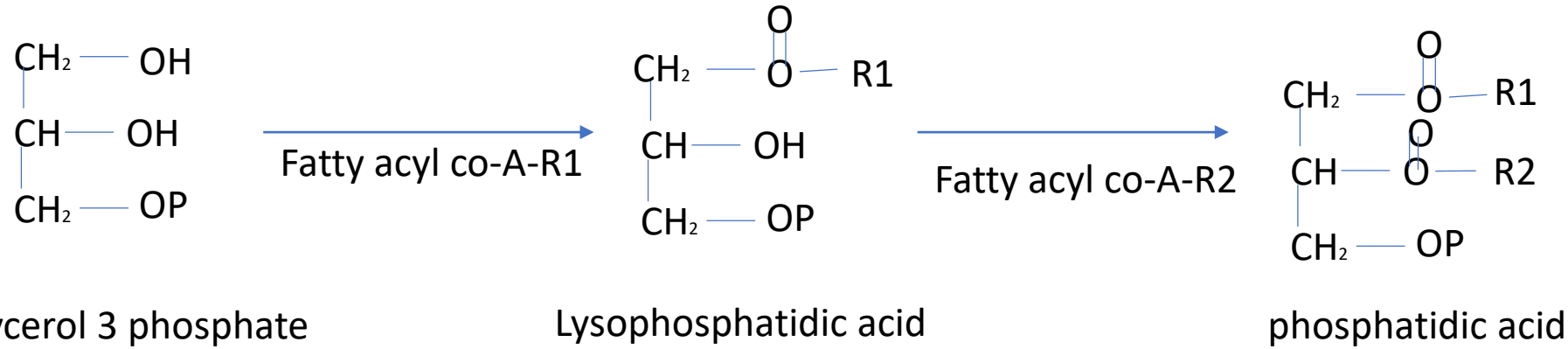
Lipid synthesis on SER, protein transport

Lipid synthesis

- Smooth ER produces many membrane lipids including both phospholipids and cholesterol.
- Phospholipids are amphipathic in nature (having both hydrophilic and hydrophobic parts).
- Their synthesis takes place at the cytosolic side of the ER membrane. And the reaction is catalysed by the membrane associated enzymes.
- The initial step in phospholipid synthesis is the condensation of two molecules of fatty acyl coenzyme A (CoA) with glycerol phosphate to make phosphatidic acid .
- Two long hydrocarbon chain of the phosphatidic acid molecule helps to anchor the molecule in the membrane.
- A phosphatase removes the phosphate from phosphatidic acid to make diacyl glycerol, and in the polar head group, either cytidine-diphosphoethanolamine (CDP-ethanolamine) or cytidine-diphosphocholine (CDP-choline) is added.
- Once synthesized on the ER, phospholipids are transported to other organelles and to the plasma membrane.

First step:



