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18/MHS06/058

Clinical biochemistry and xenobiotic

BCH 202

What are plasmalogen?

Name and draw 3 examples of plasmalogen.

Give 2 differences between plasmalogens and phosphoglycerides.

1. What are plasmalogens?

Plasmalogens are naturally occurring phospholipids containing sn-1-Z-1' -O-alkenyl chains of varying lengths and degrees of unsaturation that comprise as much as 18% of total phospholipid in mass in humans.

Plasmalogens were first described by Feulgen and Voit in 1924 based on studies of tissue sections. They treated these tissue sections with acid or mercuric chloride as part of a method to stain the nucleus which resulted in the breakage of the plasmogen vinyl-ether bond to yield aldehydes. In turn, the latter reacted with fuchsine-sulfurous acid stain used in this nuclear staining method and give rise to coloured compounds inside the cytoplasm of the cells. Plasmalogens were named based on the fact that these coloured compounds were present in the "plasmal" or inside the cell.

In mammals, the sn-1 position is typically derived from C16:0, C18:0, or C18:1 fatty alcohols. The most common head groups present in mammalian plasmalogens are ethanolamine or choline.

These are phospholipids which have an aliphatic long chain alpha-beta unsaturated alcohol in ether linkage with the first hydroxyl group of glycerol. The second OH group is esterified to a fatty acid. The phosphoric acid is attached to choline or ethanolamine. The alcohols have about C12 to C18 chain length. Plasmalogens are found in numerous human tissues,

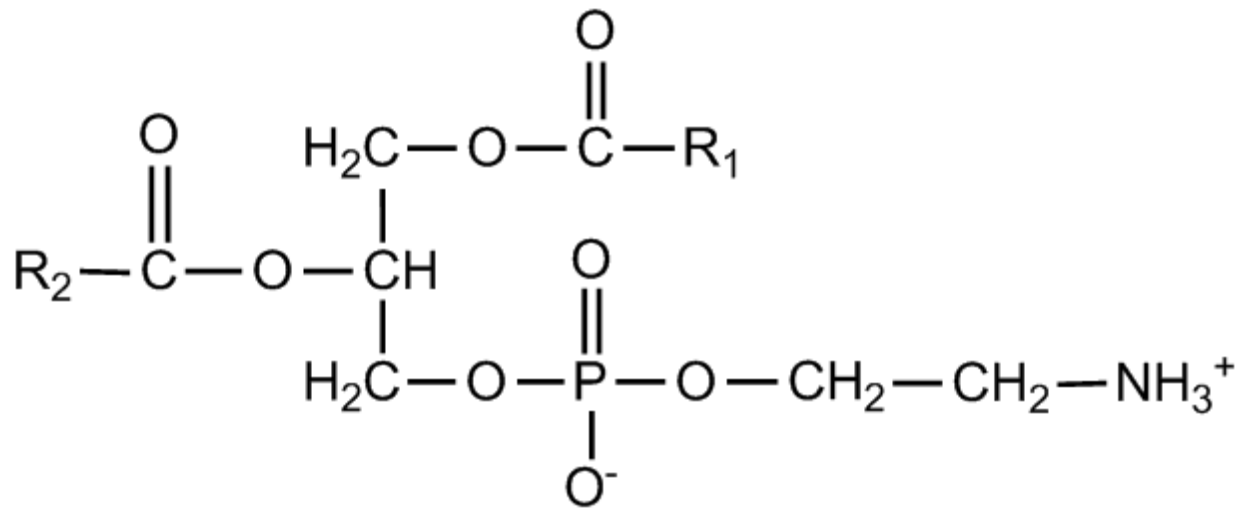
with particular enrichment in nervous, immune, and cardiovascular system. These electron-rich vinyl etherphospholipids are found in the electrically active tissues of mammals, most prominently in brain, myelin and heart. In human heart tissue, nearly 30-40% of choline glycerophospholipids are plasmalogens. Even more striking is the fact that 32% of the glycerophospholipids in the adult human heart and 20% in brain and up to 70% of myelin sheath ethanolamine glycerophospholipids are plasmalogens. Plasmenylcholines are known to be an important depot for arachidonic acid in heart tissue. Human nervous system tissues, especially brain and myelin sheath, contain high concentrations of plasmenylethanolamine and polyunsaturated fatty acids (PUFA).

Although the functions of plasmalogens have not yet been fully elucidated, it has been demonstrated that they can protect mammalian cells against the damaging effects of reactive oxygen species. In addition they have been implicated as being signaling molecules and modulators of membrane dynamics. Biosynthesis of plasmalogens begins with association of peroxisomal matrix enzymes GNPAT (glycerone phosphate acyl transferase) and AGPS (alkyl-glycerone phosphate synthase) on the luminal side of peroxisomal membrane. These two enzymes can physically interact with each other to increase efficiency. Therefore, fibroblasts without AGPS activity have a reduced GNPAT level and activity.

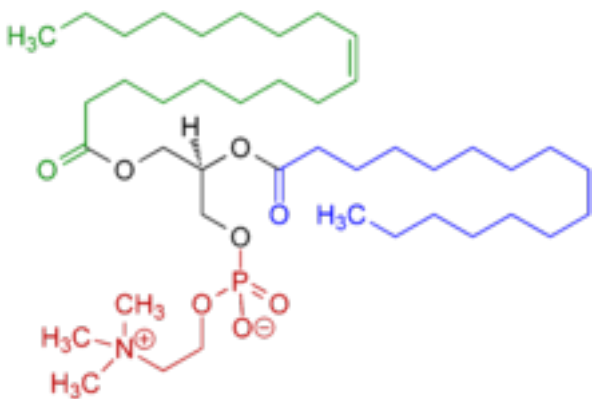
Peroxisome biogenesis disorders are autosomal recessive disorders often characterized by impaired plasmalogen biosynthesis. In addition, genetic mutations in the GNPAT or AGPS genes can result in plasmalogen deficiencies, which lead to the development of rhizomelic chondrodysplasia punctata (RCDP) type 2 or 3, respectively.

2. Name and draw 3 examples of plasmalogens.

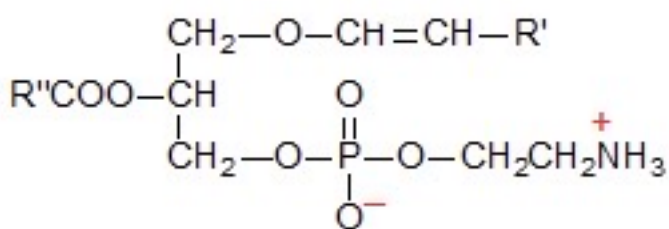
A. Phosphatidylethanolamine



### B. 1-Oleoyl-2-palmitoyl-phosphatidylcholine



### C. Plasmenylethanolamine



3. Give 2 differences between plasmalogens and phosphoglycerides

A. Phosphoglycerides is any phospholipid based on glycerol while, Plasmalogens is any of a class of phospholipids found in cell membranes, in which one of the fatty acids is replaced by an aldehyde.

B. Phosphoglycerides have head groups serine, inositol, glycerol etc. While, Plasmalogens have only head groups choline and ethanolamine

