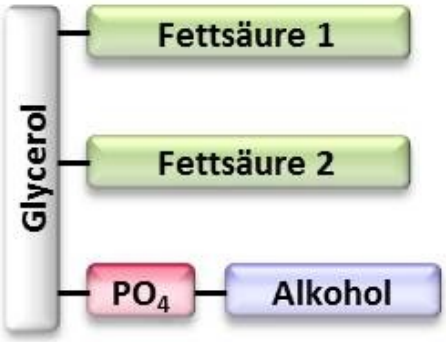
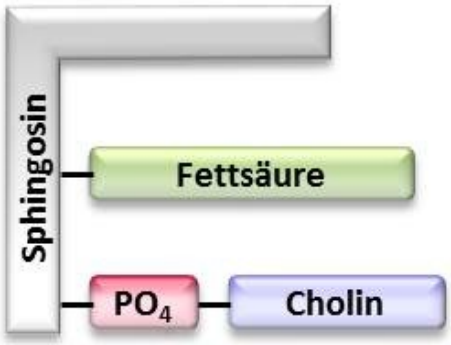
1. **Which groups can membrane lipids be devided into according to their components? Which are the most abundant membrane lipids?:** Phospholipids and glycolipids. The largest group and most abundant are the glycerophospholipids. The most abundant lipid in cell membranes of mammals is phosphatidylcholine.
2. **Which are the structural components of a glycerophospholipid? Draw a schematic representation.:**



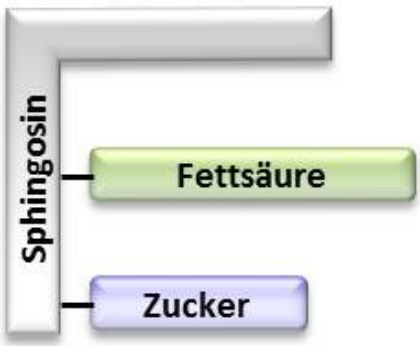
Glycerole backbone, two fatty acids and a phosphoalcohol group.

3. **Which are the structural components of a sphingomyelin? Draw a schematic representation.:**



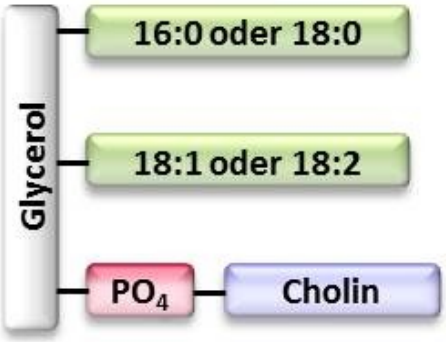
Sphingosine backbone, one fatty acid, phosphocholine or phosphoethanolamine.

4. **Which are the structural components of a sphingoglycolipid? Draw a schematic representation.:**



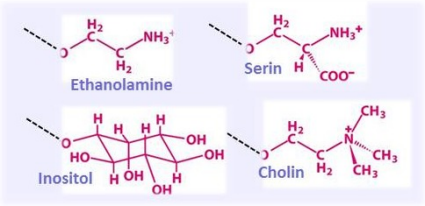
Sphingosine template, one fatty acid, mono- or oligosaccharide.

5. **Which is the most common phospholipid in the membranes of mammals? Draw the schematic representation. Mention the most common type of fatty acids included.:**



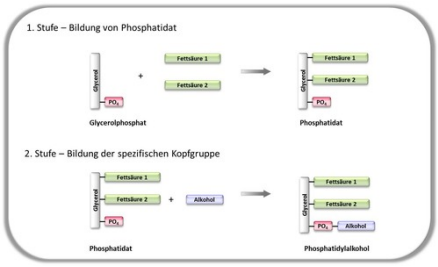
Phosphatidylcholine.

6. **From which components are glycerophospholipids synthesized?:** Glycerol-3-phosphate, two fatty acids, alcohol.
7. **Which are the most common alcoholic groups found in glycerophospholipids?:**



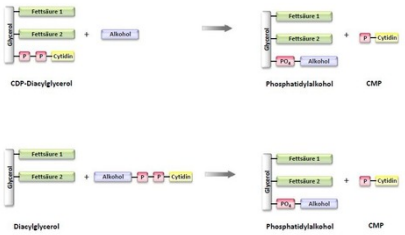
Choline, ethanolamine, serine, inositol.

