

# Curs nr. 5 Biochimie AMG

## Lipidele

Cadru didactic predare SL Dr. Grecu  
Daniela

adresa mail pentru corespondenta cu  
studentii: [grecu.daniela@umft.ro](mailto:grecu.daniela@umft.ro)

# Lipidele

- compusi organici naturali, heterogeni ca structura si functii
- insolubile in apa
- solubile in solventi organici (eter, benzen, cloroform)

# Lipidele

**1. Simple:** contin C, H, O

Exemplu: trigliceride (triacilgliceroli)

**2. Complexe:** contin si N/ P (sau ambele)

Exemplu: glicerofosfolipide (fosfolipide)

**3. Derivate**

Exemplu: colesterolul

# Constituentii moleculelor lipidice

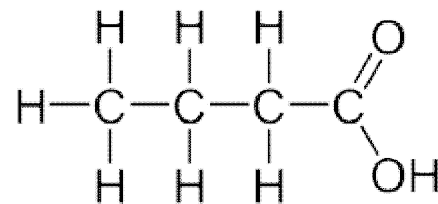
- **Acizii grasi**
- Alcoolii

# Acizii grasi

Tipici:

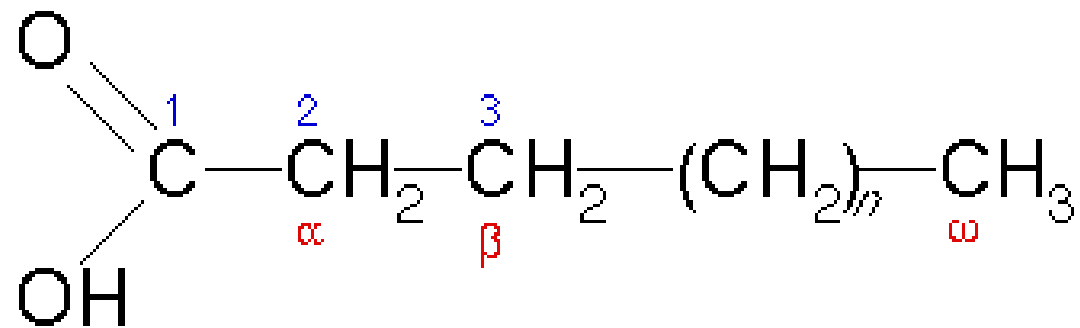
R - COOH

- nr. par atomi C: 4  $\rightarrow$  32



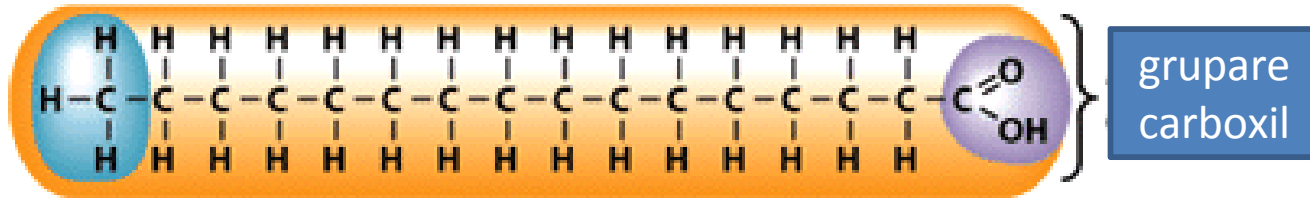
- **monocarboxilici** alifatici cu catena normala
- saturati sau nesaturati

# Acizii grasi



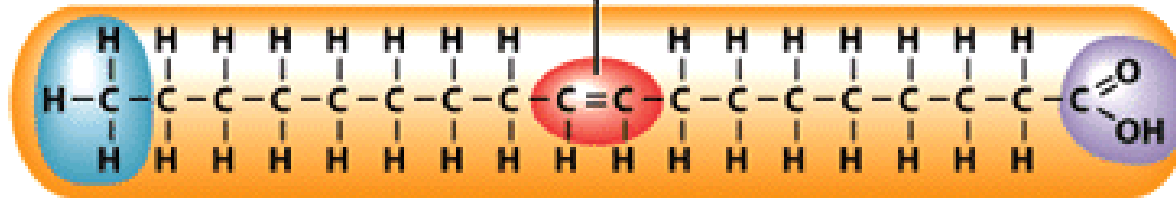
Numerotarea acizilor grasi

$C_{\omega}$

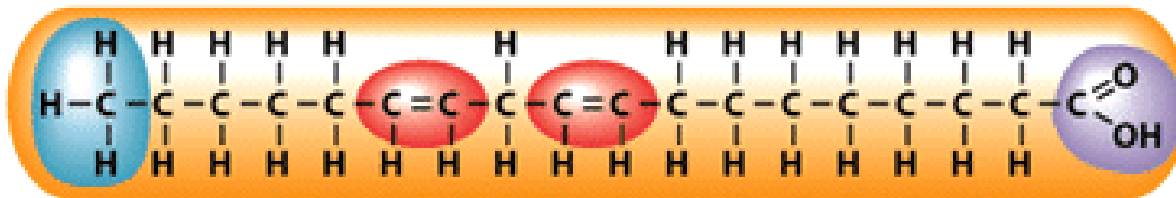


acid palmitic (16 C)

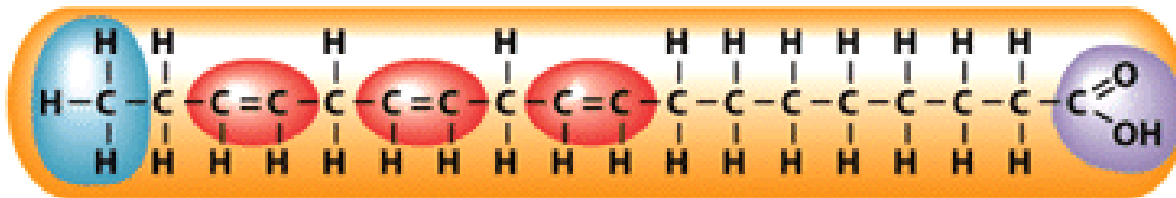
dubla legatura



acid oleic C18:9 (omega-9)



acid linoleic C18:9,12 (omega-6)



acid linolenic C18:9,12,15 (omega-3)

# Acizi grasi

- acizii grasi nesaturati  $\omega$ -3 si  $\omega$ -6 sunt **acizi grasi esentiali**

## Acizii grasi esentiali:

- nu pot fi produsi in cantitati suficiente
- trebuie obtinuti prin alimentatie



# **Alti acizi grasi din structura lipidelor**

- **cu nr. impar de atomi de C**
- **ramificati**
- **hidroxilati**: in lipidele din substanta cerebrala
- **ciclici**: acidul prostanoic → Pg (hormoni cu actiune predominant locala)

