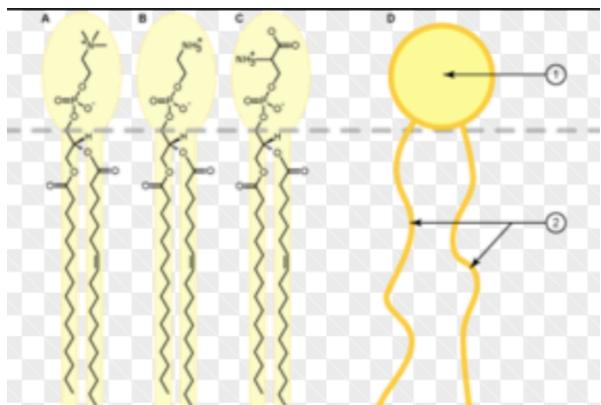


# UE I - AG, LP, Glucide

Fiche de cours n°15  
Pr Broly



D-allose	D-allose	D-glucose	D-fructose	D-galactose	D-glucosamine	D-galactosamine	D-glucuronic acid
<chem>O=C[C@H]1O[C@H](CO)[C@@H](O)[C@H](O)[C@H](O)[C@H]1O</chem>							
<chem>OC[C@H]1O[C@H](CO)[C@@H](O)[C@H](O)[C@H](O)[C@H]1O</chem>							
<chem>OC[C@H]1O[C@H](CO)[C@@H](O)[C@H](O)[C@H](O)[C@H]1O</chem>							
<chem>OC[C@H]1O[C@H](CO)[C@@H](O)[C@H](O)[C@H](O)[C@H]1O</chem>							
D-allose	D-allose	D-glucose	D-fructose	D-galactose	D-glucosamine	D-galactosamine	D-glucuronic acid

J. Segard (2005)

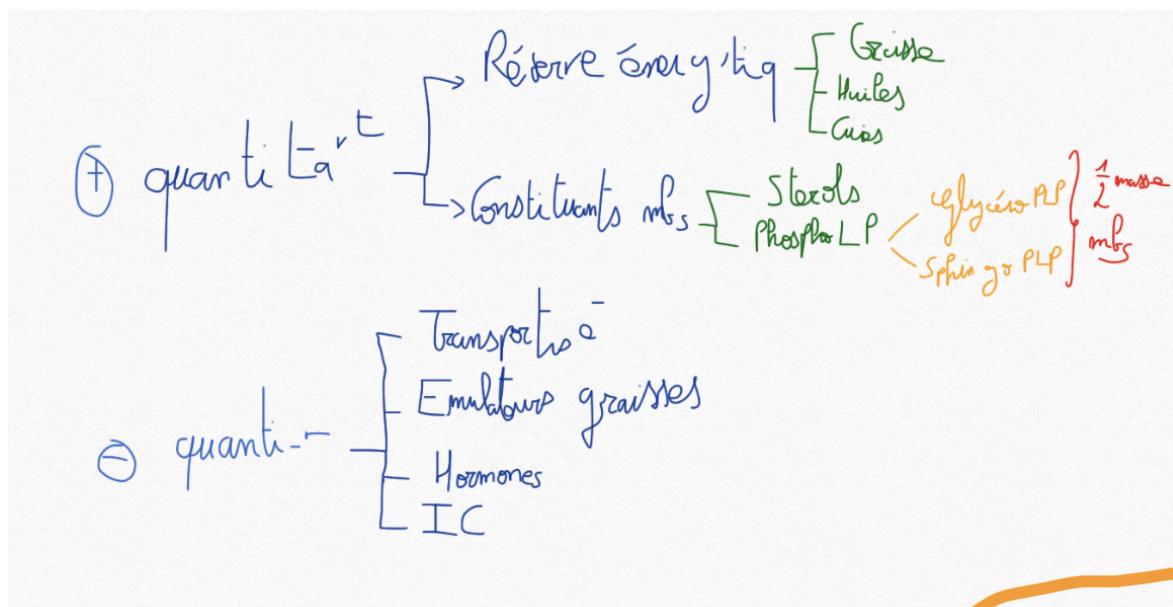
# LP

## Glucides

### Prot

#### LP

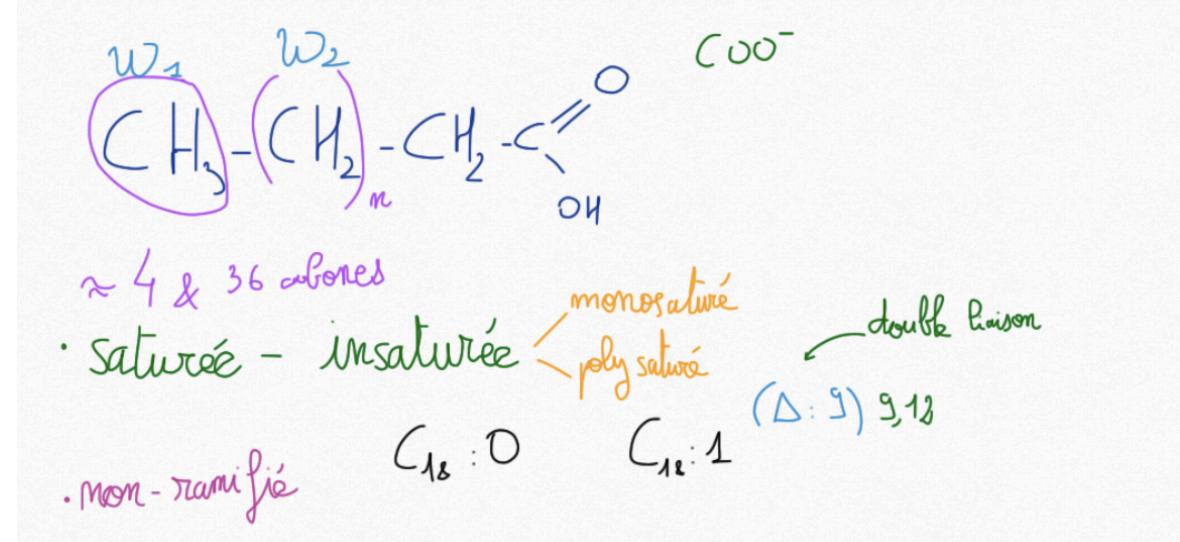
- grand groupe structure
- carac chimique diverse; **insolubilité ds eau**,
- Ppté biologique diverse; + quantitativement  
- quantitativement



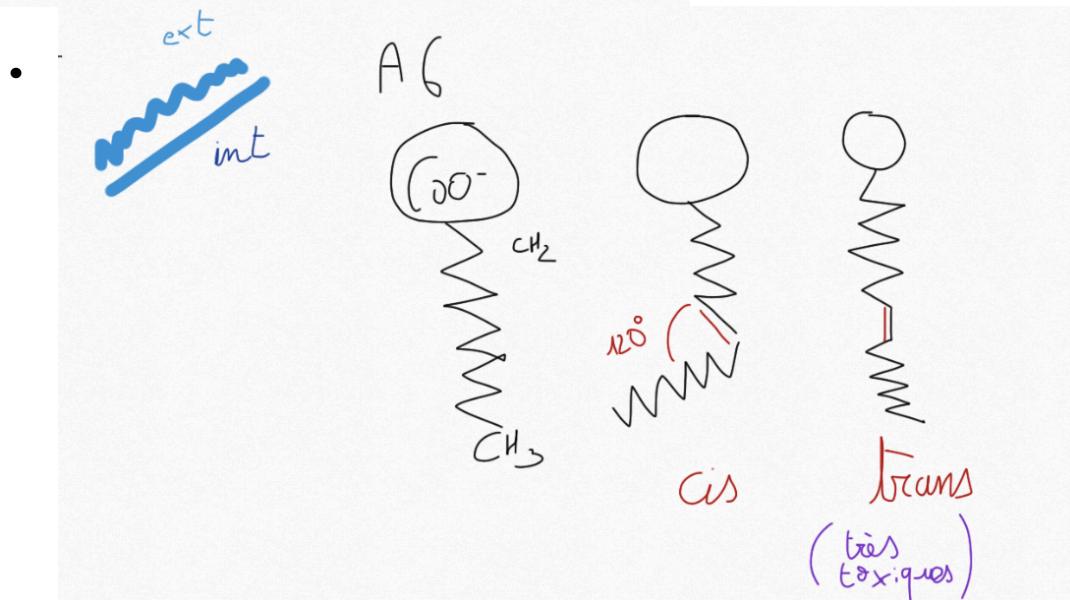
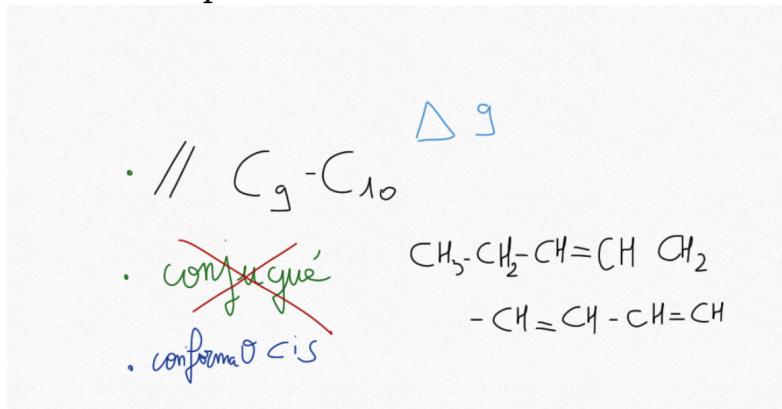
#### GRAISSE

- Dérivés acide gras : AG
- Dérivés hydrocarbures. : réduit + + + : niveau oxydation faible

- structure



- chez homme : 12-24 Carbones pour AG
- Nbr pair



- chez homme : AG CIS

- Solubilité : très faible

*Ex: si Acide Laurique, si dissout ds eau : 0,063 mg/g d'eau  
 Glucose 1100 mg/g d'eau*

Diminue avec nb carbone ds chaînes AG  
 Diminue avec nbr de double liaison

- Point de fusion : Diminue lors nbr double liaison augmente

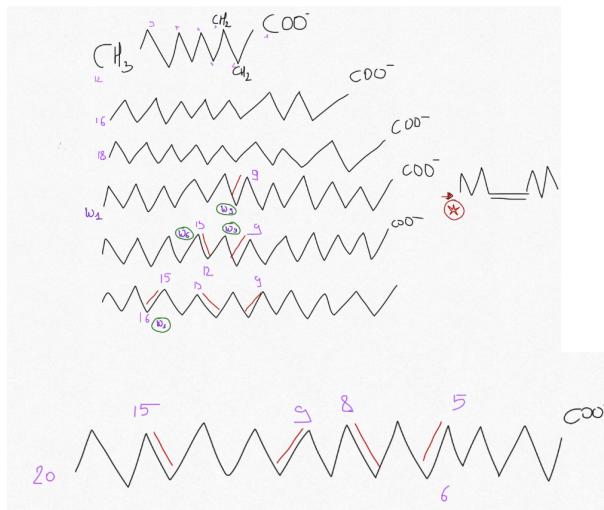
Ex : 12-24 C : 25° Cire

Insaturée 12-24 C : huileuse

L.P.S.G.L.L.A

Diminue quand nbr C diminue

- Acide Laurique  $C_{12}$  : 0 : saturé
- Acide palmitique  $C_{16}$  : 0
- Acide stéarique  $C_{18}$  : 0
- Oléique  $C_{18}$  :  $1^{\Delta 9}$  :  $\omega^9$
- Lunoléique  $C_{18}$  :  $2^{\Delta 9,12}$  :  $\omega^6$
- Lunolérique  $C_{18}$  :  $3^{\Delta 9,12,15}$  :  $\omega^3$
- Arachidonéique  $C_{18}$  :  $4^{\Delta 5,8,11,14}$  :  $\omega^6$



