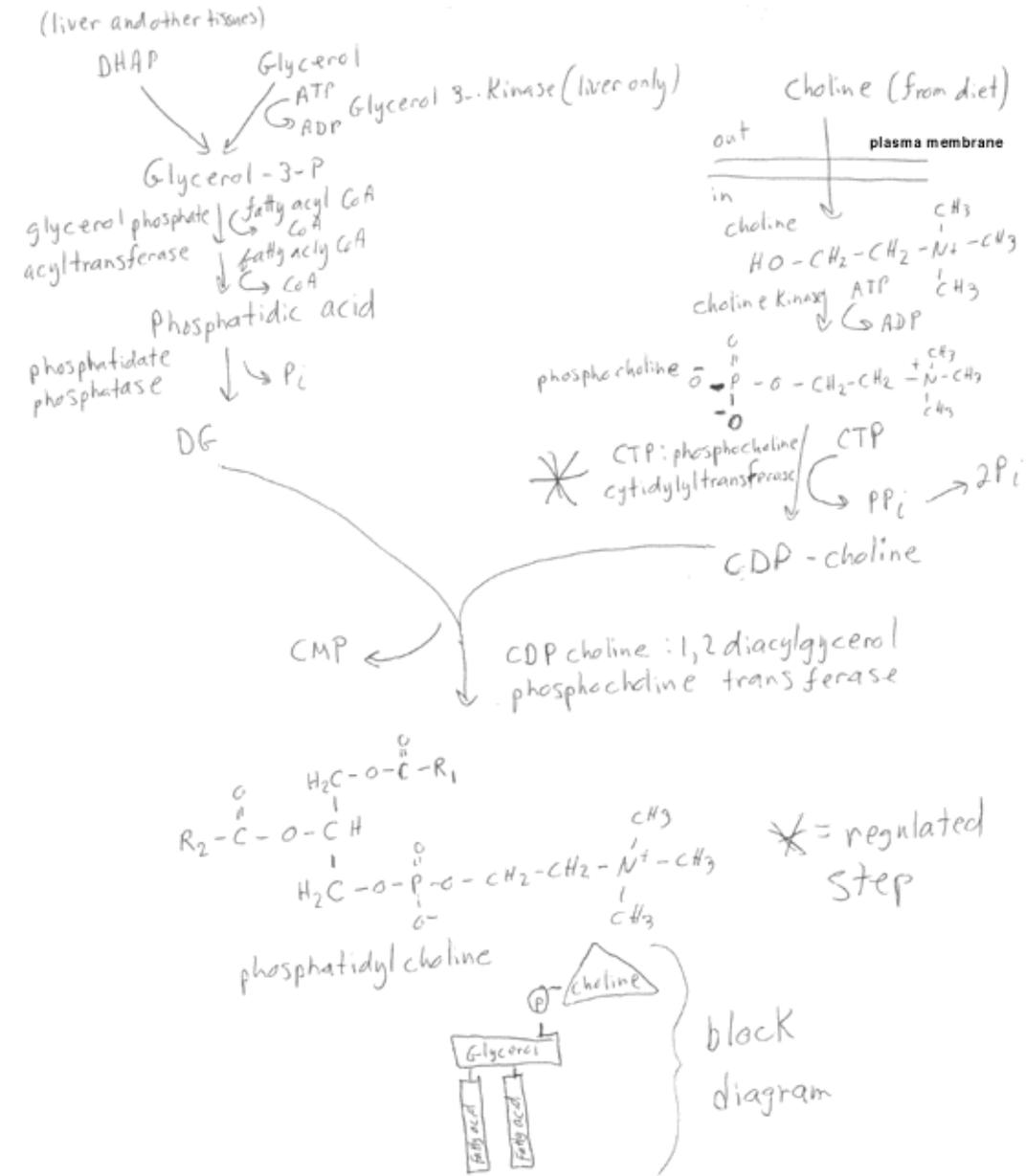


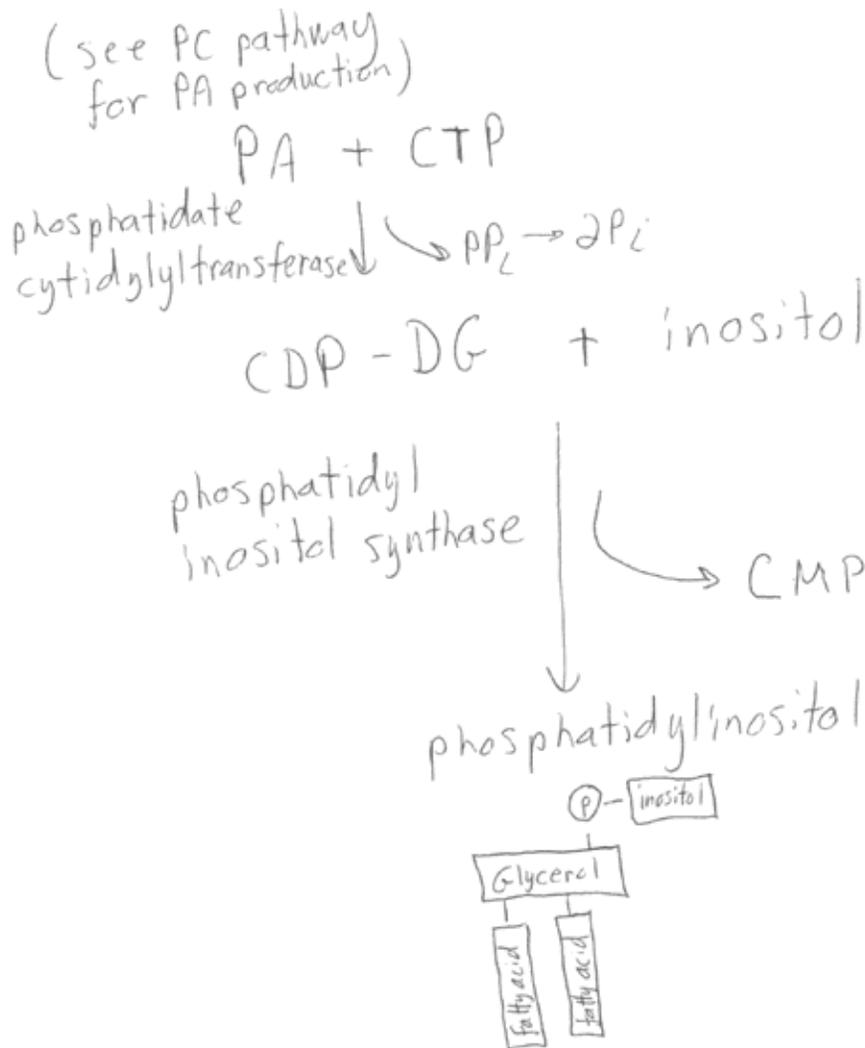
Phospholipid/Sphingolipid Biosynthesis--12 Nov. 2002

1) Draw the biochemical steps in PC and PI biosynthesis.

PC biosynthesis:



PI biosynthesis:



How can PE be converted into PC?

By three successive methylations of the primary amino group of ethanolamine. S-adenosylmethionine is the donor of activated methyl groups. You do not need to know the mechanism or the name of the enzyme that catalyzes this reaction.

By what process is most PS made?

Most PS is made by head group exchange with phosphatidylethanolamine. The reaction is:

PE + serine \square PS + ethanolamine

2) How is phosphatidylcholine (PC) biosynthesis regulated.