# Proprietatile acizilor grasi

- cu bazele formeaza **saruri (sapunuri)** = agenti de emulsionare
- cu alcooli formeaza **esteri**: reactie importanta in sinteza majoritatii lipidelor
- cei nesaturati **aditioneaza  $H_2$**  – transformarea uleiurilor in grasimi solide

# Proprietatile acizilor grasi

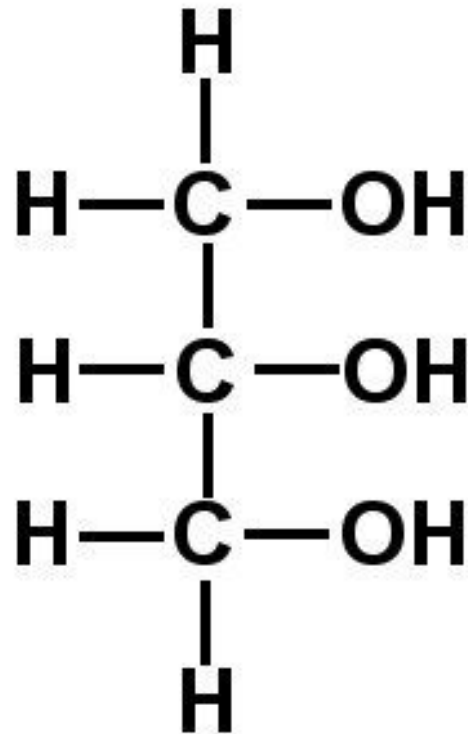
Pot fi **oxidati**:

- in vivo - **beta-oxidare**: au rol energetic direct fiind substraturi energetice pentru majoritatea tesuturilor
- in vitro - se formeaza compusi cu gust si miros neplacute (**rancezire**)

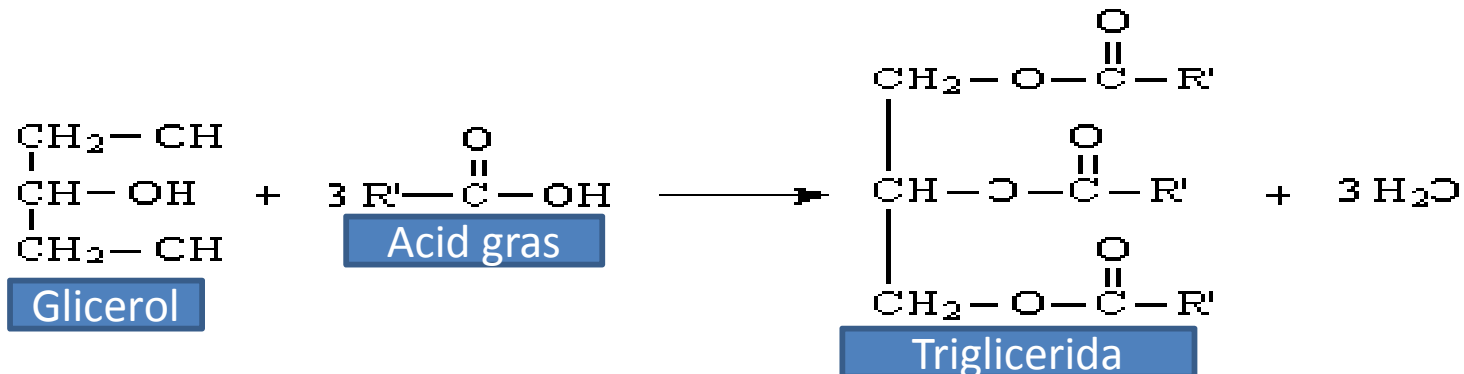
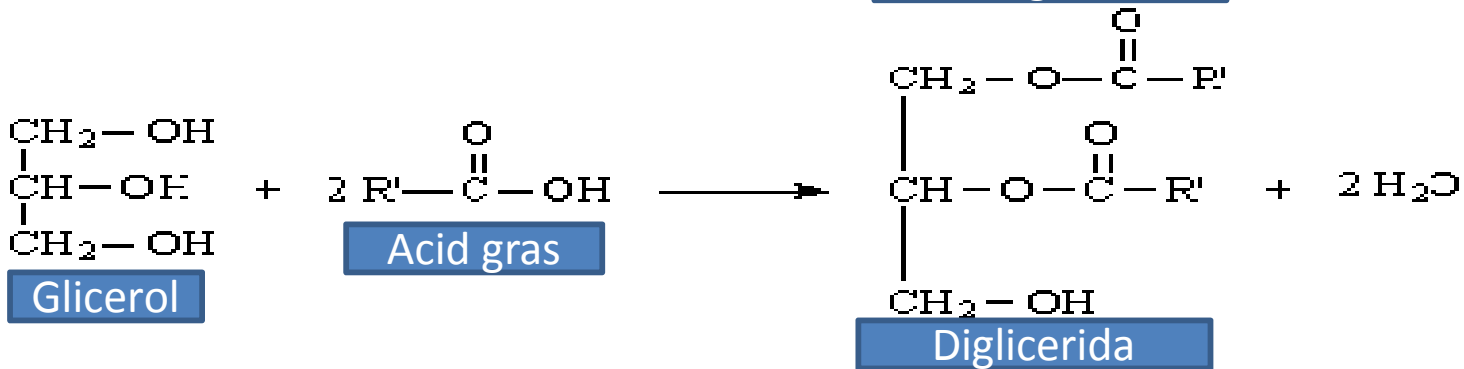
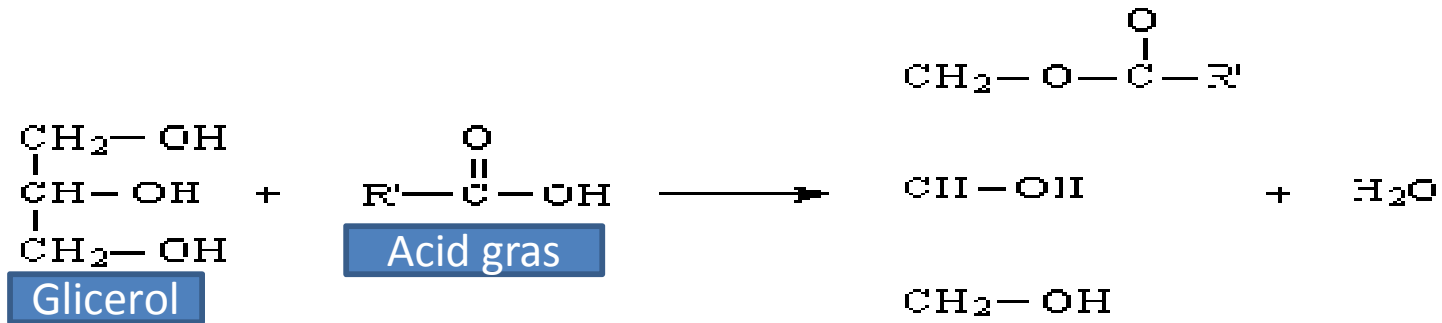
# Constituentii moleculelor lipidice