→  $\Delta^9$  desaturase : met double liaison AG en position 9

→ elongase : allonge AG vers extr carboxylique : COO<sup>-</sup>

→ desaturase : double liaison à partir COOH

- de acide oléique à arachidonéique : synthèse à partir AG
- Autres AG : AG essentielles indispensables qu'on doit tirer alimentation

- absorber 1g/kg lipides par jour
- 75kg 75g LPs
- AG néfaste : trans : hydrogénéation industrielle ⇒ pathologies cardiovasculaires

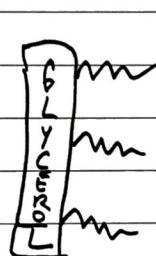
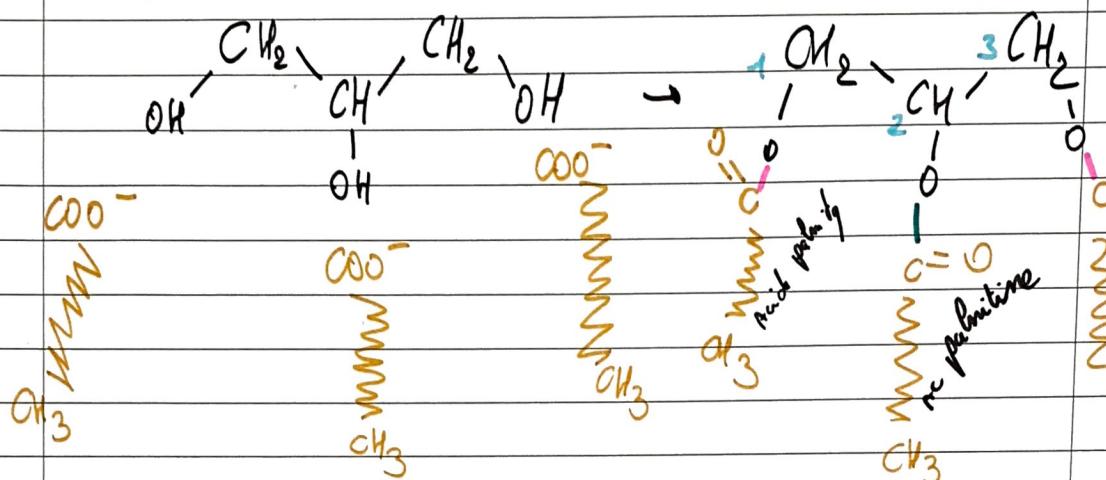
aïs-g<sub>h</sub>  
• Triglycérides : AG : hydrocarbures.

• **Triglycérol** = Triglycérides = graisses neutres = TAG.

Glycérol : 3 C.

Paste I<sup>r</sup>

II<sup>r</sup>



Simple : m 3 AG : **Tristéarine**  
**Tri palmitine**

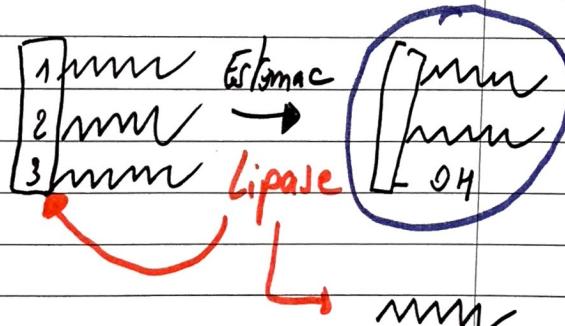
→ Mixte :  
(+ fréquent) **1, 2 Dipalmityl 3 Stearyl gly**

TAG

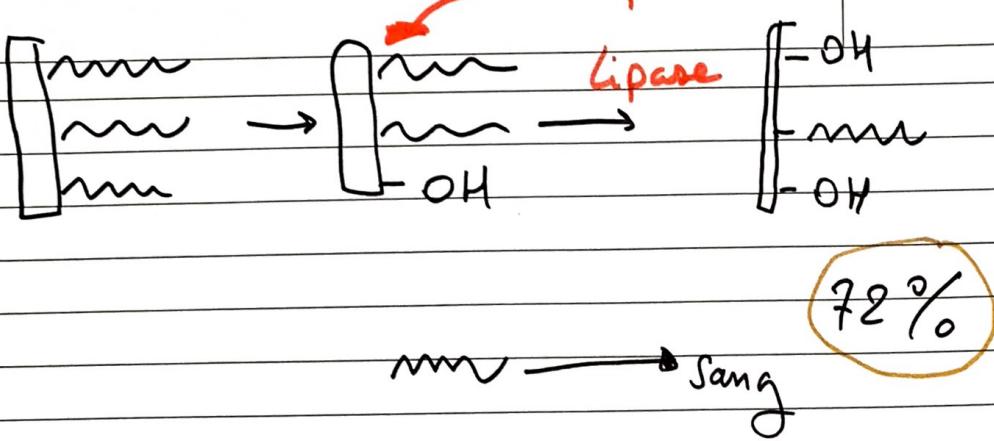
↳ anhydride

- TAG : ➤ part<sup>t</sup> patient → 90% TAG
- graisse animale → cholestérol (like V esq<sup>u</sup>)
- huile végétale → LP<sub>s</sub>-ceramides

(LP<sub>s</sub>) → 90% TAG



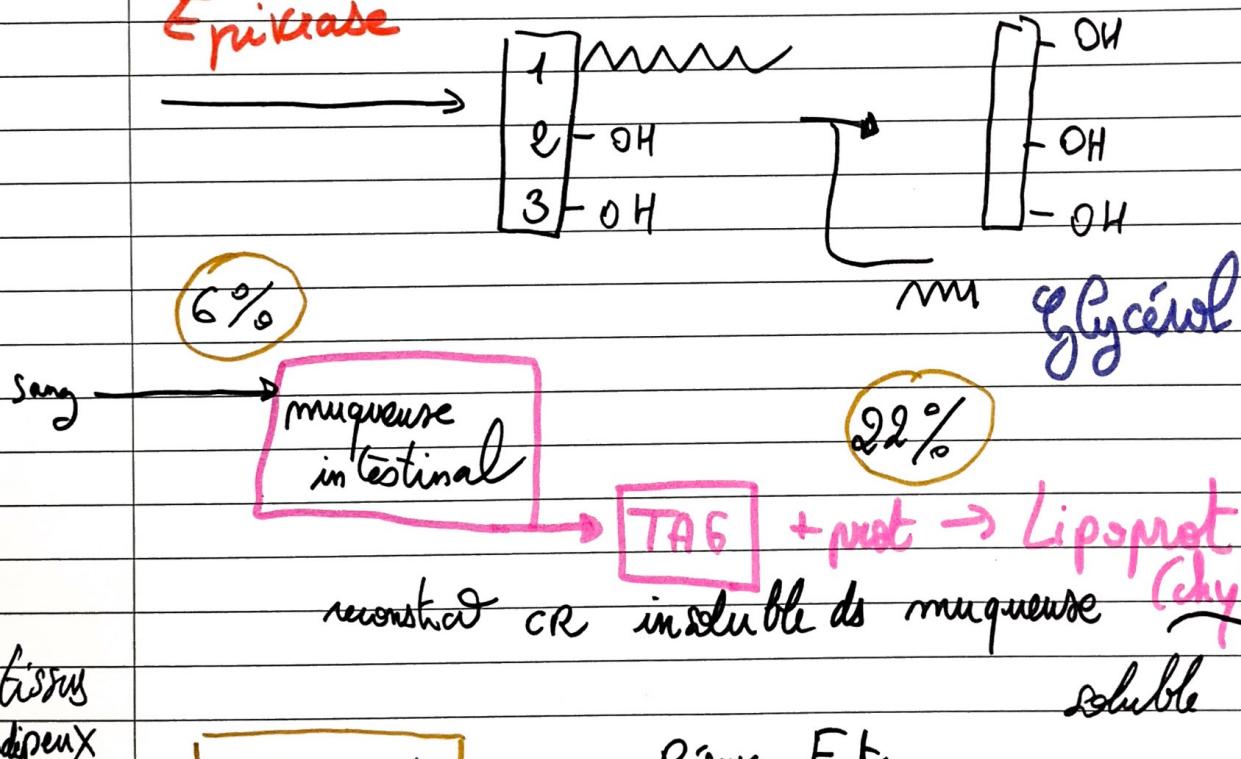
Di-acylglycérol.



Diacylglycérol

1monacylglycérol

Erythrocyte



tissus adipex

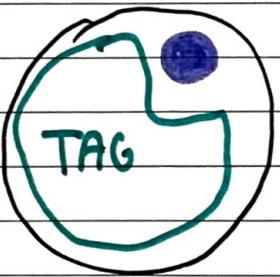
- Adipoctes BLANCS

$\rightarrow$  TAG  $\rightarrow$  Réserves Egtg  
 $\rightarrow$  Rete méca.  
 $\rightarrow$  Rete thermiq.

- Adipoctes BRUNS

$\rightarrow$  TAG  $\rightarrow$  Thermo régula

REL  
MDies  
RER



100-200 µm

## ADIPOCYTES BLANCS

↳ 10-15% du corps

- isolé - T. glf : conjonctif
- m<sup>el</sup> osseux



- stocké
- sous-cutané : ▷ Fœtus
- ▷ f : bras, <sup>00</sup> pectoral
- ▷ c : mag, p abdomen

▷ fond orbite  
▷ paume, plante pied

- Profond :

Pleine forme

Emphasee forme

Adipocytes

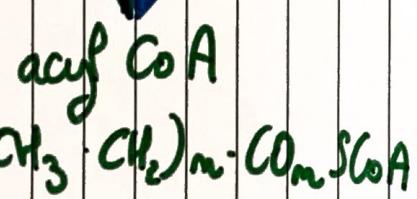
Sang

Autre tissus

GP  
Glycolyse



Lipogénèse



- Fasting
- Jeune
- ΔB·t·q
- Effet moche

Glycose 6 P

Glycérol 3 P

Glycose

Chylomicron

TAG

VL DL

insuline

Acide  
Palmitique  
 $\text{C}_{16}:0$

97% d/J

Lipoprotéine lipase

LPL

- Glycagone
  - Catecholamine
- hormones

Lipase  
Hormone  
Sensible

TAG

AGL

Glycérol

Glycérol

AGL

AGL

④

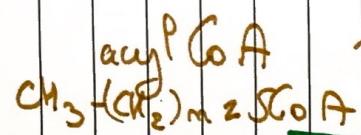
(P) : Phosphate

Autres tissus

129 ATP

51,6 kJ

CPT  
Carnitine  
Palmitoyl  
Transférase



AcylCoA  
Synthétase

AGL

(5)

syst phosphorylante

M D i e s

$\beta$ -oxydation



NADH<sub>2</sub>

$2e^-$



1



2



3



4



5



ME



ATP synthase

$$\frac{5681 \text{ kJ}}{x = 68 \%}$$

acetyl CoA



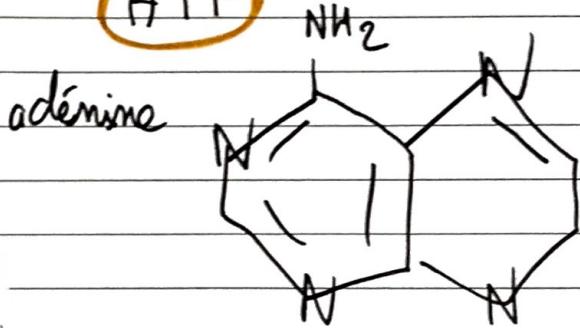
- 1: NADH dehydrogénase
- 2: ubiquinone oxydase
- 3: cytochrome C oxydase