By regulating the activity of **CTP: phosphocholine cytidyltransferase**, the enzyme that makes the activated CDP-choline. The enzyme is activated when it is bound to the ER membrane. 4 things regulate its ER membrane association: a) decreased PC in ER membrane increases its membrane association (**turned on**). b) increased ER membrane fatty acids increase its membrane association (**turned on**), c) increased ER membrane diacylglycerol increases its membrane association (**turned on**), and d) phosphorylation decreases its membrane association (**turned off**)

3) List the processes that phospholipases are involved in.

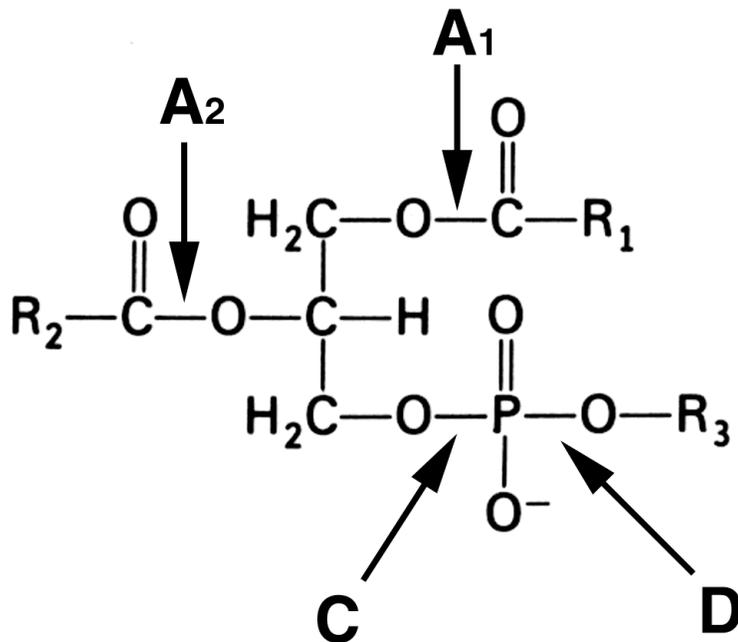
PLA2 (phospholipase A2) is involved in repair of oxidized fatty acids of phospholipids, releasing arachidonic acid as a substrate for eicosanoid biosynthesis and for stimulating membrane fusion, and for the first step in dipalmitoylphosphatidylcholine biosynthesis.