- Acizii grasi
- **Alcoolii**

# Glicerolul



# Glicerolul



# **Alti alcooli din structura lipidelor**

In structura glicerofosfolipidelor :

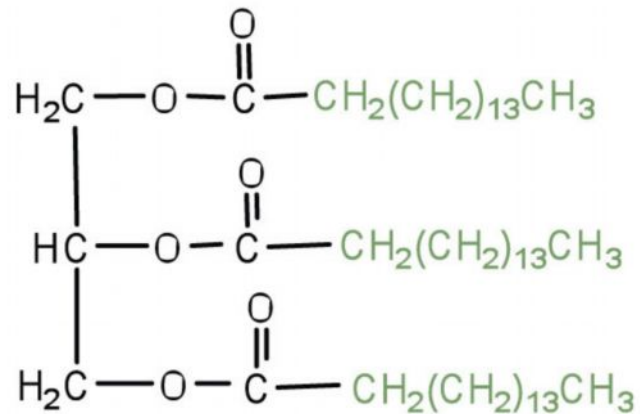
- aminoalcooli
- alcooli ciclici

# Trigliceridele (TGL)

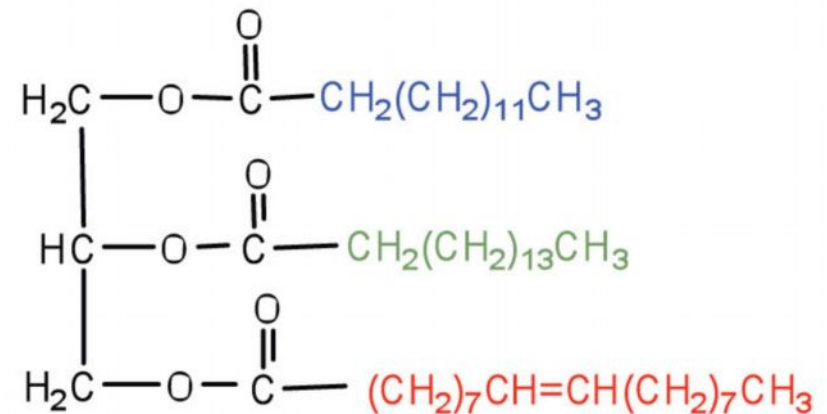
- sunt lipide simple: contin C, H, O
- sunt esteri ai glicerolului cu acizii grasi
- se mai numesc **triacilglicerolii (TAG)**
- sunt cele mai abundente lipide



# Trigliceridele



**Triglicerida simpla:**  
glicerol esterificat cu 3  
molecule de acid  
palmitic



**Triglicerida mixta:**  
glicerol esterificat cu acid miristic, acid  
palmitic si acid oleic

(majoritatea)

# Trigliceridele

- sunt compusi nepolari → **forma de depozit a lipidelor**
- sunt depozitate in tesut adipos (adipocite), mai abundent in stratul subcutanat

# Trigliceridele

- TGL din tesutul adipos → **rol de depozit energetic**: valoare energetica semnificativ mai mare decat cea a glucidelor
- **rol de protectie**: sunt izolatori mecanici si termici

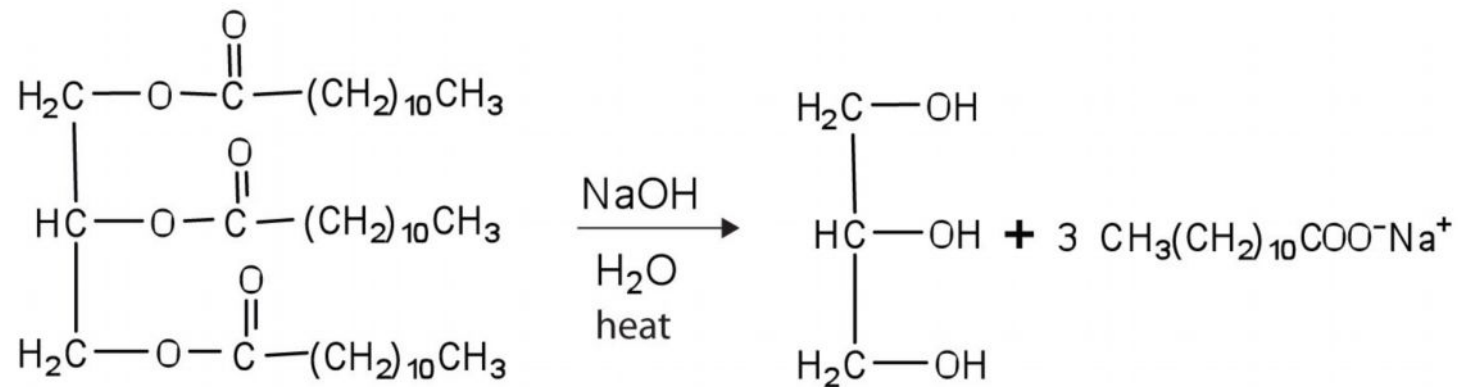
# Trigliceridele

Pot fi:

- de origine animala: **grasimi, unturi** (predomina acizii grasi saturati)
- de origine vegetala: **uleiuri** (predomina acizii grasi nesaturati)