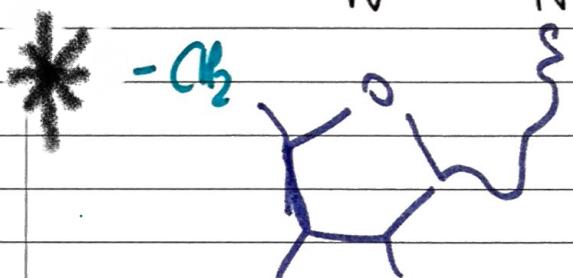
ATP

Synthase

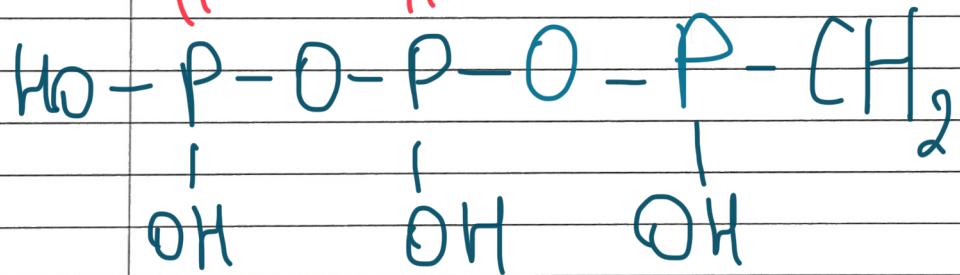
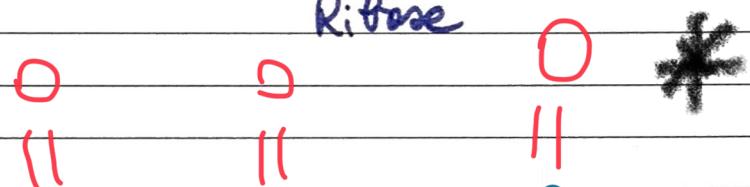
ATP



ATP → 51,6 kJ



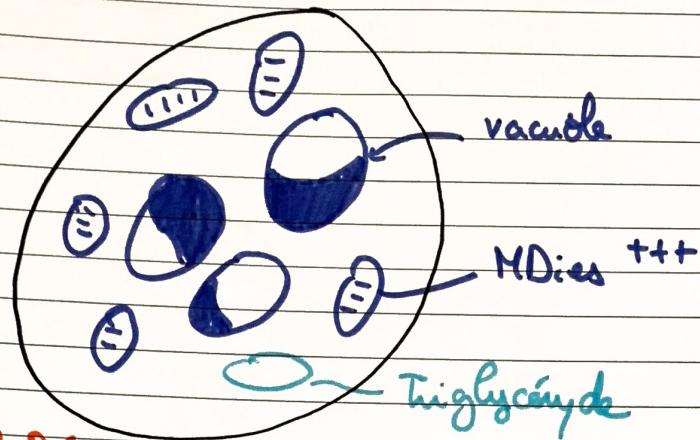
Ribose



UE1. R. Brétry

$\text{SIP} \rightarrow E(\text{t})$   
 $\text{mt} (\text{t})$   
 $\text{BIP}$

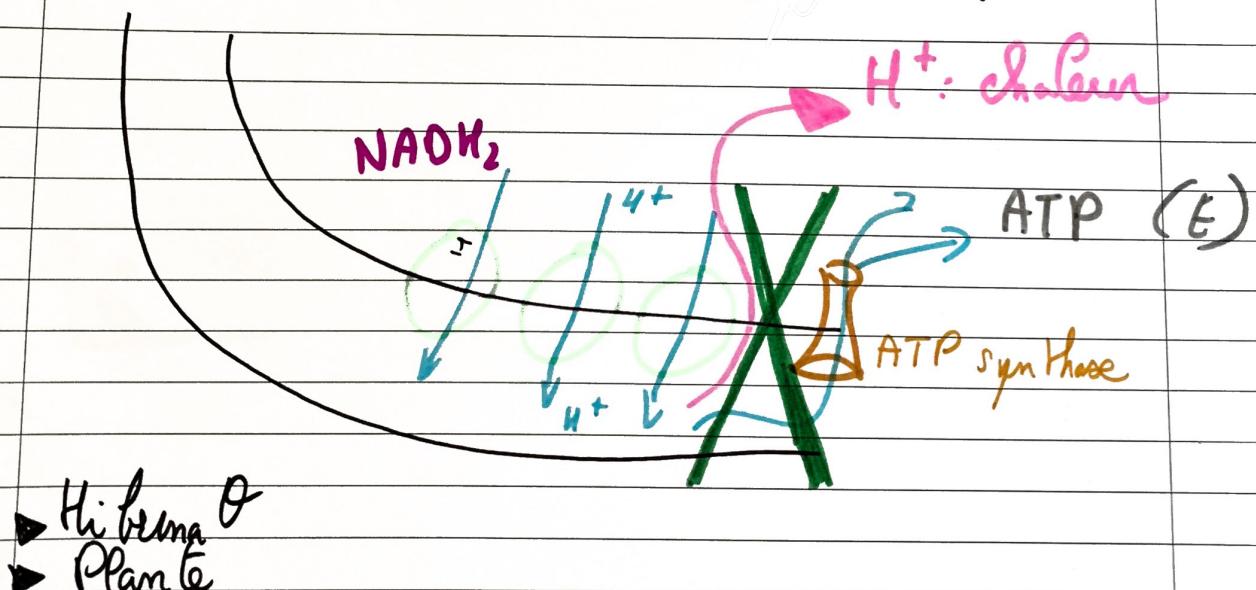
Tissus adipeux BRUNS



• 4% corps

- mrd mé : zone inter scapulaire  
 : contour râveux  
 : rein  $\Rightarrow f^{\rho\theta}$  thermo

↳ mica - décapage phosphoryl $\theta$  oxidative



①

• Triglycérolide hydro → réduire

Prot	4 Kcal
Glycogène	1 Kcal
TAG	9 Kcal

8,25 × E

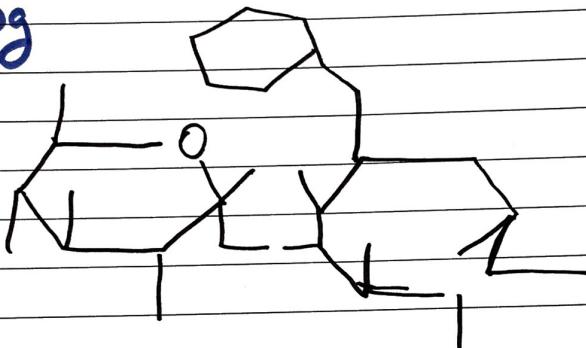
en...

► Amphyche (250 kJ de)

x 3

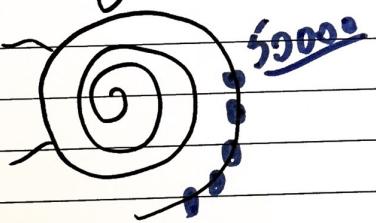
6,75 × E / gr glyc

$$\begin{matrix} 1 \text{ g } \text{gl} & \times c \\ 2 \text{ g } \text{glyc} & \end{matrix} \Rightarrow 3 \text{ g}$$



50 000

Polymerne glucose



foie 1,8 kg 70 g glyc  
muscle 35 kg 270 g glucose  
... 10 g

350 g glycogène

→ glycogène : source rapide E

► TAG : 70 kg 100 000 Kcal  $\Rightarrow 70 \times 6,75 = 675 \text{ kg}$

► Prot : 25 000 Kcal

► Glycogène 600 Kcal

► Glucose 40 Kcal

575 kg

nsθ TAG oui  
9 glycogène

• Glycogène : sine rapide E

1 jour

• TAG : + lent

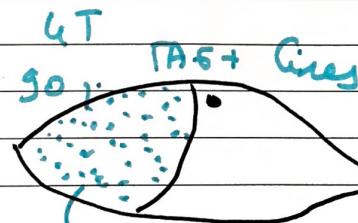
1 mois

9

.....

f

- TAG :
  - Thermoprotect
  - Méca
- Esthétiques



organes spermaceti

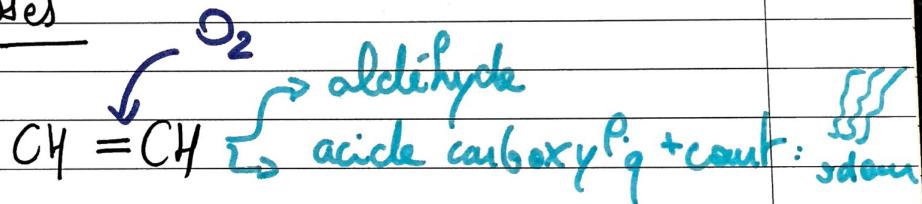
densité

goutte

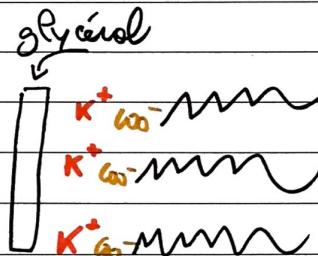
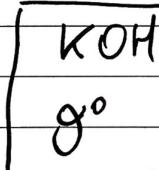
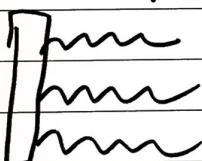
liquide 37 °C  
≤ 31 °C

crystallisé

### Rendement graisses



### Saponification graisses



sel potassique acide gras

• Cires

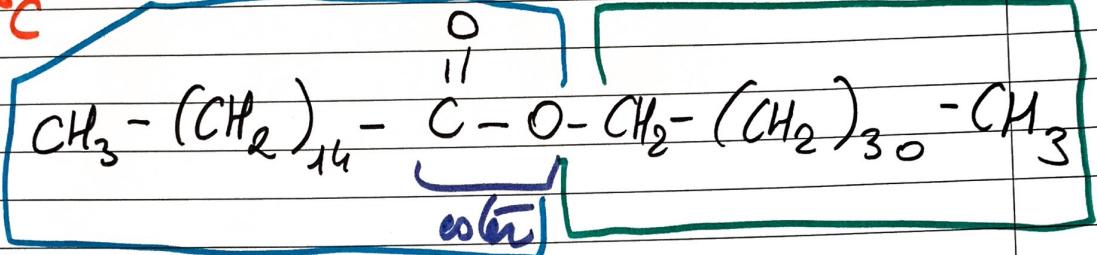
Cire

A6  
longue chaîne  
Ester  
14 - 36°C

Alcool  
longue chaîne  
16 - 30°C

P<sup>+</sup> fusion

100°C



A6 : acide palmitique

triacétanol

⇒ triacétanyl palmitate : cire abeille

- réserve E
- assouplissant → Lamoline
- imperméabilisant
- déshydratant / parasite (Rhodo, fourmis)

→ 10g / kg / j max LP.

ch. huile  
monoinsaturée  
polyinsaturée

• film de graisses : gr. stéarine / myristate → A6 huile  
• gr. stéarine / stéarines (acide laurique)

