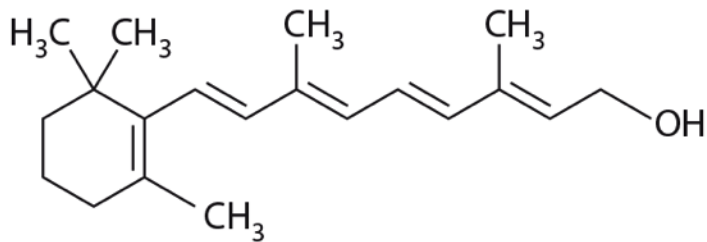
Aldosterone
(un mineralcorticoide)



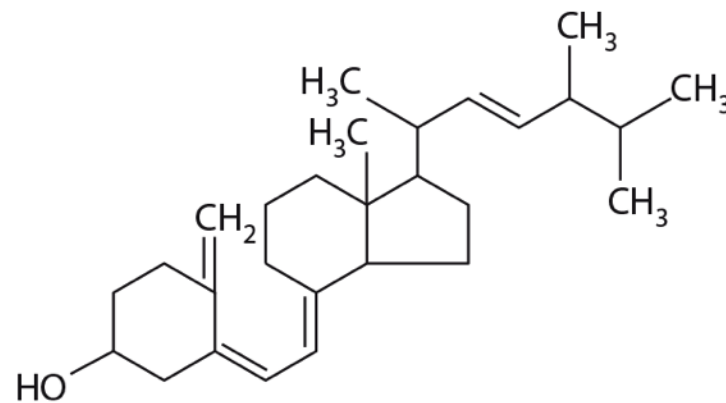
β -Estradiolo
(un estrogeno)

GLI EICOSANOIDI HANNO MOLTE FUNZIONI BIOLOGICHE

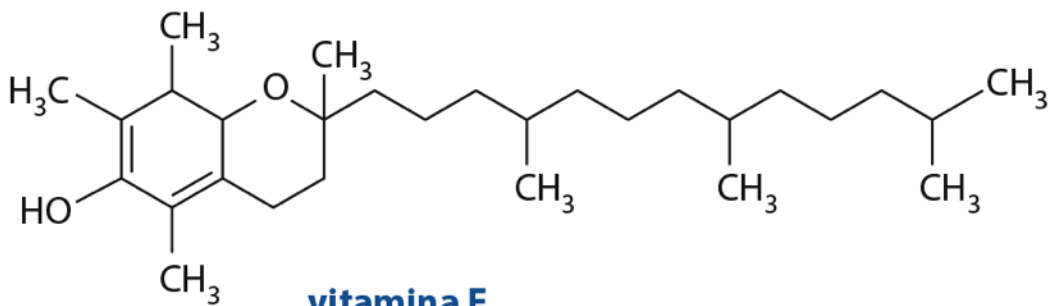




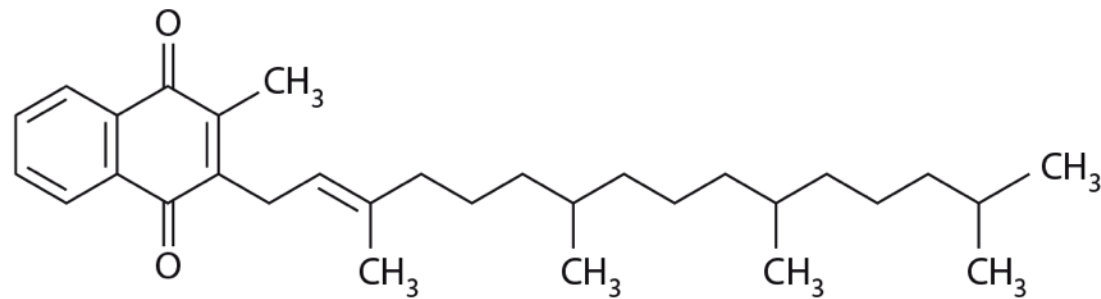
vitamina A



vitamina D



vitamina E



vitamina K