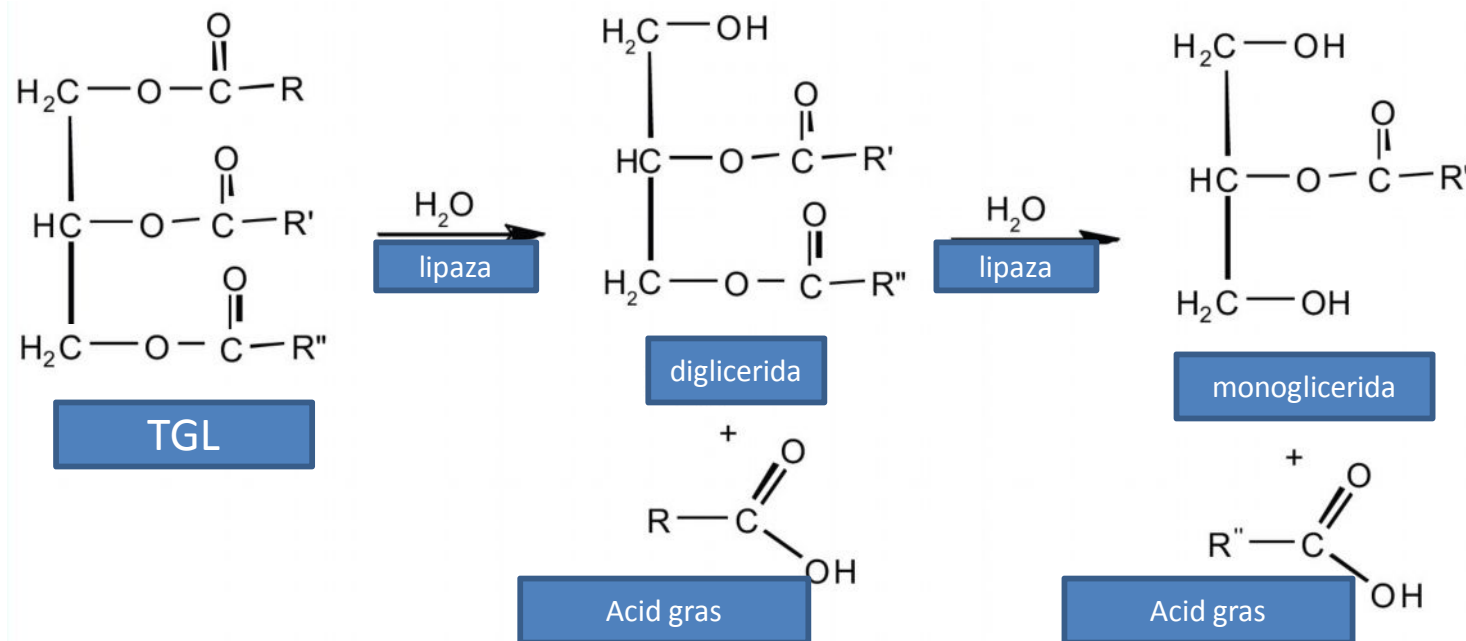
# Proprietatile trigliceridelor

- pot fi hidrolizate in prezenta bazelor (KOH, NaOH) → **sapunuri** (saponificare)



# Proprietatile trigliceridelor

- in organism: hidroliza enzimatica (**lipaza**), in trepte

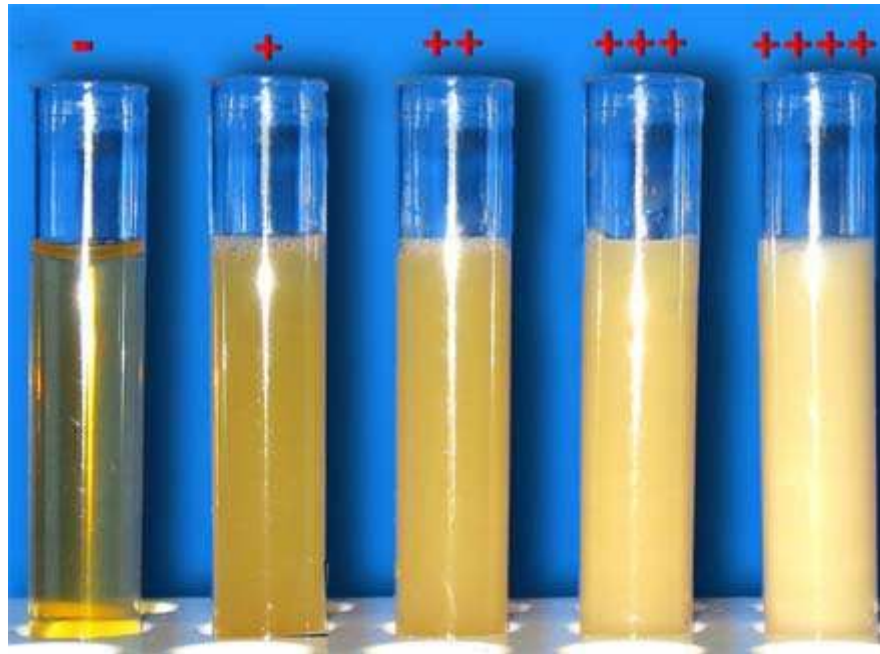


# Trigliceridele

- in sange: TGL + proteine + alte lipide  $\Rightarrow$  **lipoproteine**
- parametru de evaluare a metabolismului lipidic

# Trigliceridele

- concentratiile crescute ale TGL → modifica aspectul serului (ser opalescent → lactescent)