• gr. stéarine : huile olive

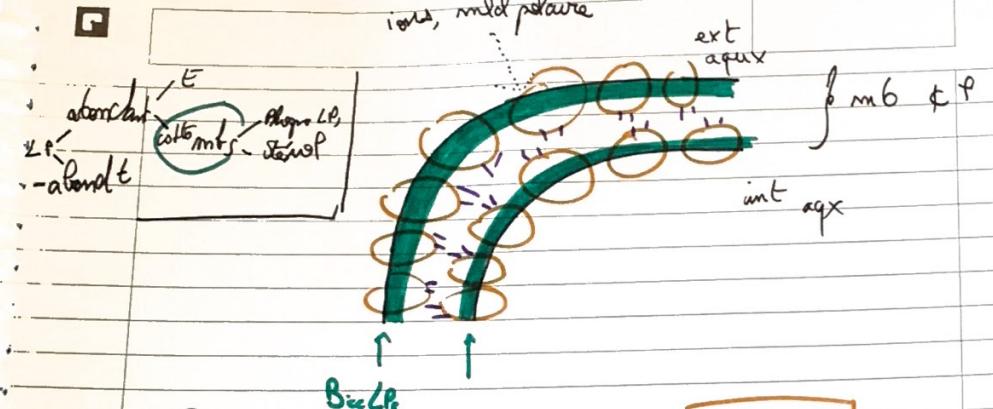
• huile gr. stéarine, A6 stearine  $\frac{w_6}{w_3}$  &  $\frac{w_6}{w_2}$  ratio

$$\frac{w_6}{w_3} = 20 \text{ abs q. l. fwt d+ q rapport 4}$$

→  $w_6$  (tournesol)

↑ la  $w_3$  : sucre r. g. le lait (poisson / saumure) ou huile

$$\text{huile olive } \frac{w_6}{w_3} = 2,5$$



- (LP)  $\rightarrow$  amphiphiles
- $\rightarrow$  amphiphathing

- $\blacktriangleright$  Glycosphingolipides
- $\blacktriangleright$  Sphingolipides
- $\blacktriangleright$  Stérols

### Partie hydrophobe

- Glycerol
- 2AG

• Amine longue chaîne  
= sphingosine

### Partie hydrophile

X ou H

X ou H

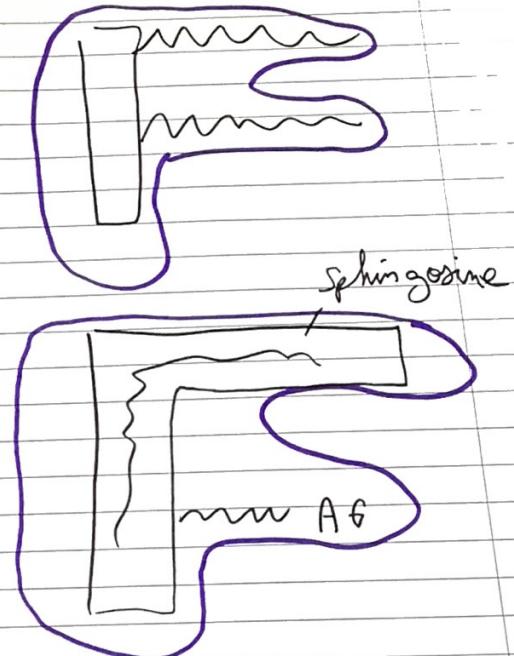
X ou P

ou noix hydrocarbonés  
fusionnés

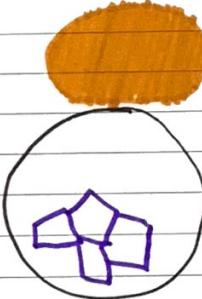
Stérols

(5)

Glycérin

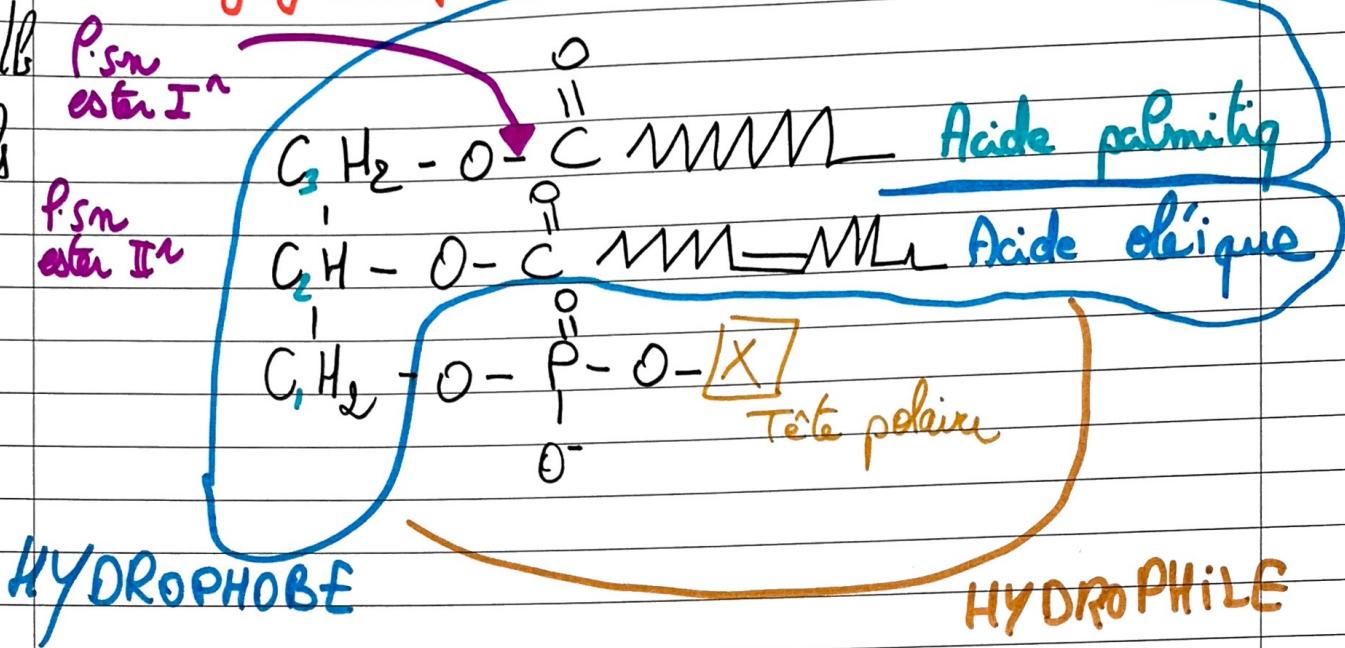


Sphing



Glycophospholipids  
Sphingolipids  
Sterols

## Glycérophospholipides

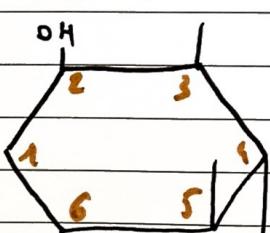


► H : acide phosphatidique  
 ► choline :  $\text{CH}_2 - \text{CH}_2 - \text{N}^+ \left( \begin{matrix} \text{CH}_3 \\ | \\ \text{CH}_3 \end{matrix} \right)$  Phosphatidylcholine

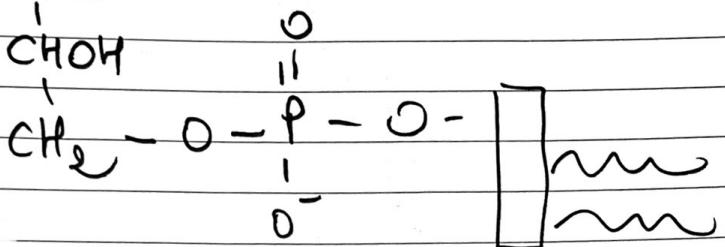
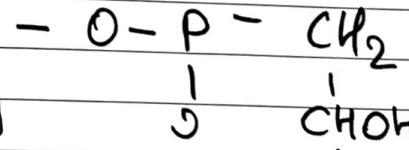
► Sérum :  $\text{CH}_2 - \text{CH}_2 - \text{NH}_3^+$  Phosphatidylserine

► éthanolamine :  $\text{CH}_2 - \underset{\text{COO}^-}{\text{CH}} - \text{NH}_3^+$  Phosphatidylethanolamine

► glycérol :  $\text{CH}_2 - \underset{\text{CH}_2\text{OH}}{\underset{|}{\text{CH}}} \text{OH}$  Phosphatidylglycerol

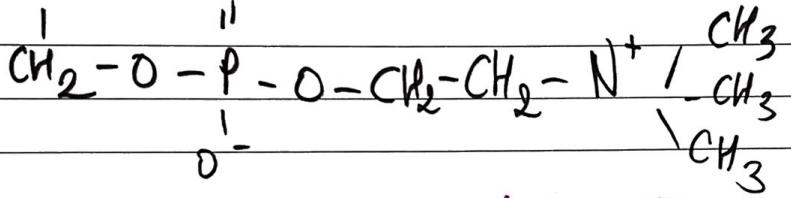
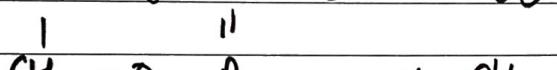
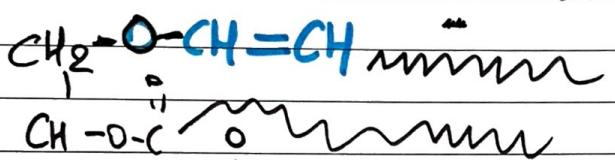
► inositol :  Phosphatidylinositol

► Phosphatidylglycerol



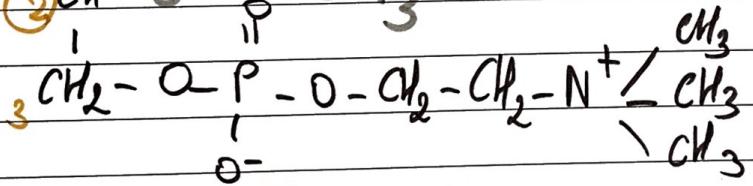
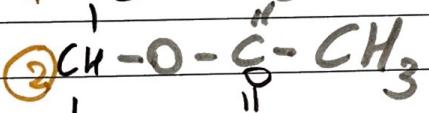
## LPs éthers :

► **Plasmalogènes** : -  $\downarrow$  cardiaques  $\frac{1}{2}$  phospho LPs



► **PAF : Platelet Activation Factor (Hormone)**

Saturée



Acide acétiq

PAF  
lymphophile

Op des sanguine

sétonine

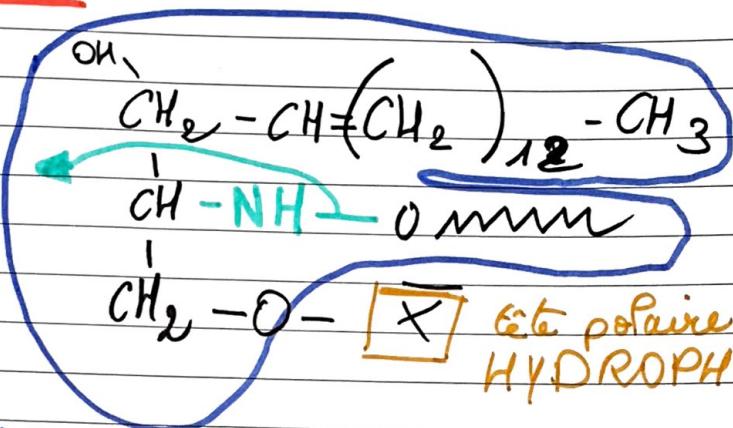
②

# SphingoLIPs

amines à glycocomplexes

Liaison amide

C16n<sub>22</sub> : saturé

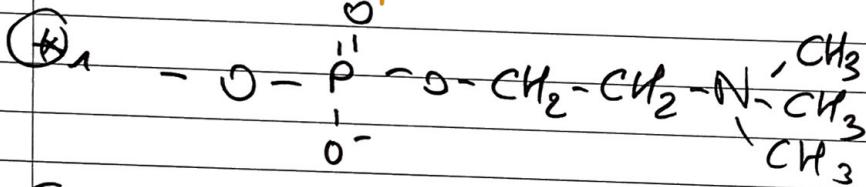


HYDROPHOBIC

•  : ▶ H : Céramide.