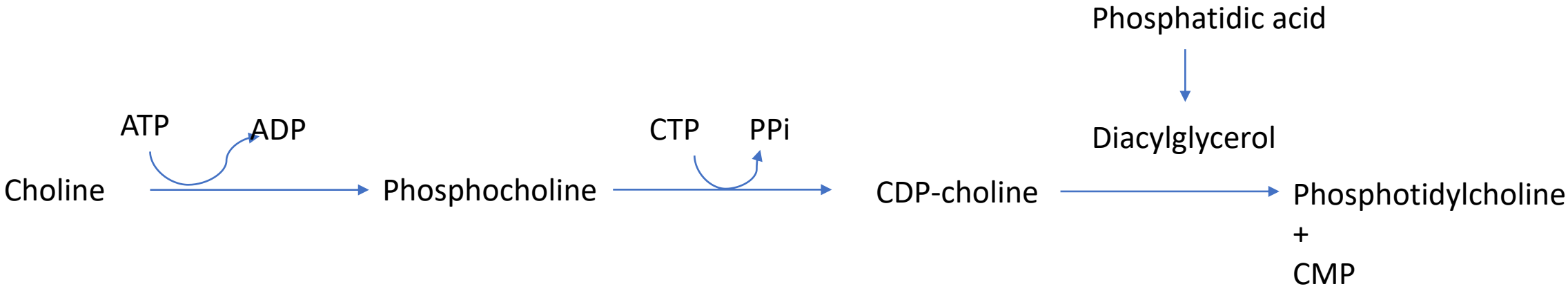
Glycerol 3 phosphate

Lysophosphatidic acid

phosphatidic acid

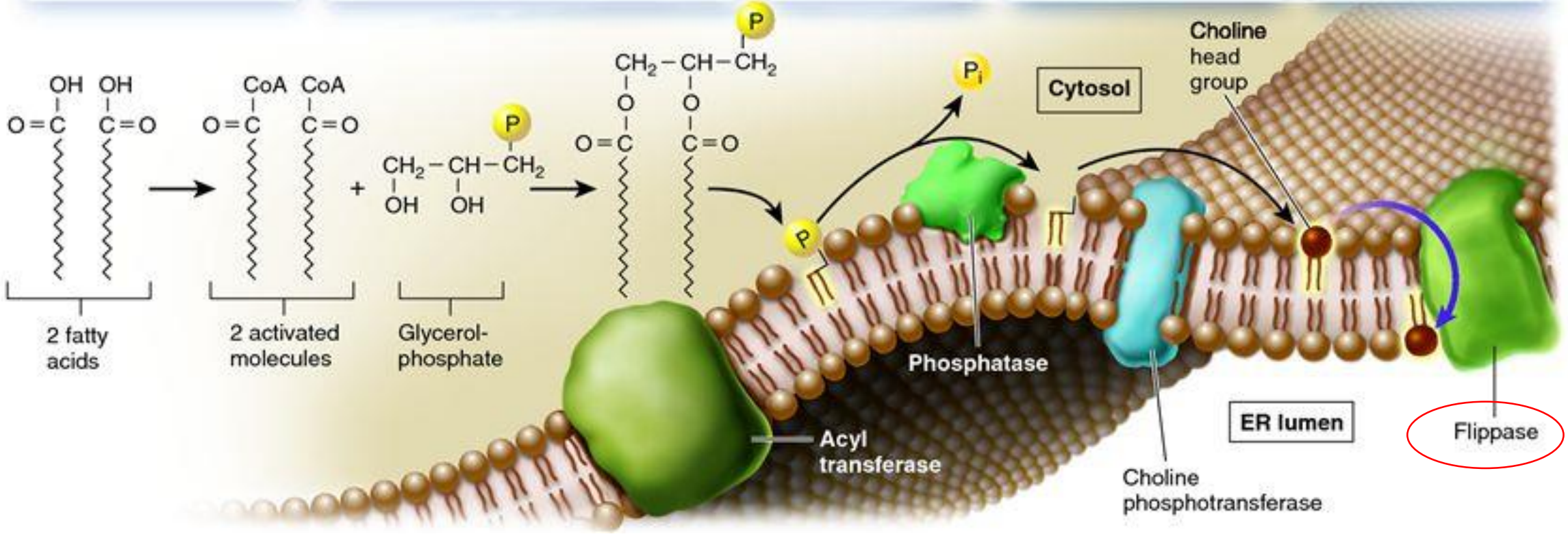
Second step: Two ways to attach head group

1. Phosphatidic acid activated by CTP condensation and forms CDP diacylglycerol. This activated diacylglycerol then reacts with OH group of alcohol to form phosphodiester linkage. In case of ionositol the product will be phosphatidylinositol and CMP



2. In this activated alcohol is used. It involves phosphorylation and activation of head group, followed by condensation with diacylglycerol.

1. In the cytosol, fatty acids are activated by the attachment of a CoA molecule.
2. The activated fatty acids bond to glycerol-phosphate and are inserted into the cytosolic leaflet of the ER membrane via acyl transferase.
3. The phosphate is removed by a phosphatase enzyme.
4. A choline already linked to phosphate is attached via choline phosphotransferase.
5. Flippases transfer some of the phospholipids to the other leaflet.



Detoxification of xenobiotic compound

- In the hepatic cell SER plays major role in detoxification
- Cytochrome P-450- catalyses the process
- It converts lipophilic compounds in to water soluble form and then it can be excreted by kidneys.

Transport of proteins

- Correctly folded and assembled proteins in the ER are packaged into COPII-coated transport vesicles that pinch off from the ER membrane. Shortly thereafter the coat is shed and the vesicles fuse with one another to form vesicular tubular clusters, which move on microtubule tracks to the Golgi apparatus.
- Many resident ER proteins slowly escape, but they are returned to the ER from the vesicular tubular clusters and the Golgi apparatus by retrograde transport in COPI-coated vesicles.

Protein transport