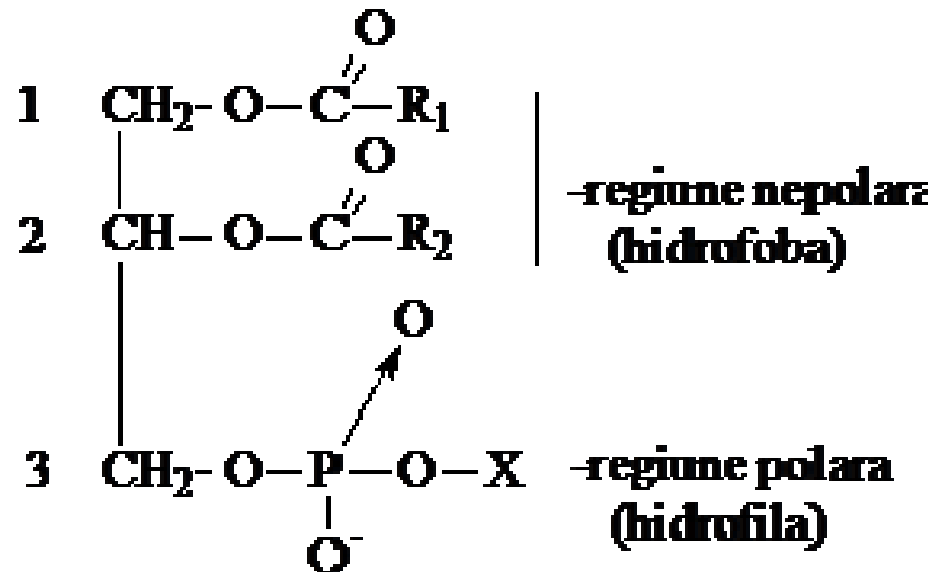


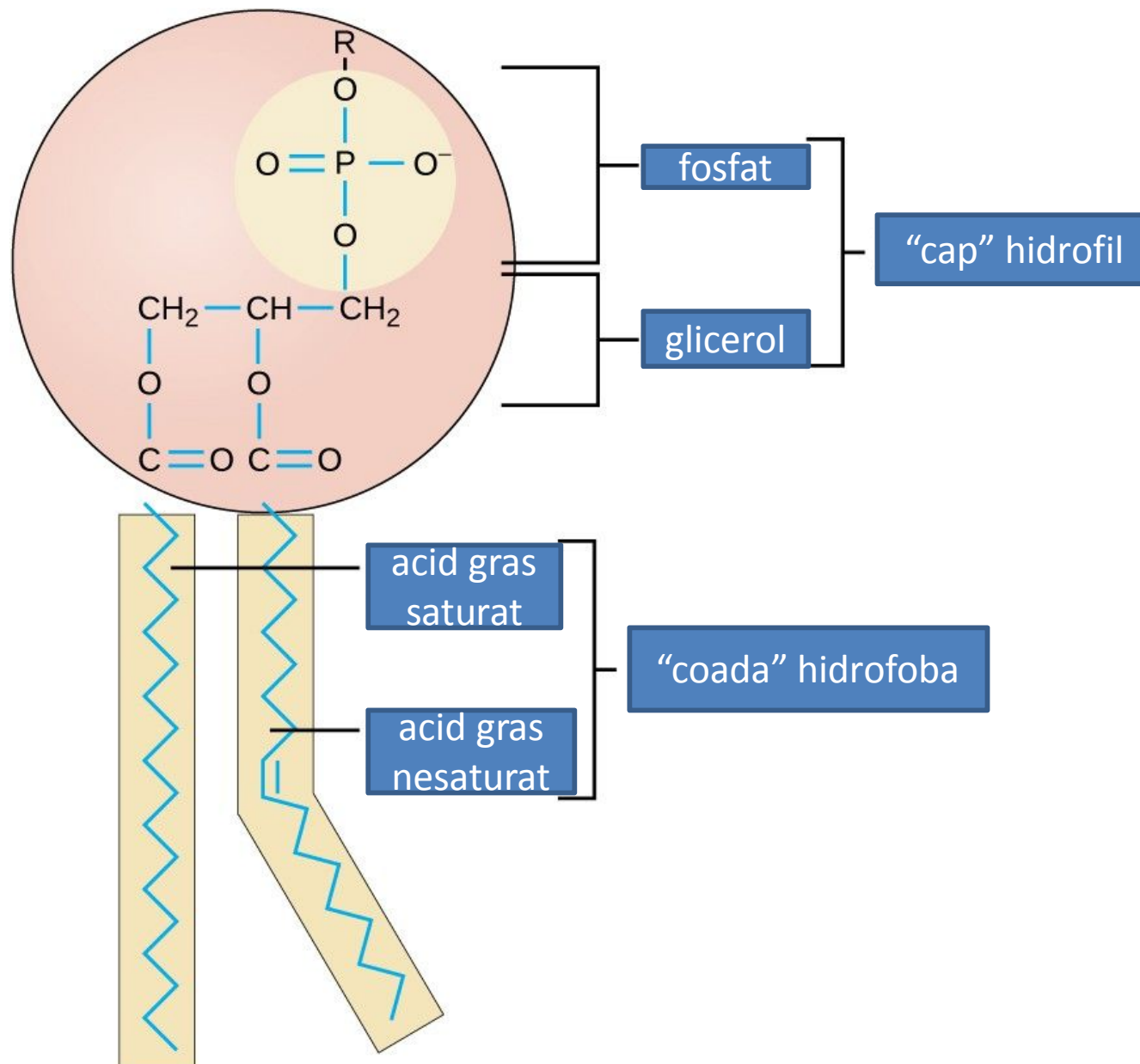
# Trigliceridele

- concentratiile crescute ale TGL:
  - **dislipidemii** primare si secundare (DZ, obezitate)
  - factor de risc pentru boala aterosclerotica

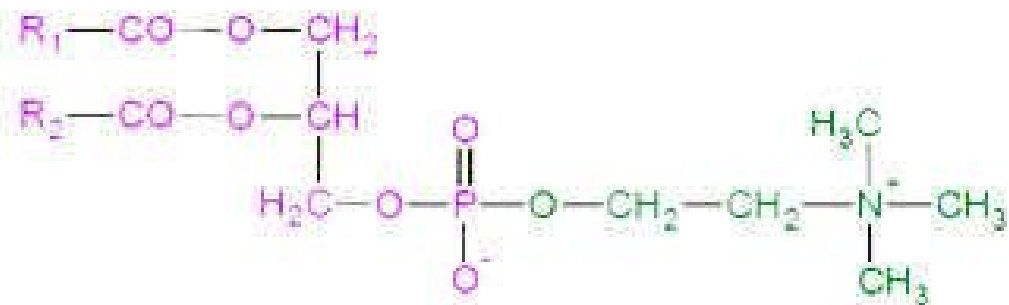
# Glicerofosfolipidele

- fosfolipidele (PL) sunt lipide complexe, derivate de la glicerol
- contin obligatoriu **fosfor**





# Lecitina (fosfatidilcolina)



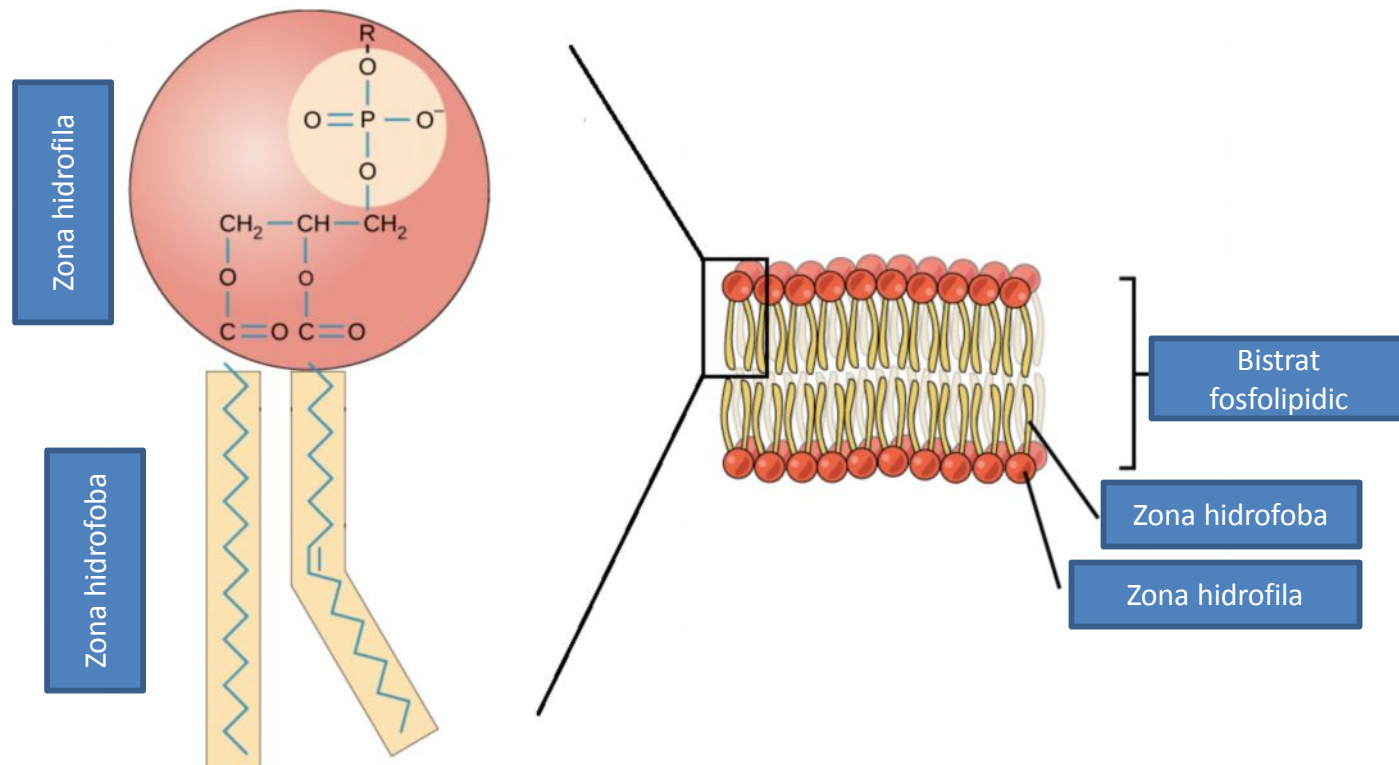
Fosfatidilcolina

# Glicerofosfolipidele

- mai abundente in tesutul cerebral
- in membranele celulare
- agenti de emulsionare (bila)
- rol in transportul lipidelor hidrofoabe