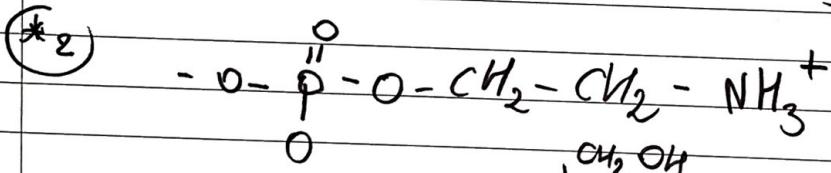
▶ Phosphocholine  
Phosphoéthanolamine

\*<sub>1</sub> →  
\*<sub>2</sub> ↗ Sphingomyeline



m6 f5

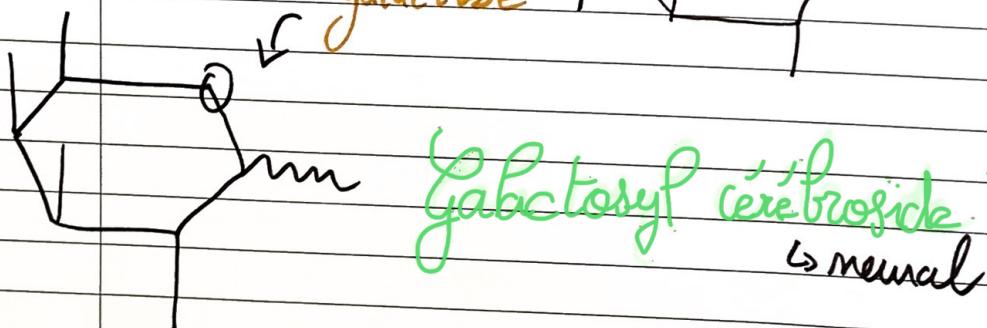
gaine de myéline



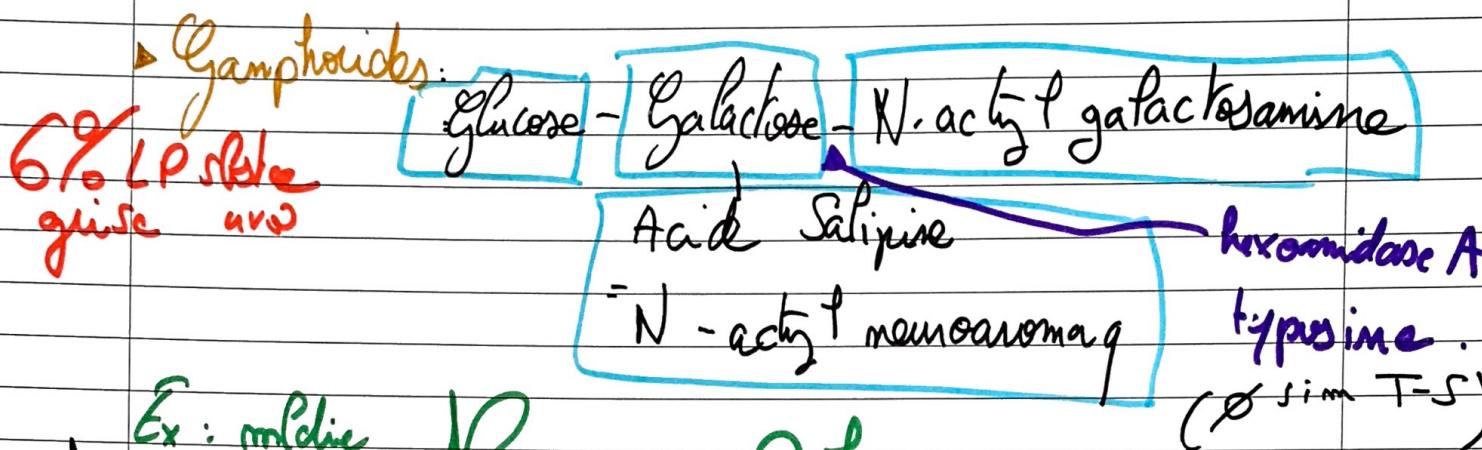
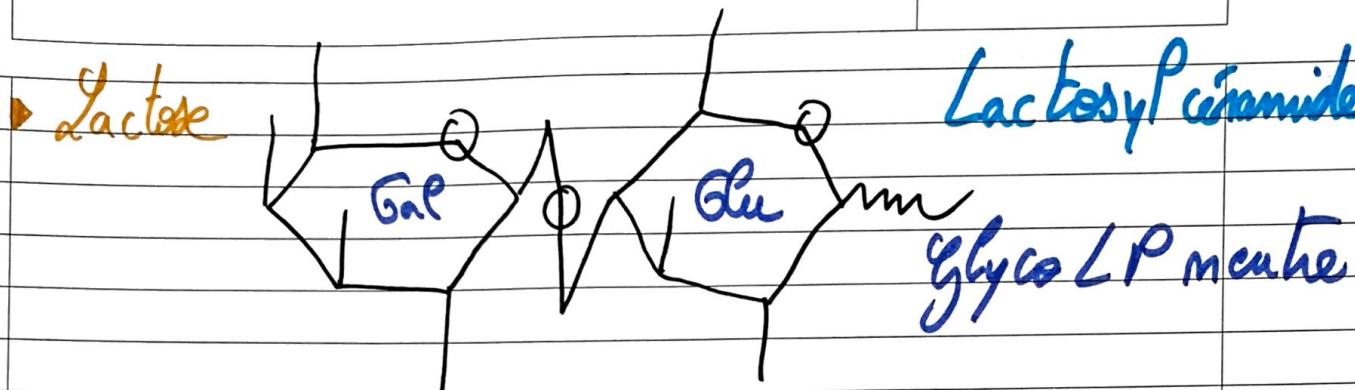
axone.



Glycosyl cérebroside  
↳ mon-neurale



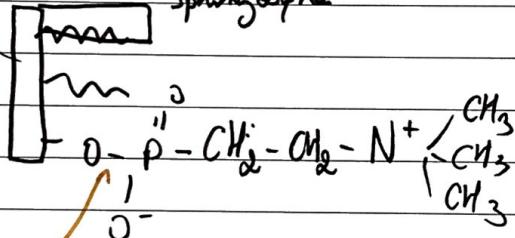
GlycoLP  
menthe



Ex: mPdie

## Niemann-Pick

Pathologie due  
au sphingomylyse



Sphingomylinase

→ Accumulation des : 

- Cerveau
- Foie
- Rate

 ⇒ Retard mental ⇒ + enfant

## mPdie Tay-Sach's

$\frac{1}{300\ 000}$  enfants

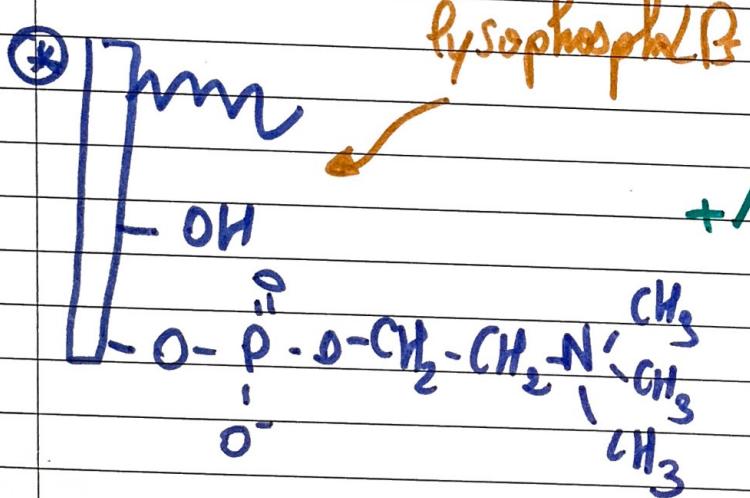
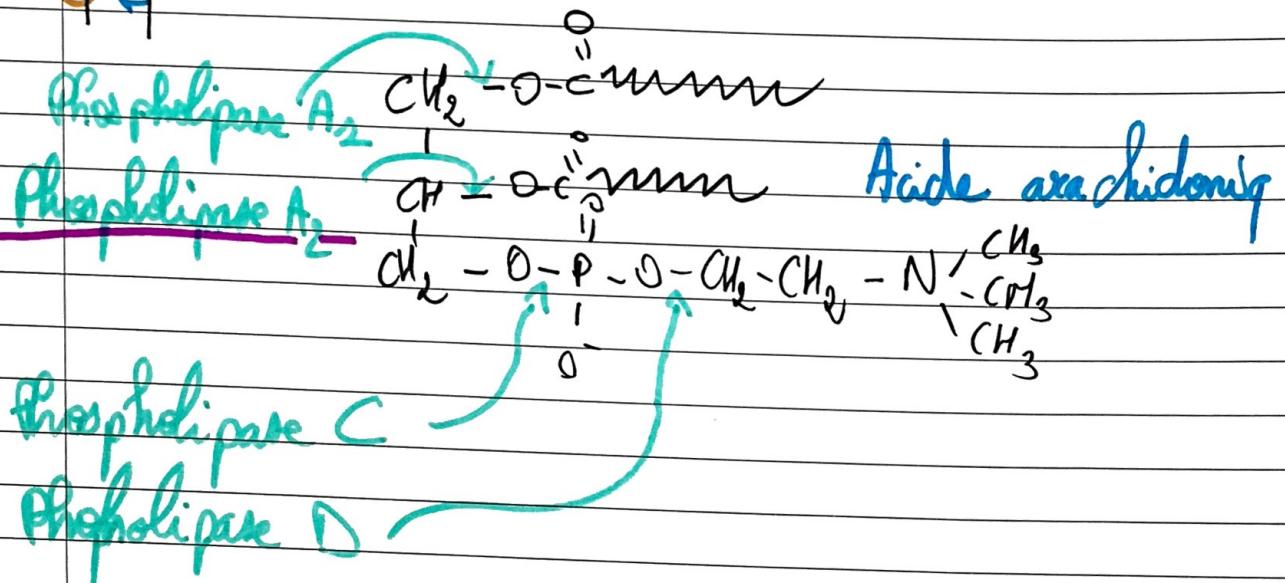
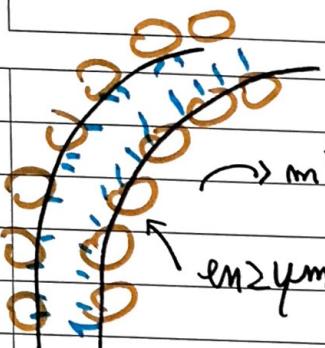
↳ Juifs Ashkenazi  $\frac{1}{30\ 000}$

↳ Fille porteur  $\frac{1}{28}$

↳ 

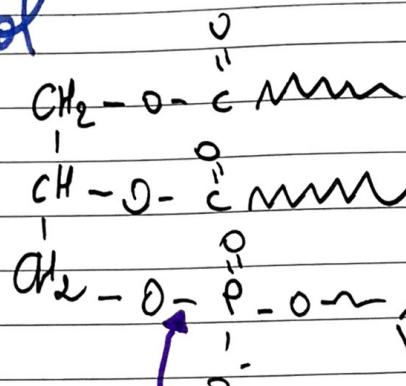
- Cerveau ⇒ Retard assistance
- Rate ⇒ Paralysie

 ⇒ + enfant 3 ans.