8. **What are the two stages of glycerophospholipid synthesis?:**



First, glycerolphosphate acyltransferase catalyzes the formation of phosphatidate. Then one of the alcohols is attached to form the specific head group.

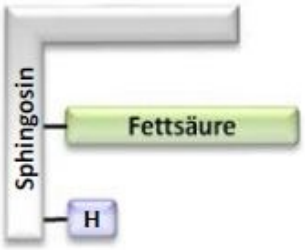
9. **What are the two ways to get from the phosphatidate to the phosphatidyl alcohol?:**



To enable the reaction between phosphatidate and the alcohol, one of both substrates has to be activated by cytidine diphosphate.
First possibility: The phosphatidate gets activated by cytidine diphosphate to form CDP-diacylglycerol which then reacts with the alcohol.
Second possibility: The alcohol gets activated by cytidine diphosphate. The phosphatidate dephosphorylates to form diacylglycerol which then reacts with the activated alcohol.

10. **What are the two stages of sphingolipide synthesis?:** 1. stage: synthesis of ceramid
2. stage: substitution of the ceramid hydroxy-group with various head groups

11. **From which components is ceramid synthesized?:**



- palmitoyl-CoA (most common end-product of the fatty acid synthesis)
- serine
- fatty acid

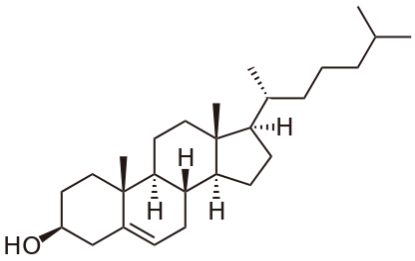
12. **A variety of membrane lipids allow different mambrane compositions. In what properties do membranes differ?:** - lipid asymmetry of outer and inner membrane layer
- lateral variability through lipid domains
- embedment of proteins
- membrane fluidity
- membrane bending
- vesicle formation
- targeting

13. **What is the most important organelle of the lipid biosynthesis?:** the endoplasmic reticulum

14. **What are the three stages of cholesterol synthesis?:** 1. synthesis of activated isopren (C5)
2. condensation of six isopren componets leading to squalen (C30)
3. cyclisation of squalen leading to cholesterol (C27)

15. **Describe briefly the synthesis of activated isopren.:** - Acetyl CoA and acetoacetyl CoA reacts to HMG-CoA.
- HMG-CoA is reduced to mevalonate which is the first specific step of the cholesterol synthesis. Moreover this is the key step of regulation (HMG-CoA-reductase).
- In multiple steps, mevalonate reacts to activated isopren.

16. **Draw the structural formula of cholesterol!:**



17. **Which groups of molecules can be derived from cholesterol and what is their function?:** - bile salts (Gallensalze)
solubilize lipids by forming micelles
- vitamin D
enhancing absorption of calcium
- glucocorticoides (eg cortisol)
are important in glucose metabolism
- mineralocorticoides (eg aldosterone)
regulate water resorption
- estrogens (eg estradiol) and androgens (eg testosterone)
regulate development of sexual characteristics

18. **Regulation of cholesterol biosynthesis: Which enzyme activity is regulated and how?:** the activity of HMG-CoA-reductase can be regulated trough:
- transcription (regulated by SREBP)
- feedback inhibition by cholesterol
- post-translational modifications
- degradation

19. **Transport of cholesterol and fatty acids throughout the body: Name the different types of lipoprotein particles involved in this transport. How does the distribution of fatty acids and cholesterol work? Which are the ones most implicated in causing atherosclerosis?:** - In order of increasing density, they are called chylomicrons, very-low-density lipoproteins (VLDL), low-density lipoproteins (LDL), intermediate-density lipoproteins (IDL), and high-density lipoproteins (HDL).
- All lipoprotein particles are transported via the blood stream. In the liver, they get reorganized. The more fatty acids they release, the denser they get. The most implicated in causing atherosclerosis are the LDLs.