# Glicerofosfolipidele

- rol **structural**: cele mai abundente lipide membranare

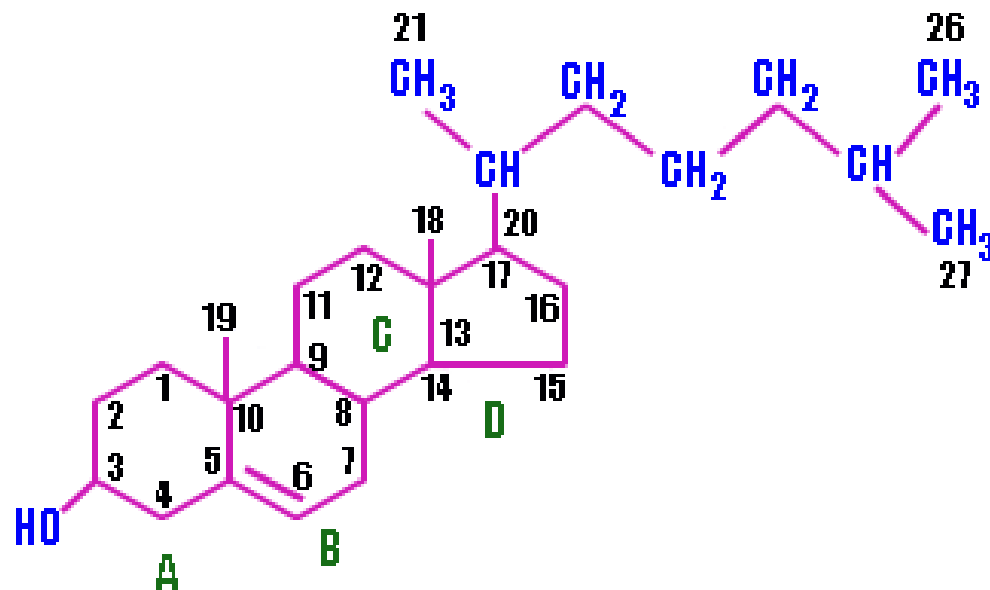


# Colesterolul

- este principalul sterol animal
- este prezent in toate celulele
- se gaseste sub forma libera si esterificat
- este mai abundent in tesutul nervos si in bila

# Colesterolul

- este o substanta solida, alba, cristalina
- are o structura ciclica cu 27 atomi de C





# Colesterolul

- provine din aport exogen si din sinteza endogena
- sinteza colesterolului: in toate tesuturile, mai intensa la nivel hepatic si glandele suprarenale

# Rolurile colesterolului

- intra in structura membranelor
- intra in structura lipoproteinelor plasmaticice
- este precursor al hormonilor steranici, acizilor biliari, vitaminei D3
- favorizeaza absorbtia lipidelor in intestin prin emulsionarea acestora

# Colesterolul

- in sange: colesterol + proteine + alte lipide = **lipoproteine**
- este un parametru de evaluare a metabolismului lipidic

# Colesterolul

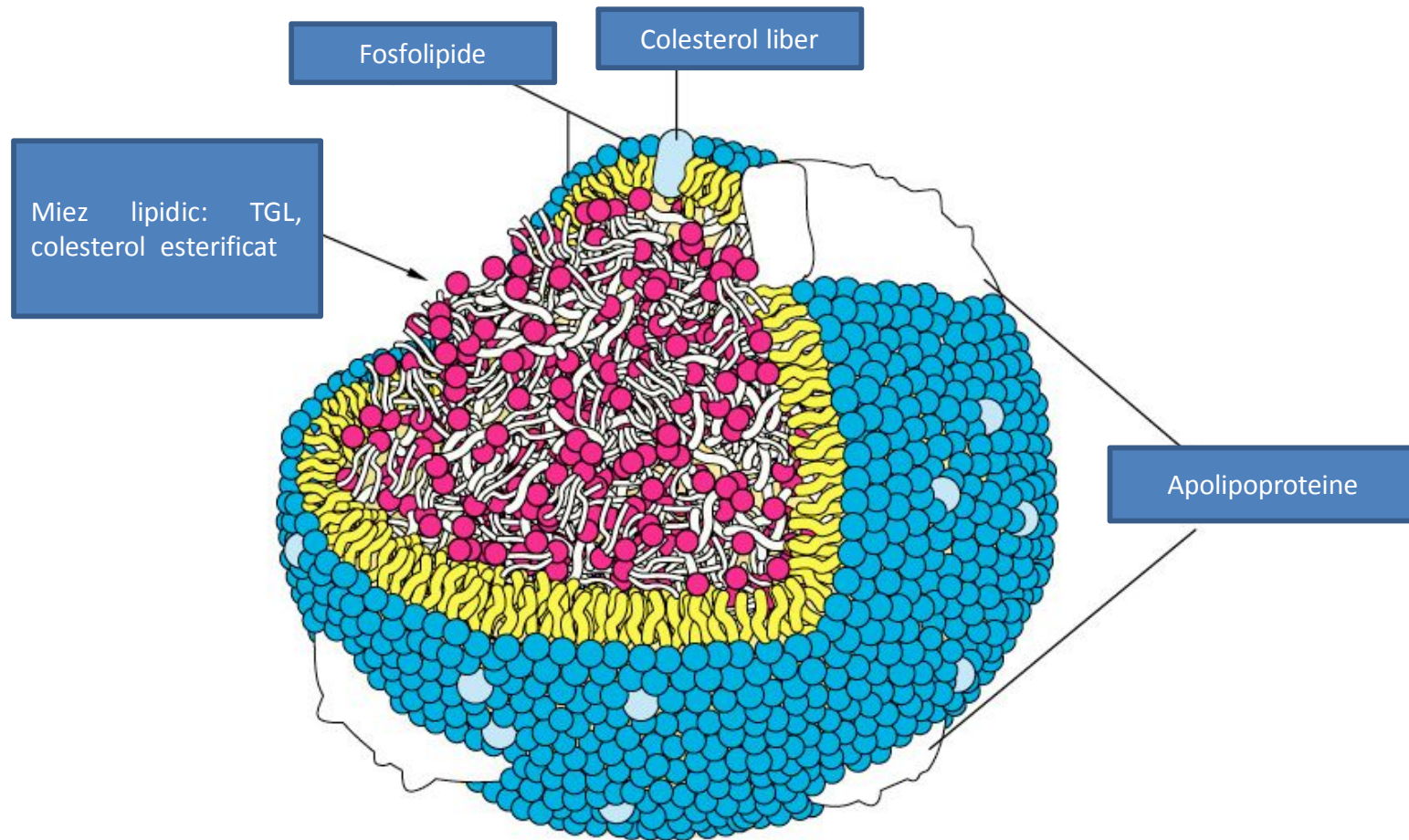
- concentratie  $\uparrow$  = **hipercolesterolemie**