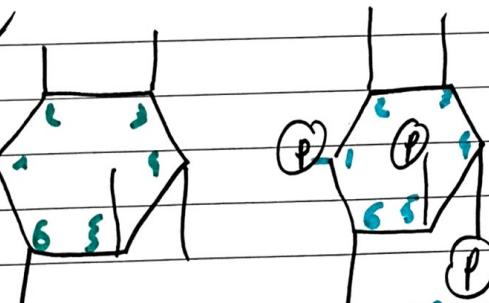
+ MMV Acide  
arachidonique  $\Rightarrow$  Enosanoïde

## Phosphatidyl inositol



Diacylglycerol: DAG  
↳ 2<sup>nd</sup> messenger

## Phospholipase C



1,6,5 triinositol  
→ iP<sub>3</sub>

## Tumbler

1

slipper c

A hand-drawn diagram on lined paper. At the top right, the text "Plug the Sanguines → coagula &" is written. Below it, a pink, curved shape representing a blood vessel is shown. A blue circle labeled "PLC" is at the bottom left. Above it, a blue circle labeled "Phosphine" has a blue line connecting them. From the PLC circle, two green arrows point upwards and to the right; one arrow points to a blue circle labeled " $iP_3$ " and the other points to a blue circle labeled "DAG".

SGLP

## polymère sacré

DONNEUR -  $\alpha$ P

- $\text{Q}:$  Glucosylgalactose -  
N-acetylglucosamine - galactose,  
fructose

A: Guo-Gal-Nacetylglucosamine

-GAP — N-acetylglutamaminic  
acid

B:  $m A \dots$

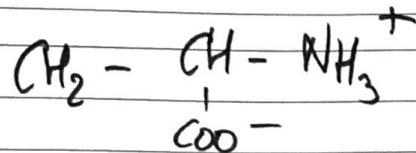
AB :

Nacetyl  
galactose

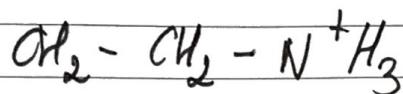
Shub  
antigénij



Séamine

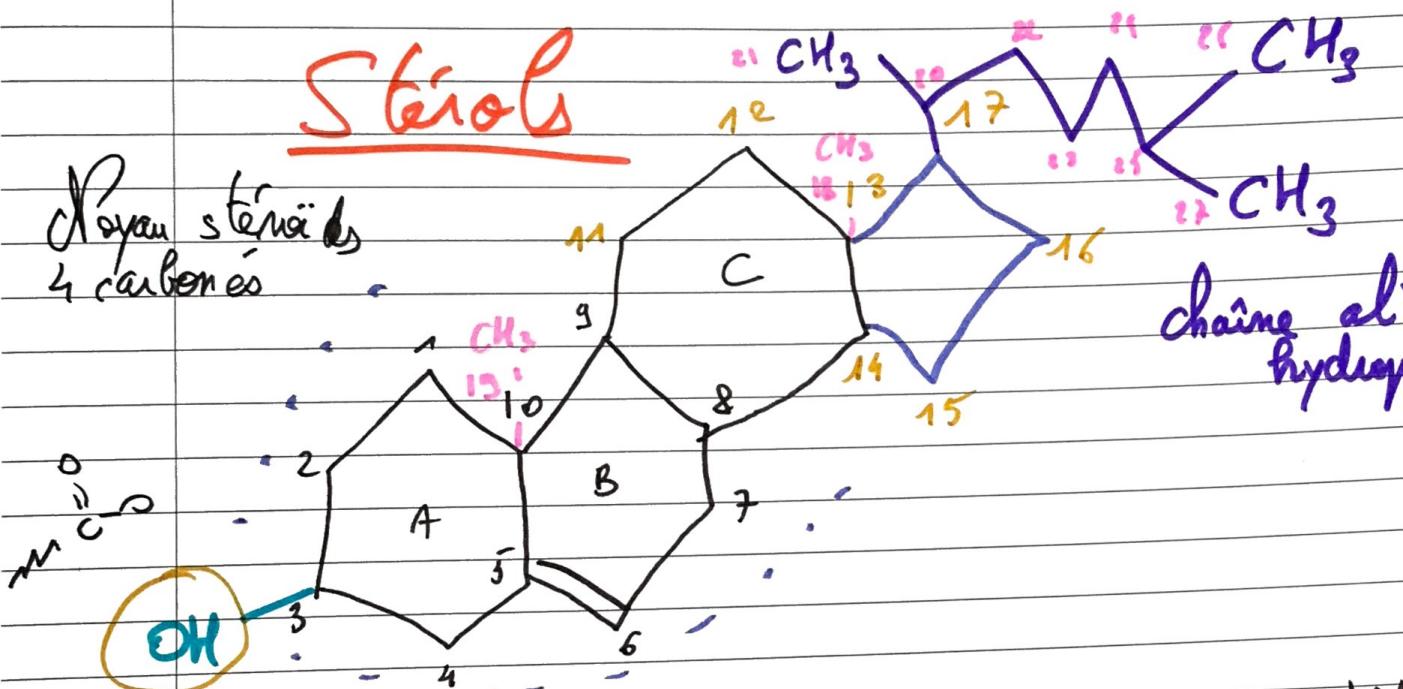


oéthanolamine



## Stérols

Chœurs stéroïdes  
4 carbones



8 Prostérol : 27 C

→ 13 prix Nobel

- Const. t mb E <sup>très</sup> mrx
- lipoprot
- | Libre esterifiée

Cis

→ source auto mils : ▷ seli liliains  
▷ hormones stéroïdes

①

gastro

• Bile : 1L / jour

→ eau (80%)  
→ cholestérol  
→ sels minéraux  
→ sels biliaires

► sels biliaires : → émulsifiants graisseux  
→ abso<sup>r</sup> vitamines A D E K (liposolubles)

foie

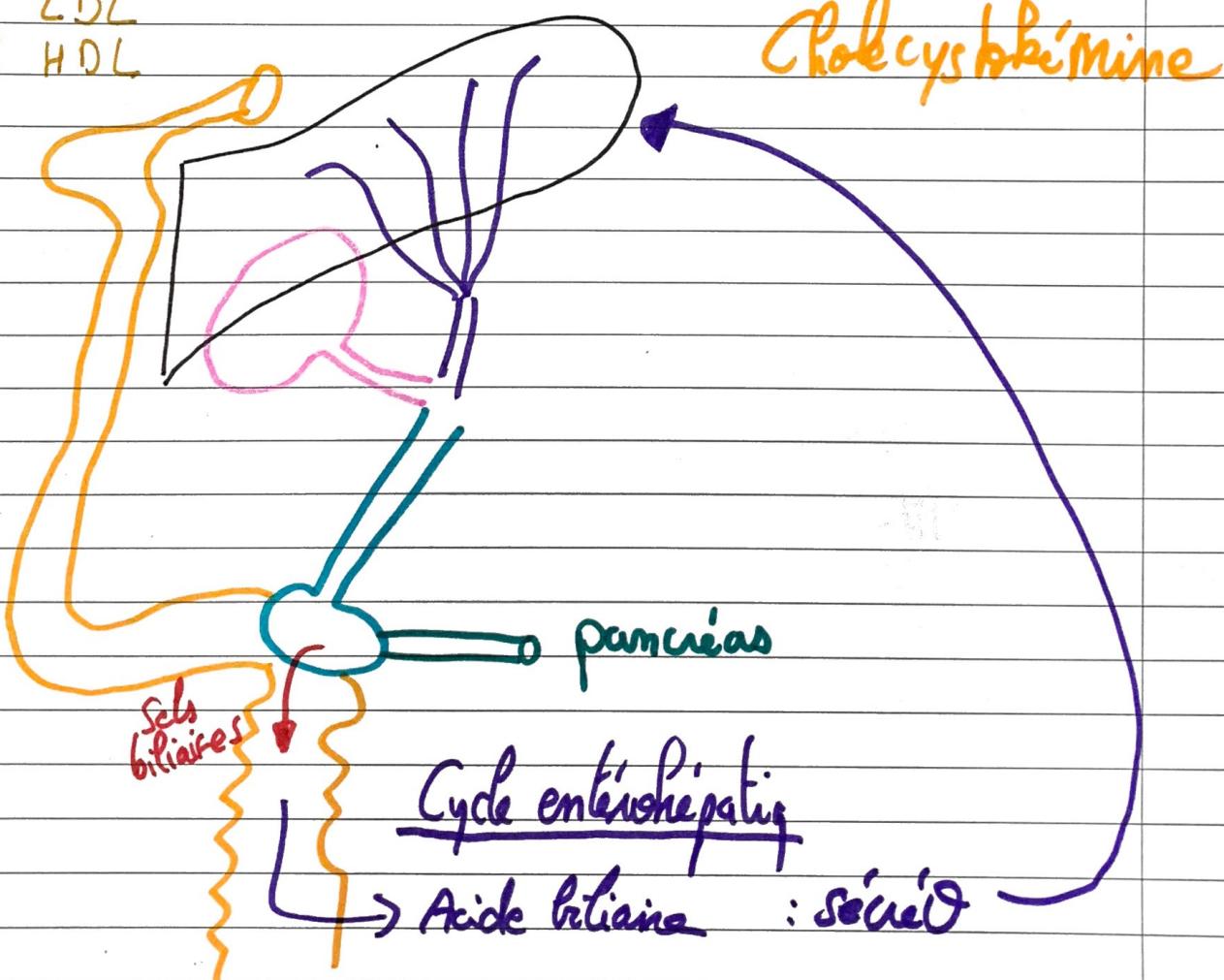
Cholestérol

Acides biliaires

Glycine  
Taurine ⇒ Sels biliaires

→ synthétisé au niveau acétyl CoA  
alimentaire

- chylomicrons  
- LDL  
- HDL



F

3,7

Acide Liliaire : Acide chohiq

3,7,12 Acide Cheno-doxycholique

3,12 Acide Desoxycholique

3 Acide Lythocholique

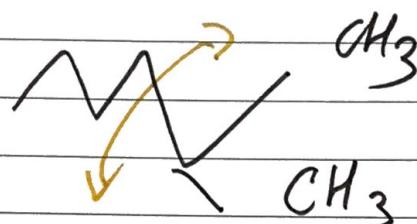
Acide  
SIL

I

II

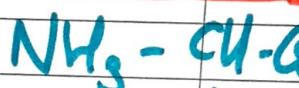
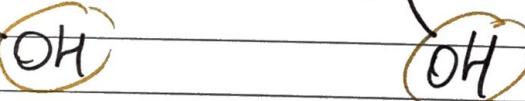
 $C_3$  $C_7$  $C_{12}$ 