PLC (phospholipase C) is involved in signal transduction. It cleaves phosphatidylinositol, 4, 5 bisphosphate into DG and IP3. The DG activates protein kinase C and the IP3 increases the intracellular concentration of calcium that activates other calcium-dependent signalling events in the cell.

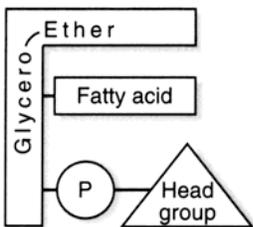
PLD (phospholipase D) is involved in forming phosphatidic acid (PA) primarily from PC. The physiological importance of this is that PA released on ER and Golgi membranes by PLD stimulates vesicle formation.

PLA1 No processes were discussed for this enzyme.

Where do phospholipases A1, A2, C and D cleave?



4) Draw the structure of ether glycerolipids (block diagram).

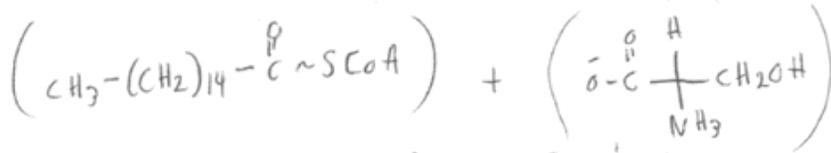


What is PAF and what does its release cause?

PAF is platelet activating factor (also called platelet aggregating factor). It is a plasmalogen (an ether glycerolipid that contains an alkenyl group).

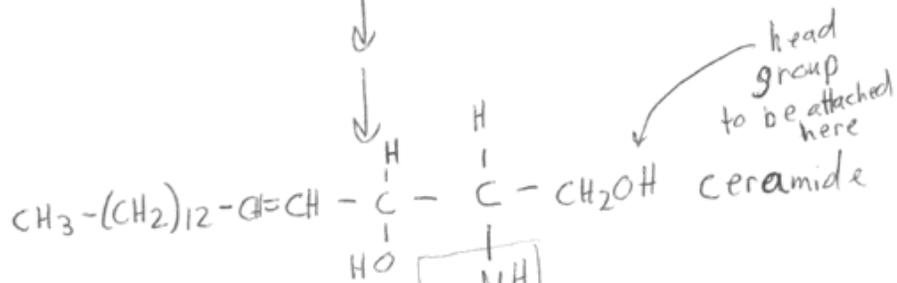
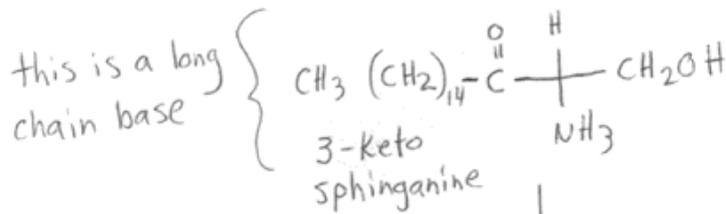
linked to the glycerol backbone through an ether linkage). PAF is released by activated phagocytic cells like macrophages. PAF causes edema, hypotension, platelet aggregation and is involved in the allergic response.

5) Draw the steps in sphingolipid biosynthesis and the structure of sphingomyelin (block diagram) and glycolipids (the general glycolipid block structure and the specific block diagram of GM1).



Palmitoyl-CoA + Serine

$\text{CO}_2 + \text{CoA} \leftarrow \downarrow$ serine palmitoyl transferase (SPT) * Regulated Step / Committed Step

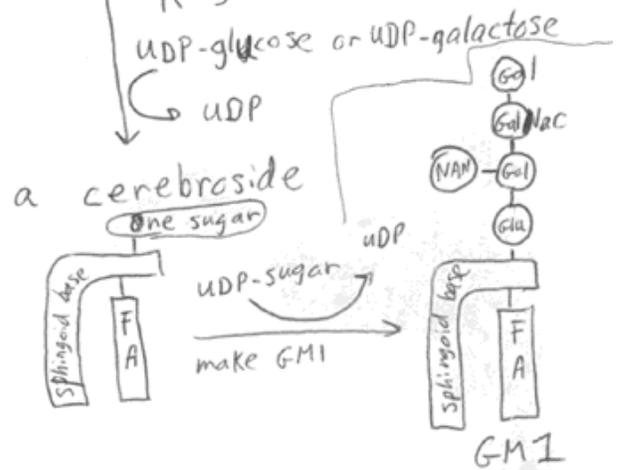
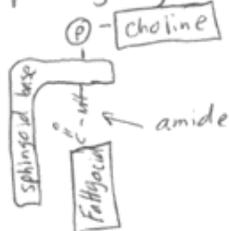


this is an amide bond

this is a fatty acid

PC
DG

Sphingomyelin



6) On which side of the plasma membrane are PE, PC, PS, PI, sphingomyelin and glycolipids primarily located?

PE, PS, and PI face the cytosol.

PC, glycolipids (gangliosides) and sphingomyelin face the outside of the cell.