→ **dislipidemii** primare si secundare

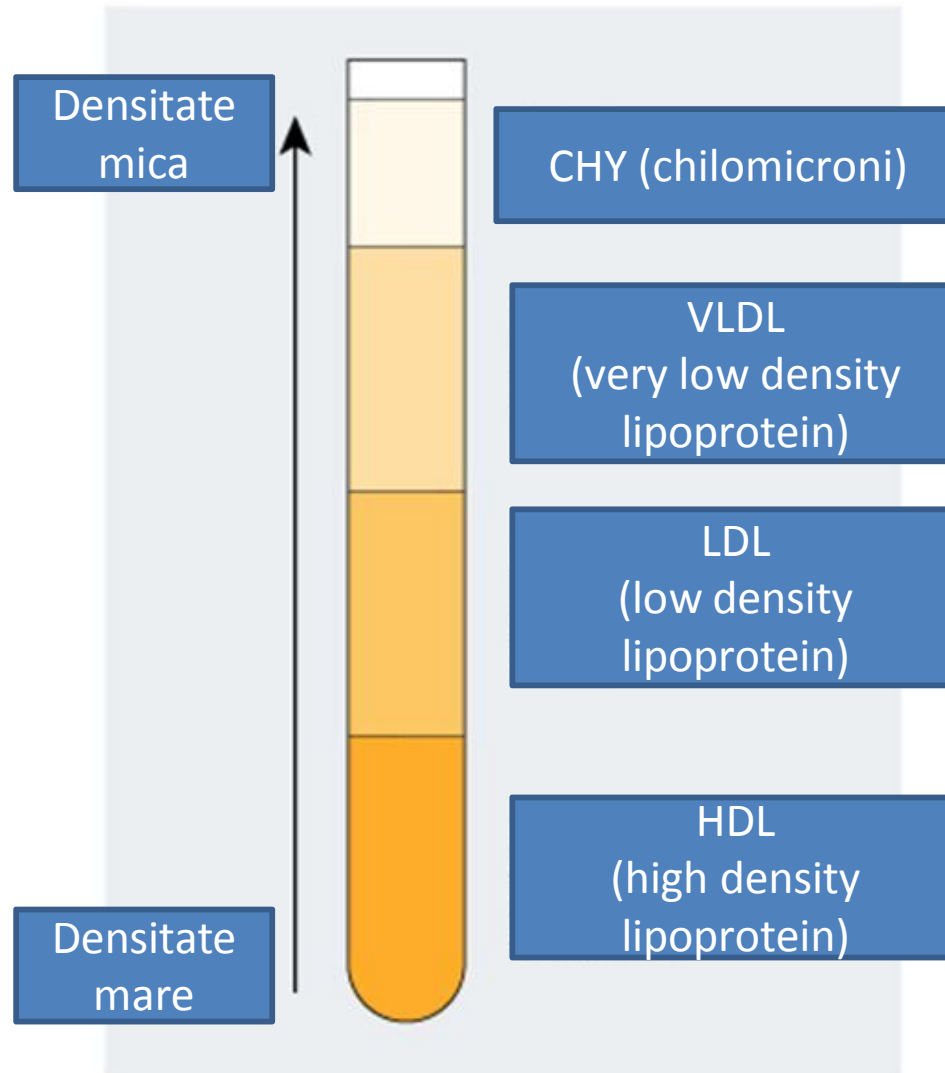
→ factor de risc crescut pentru boala coronariana

# Lipoproteinele

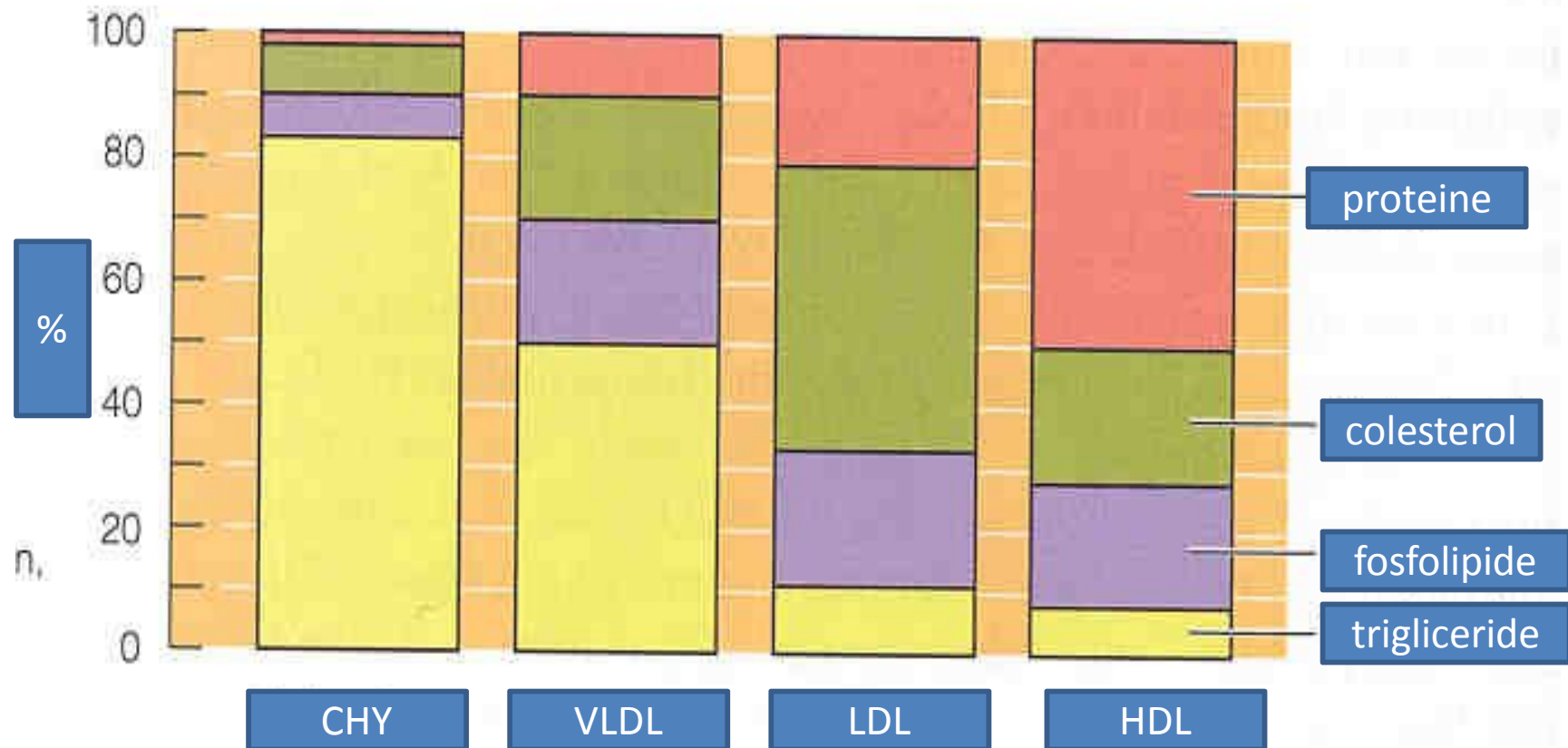
- sunt forma de transport a lipidelor in sange