Vit SS

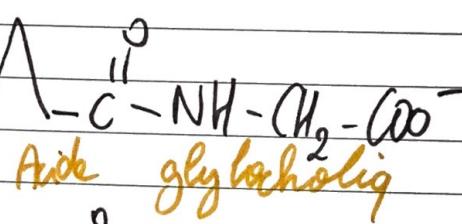
Décarpage par  
enzyme

$\Rightarrow$  a.a  
glycine

$C_2$  &  $C_{12}$

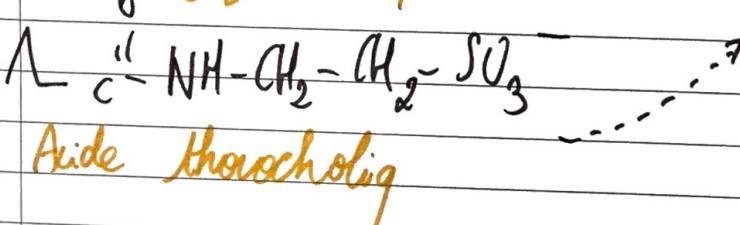


H



Acide glycocholique

Threonine

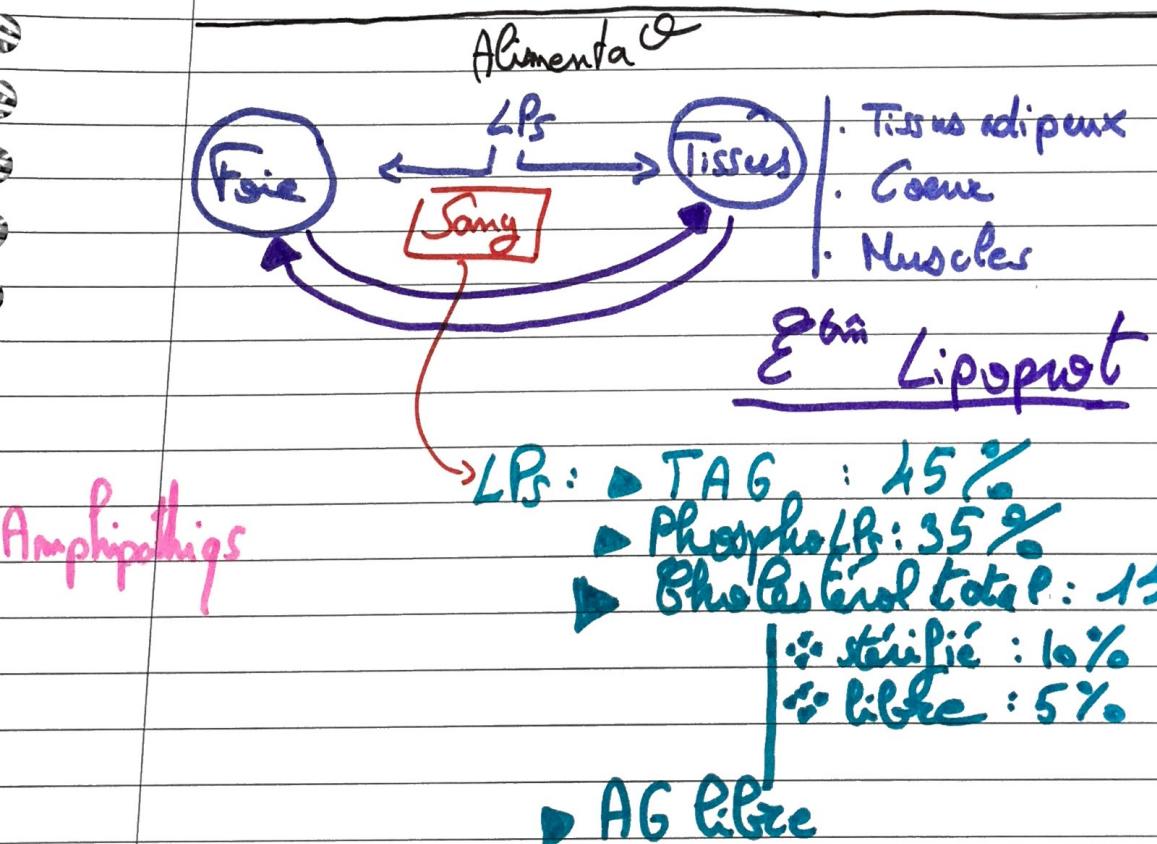
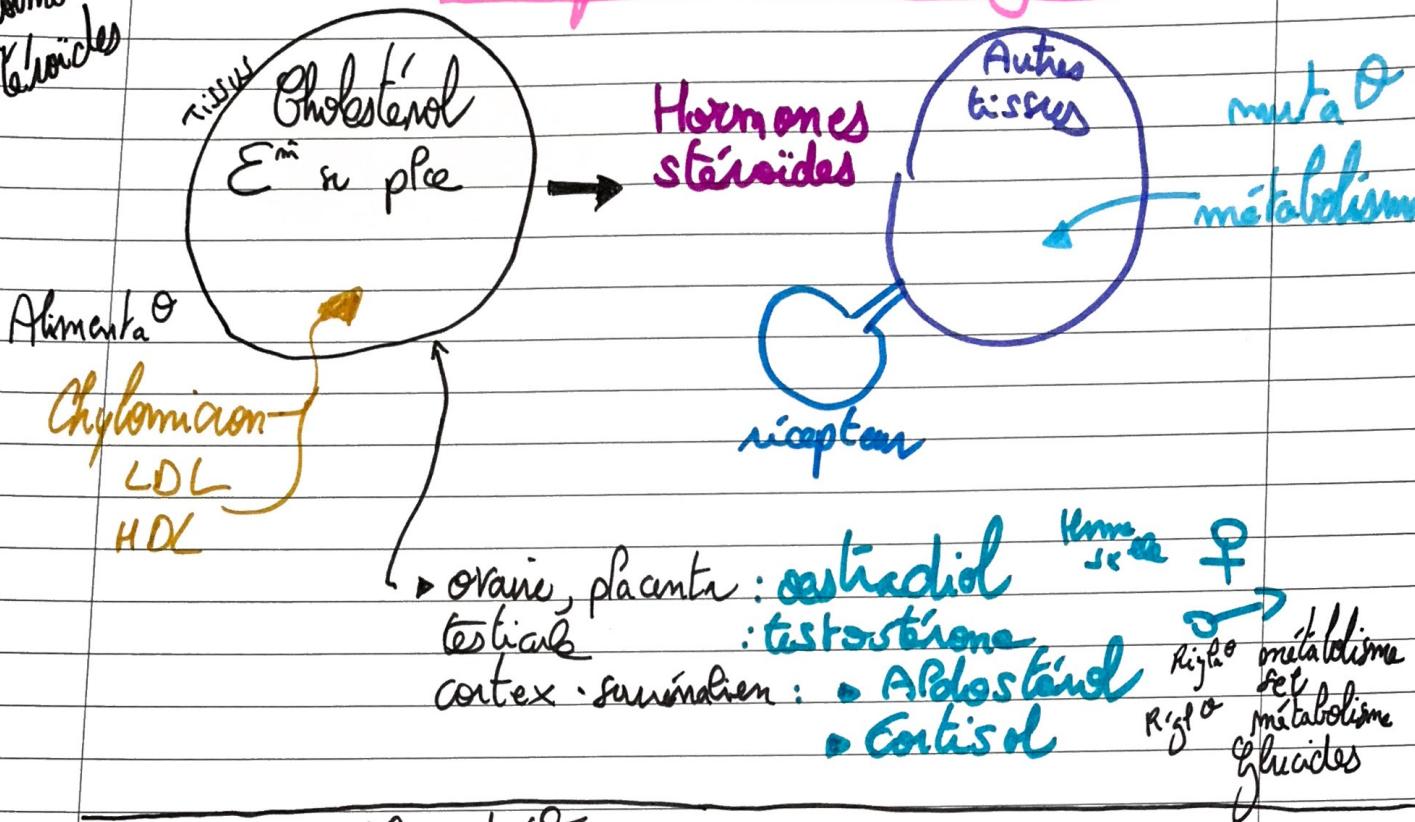


Acide thiocholique

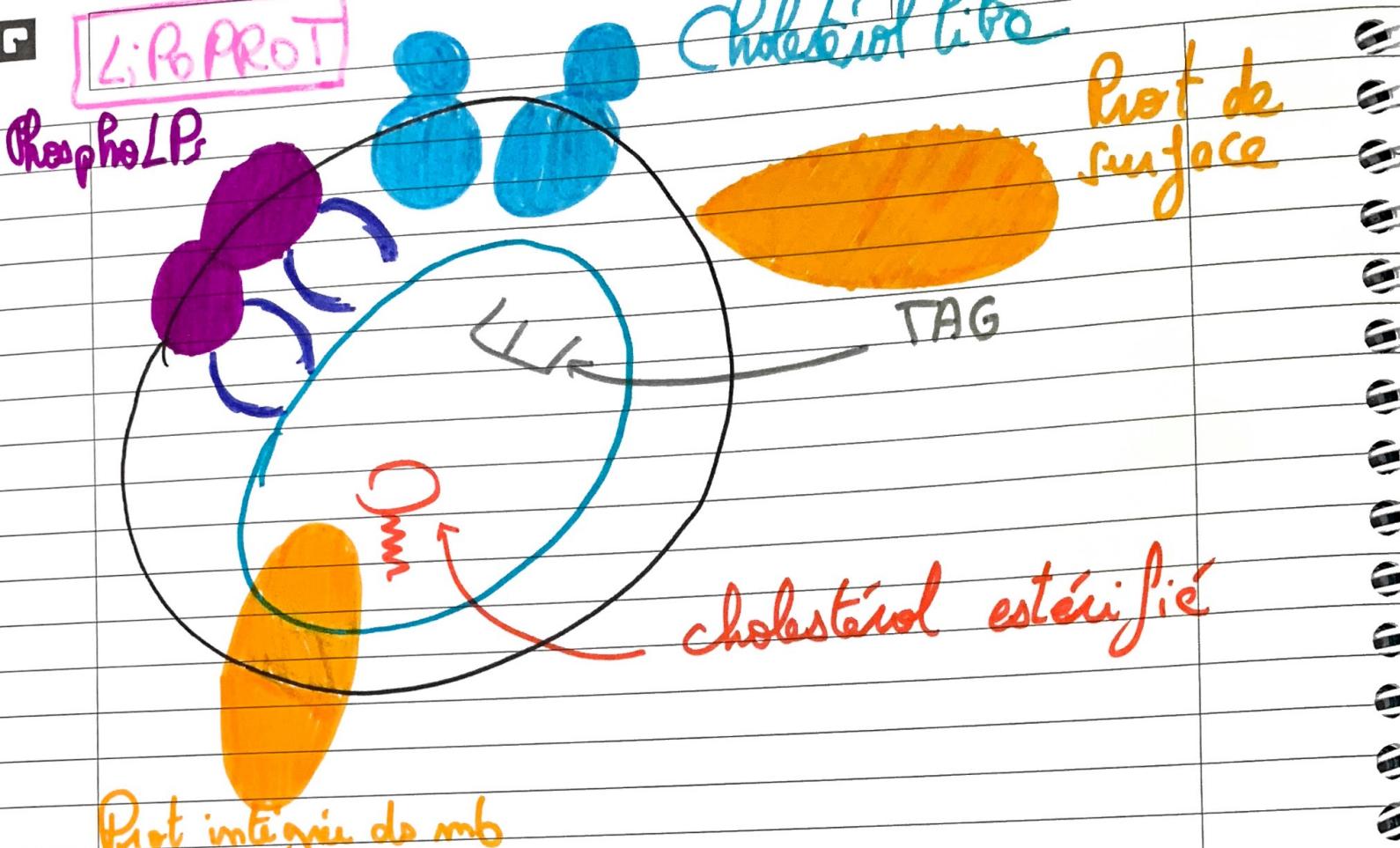


Hormones  
stéroïdes

## Transferer 1 message



Amphiphaths



Part integrante da m<sup>b</sup>

► Parte :  $\rightarrow$  Pe Co<sup>ss</sup>

$\rightarrow$  Cofator enzimático :  $\leftrightarrow$  Lipoprot lipase  
 $\leftrightarrow$  LCAT

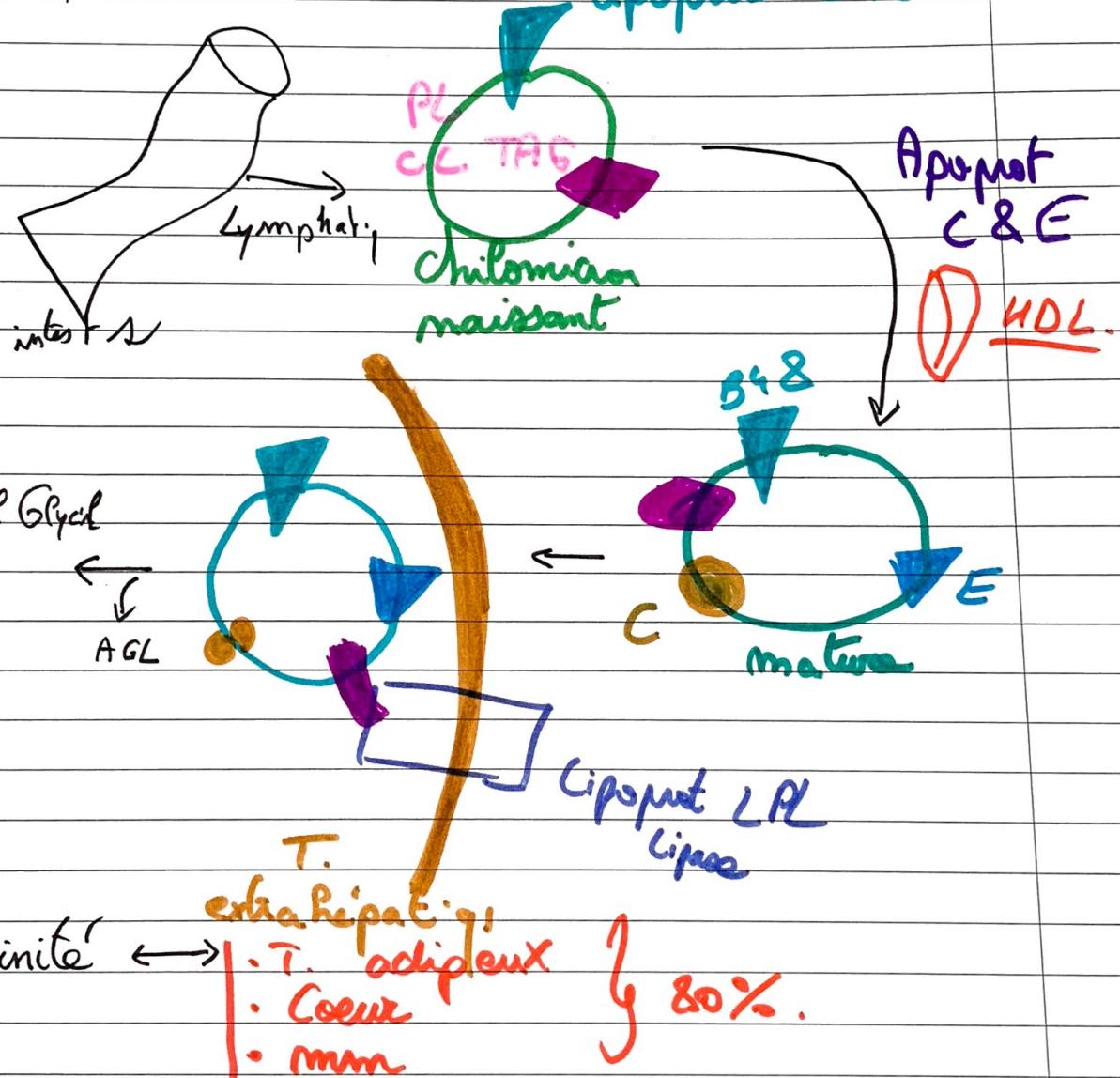
- |                 |                             |
|-----------------|-----------------------------|
| <b>Lipoprot</b> | • <i>Bilaminar</i>          |
| • VLDL          | (Very low Density Lipoprot) |
| • IDL           | (Intermediate "             |
| • LDL           | (Low "                      |
| • HDL           | (High ") )                  |



Pyramose

- glycosidase Chilomicrons  $\rightarrow$  TAG
- VLDL
- LDL
- IDL
- HDL

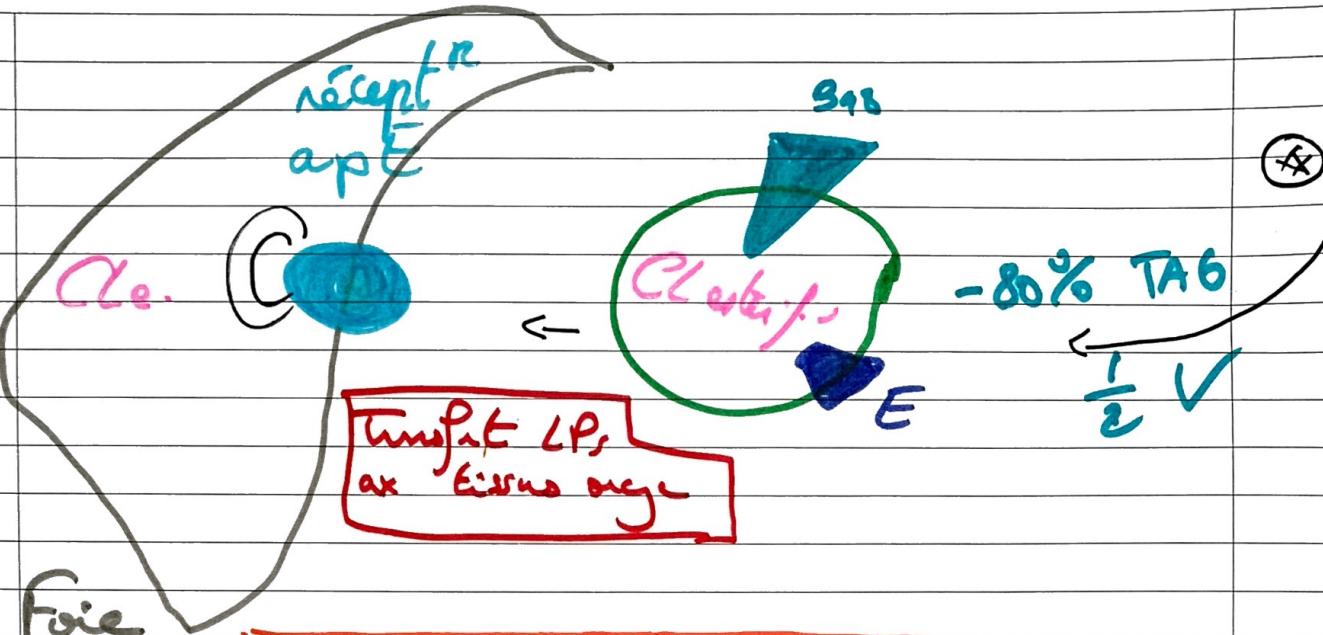
CL chitid



$$\text{affinité} \propto \frac{1}{KM}$$

$$KM \ominus 10x$$

$$\text{Affinité} = \frac{1}{KM}$$

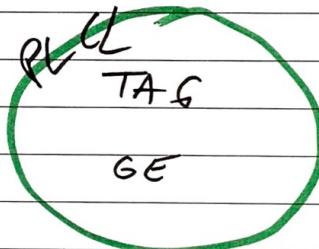


Foie

$\frac{1}{2}$  vie  
 $\frac{1}{2}$  cholestérol < 1 heure

VLDL

VLDL mûrissant



0  
 1000  
 1000

Foie

50%

B/S

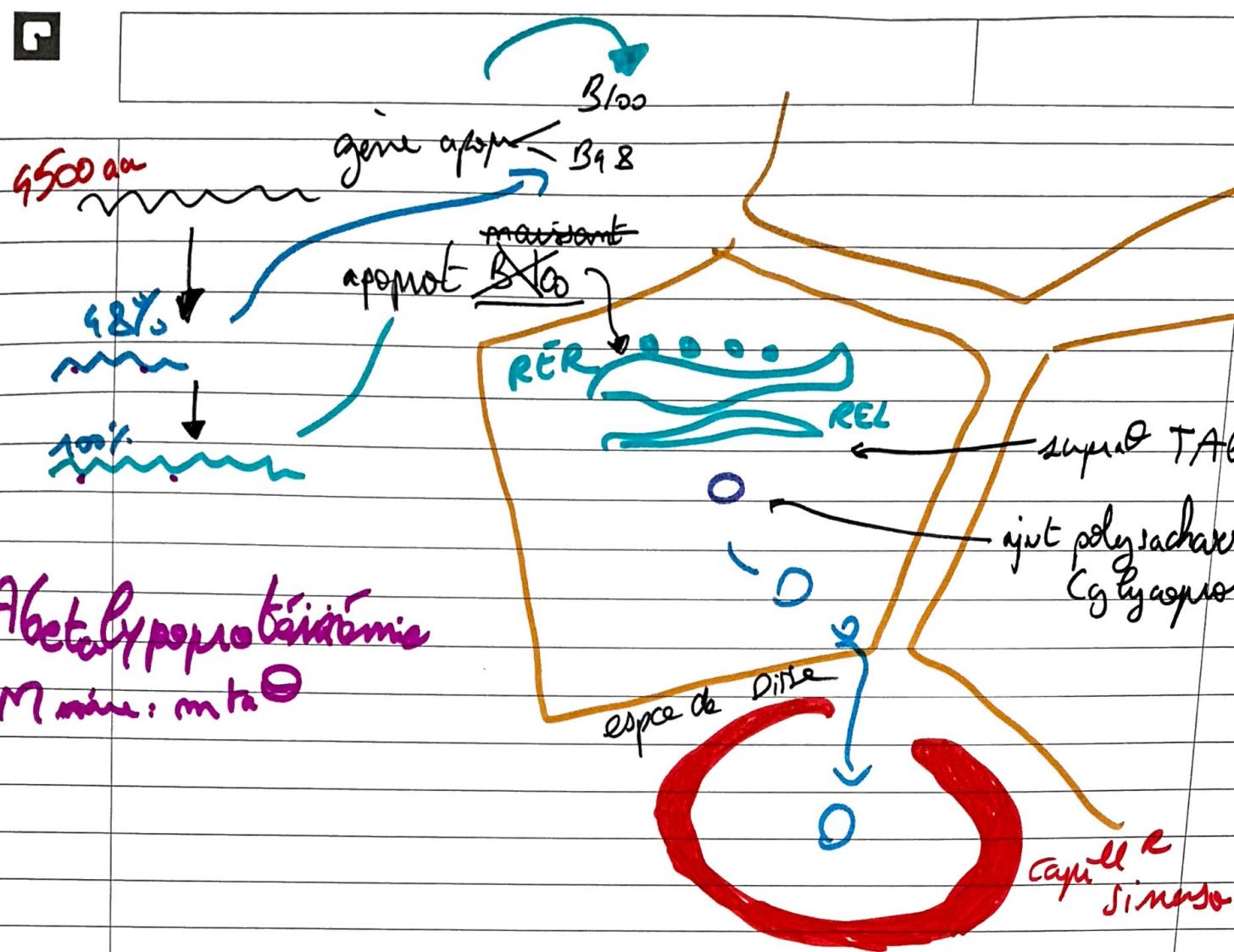
50%



50%  
 $\frac{1}{2} V$

Tissus extra-pathog.

IDL



Abetalipoproteinémie  
Mauve: mta<sup>-</sup>

- VLDL : → transport LP des TAG extrahépatique
- LDL : → apport CL des TAG extrahépatique

$$\boxed{\text{VLDL } \frac{1}{2} \text{ vie} = 2,5 \text{ jours}}$$

→ si  $\emptyset$  R<sub>c</sub> R<sub>p</sub> B100  $\Rightarrow$  hypachylie familiale.

•  $[LDL] = 1,54$  fois patho ative hypertriglyceridémie  
si  $[LDL] >$