# Separarea lipoproteinelor prin ultracentrifugare



# Compozitia lipoproteinelor



# Chilomicronii

- se formeaza in enterocite din lipidele exogene

Transporta **lipidele exogene** de la intestin catre tesuturi:

- **TGL catre majoritatea tesuturilor**
- PL si colesterolul catre ficat



# VLDL

- se formeaza in ficat din lipidele endogene
- transporta **trigliceridele endogene** catre tesuturi

# LDL

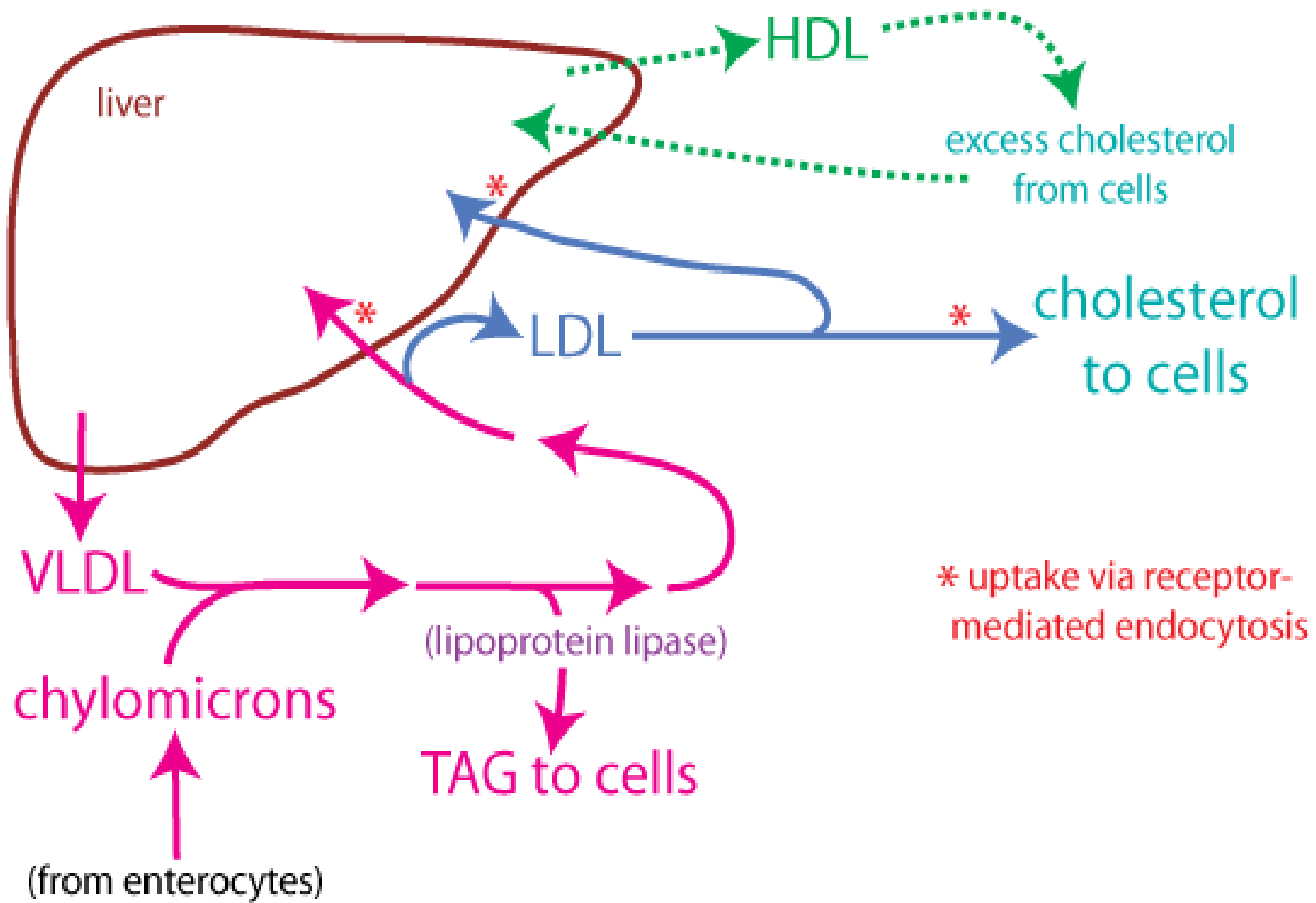
- se formeaza in ficat
- transporta colesterolul endogen de la ficat catre tesuturi



# HDL

- se formeaza in tesuturile periferice
- transporta colesterolul de la tesuturile periferice catre ficat





# Profil lipidic

- Colesterol total
  - Trigliceride
  - HDL-colesterol
  - LDL-colesterol
- sange venos recoltat a jeune



# Profil lipidic

- **Colesterol total** = se determina continutul de colesterol din toate fractiunile lipoproteice prezente in sange
- **Trigliceride** = se determina continutul de trigliceride din toate fractiunile lipoproteice prezente in sange

# Profil lipidic

## HDL – colesterol:

- continutul de colesterol din fractiunea HDL
- parametru de evaluare a metabolismului lipidic
- valori **crescute** → ↓ **riscul aterogen**

# Profil lipidic

## LDL – colesterol:

- continutul de colesterol din fractiunea LDL
- parametru de evaluare a metabolismului lipidic
- valori **crescute** → ↑ **riscul aterogen**



# Chestionar

In structura triacilglicerolilor se regasesc:

- A. glicocolul
- B. glicerolul
- C. acidul clorhidric
- D. acidul acetic
- E. acizi grasi

# Chestionar

Care dintre urmatoarele grupari functionale se gaseste in structura acizilor grasi tipici\*:

- A. carboxil
- B. cetona
- C. aldehida
- D. amino
- E. cianat

# Chestionar

In organism, colesterolul exercita urmatoarele roluri:

- A. intra in structura membranelor celulare sub forma de dublu strat lipidic
- B. intra in structura lipoproteinelor plasmatice doar sub forma esterificata
- C. este precursor al hormonilor steranici
- D. este precursor al acizilor biliari
- E. este precursor al vitaminei D3