

PROTEIN METABOLISM

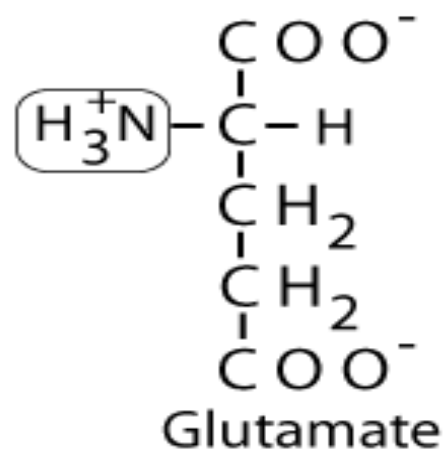
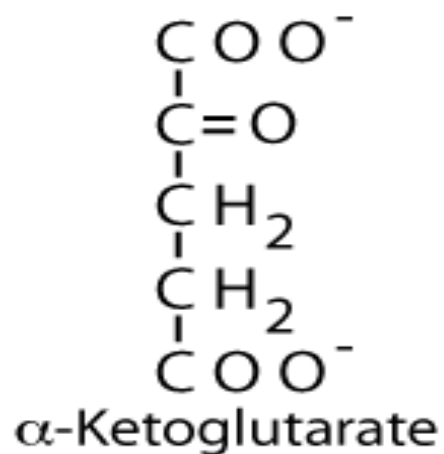
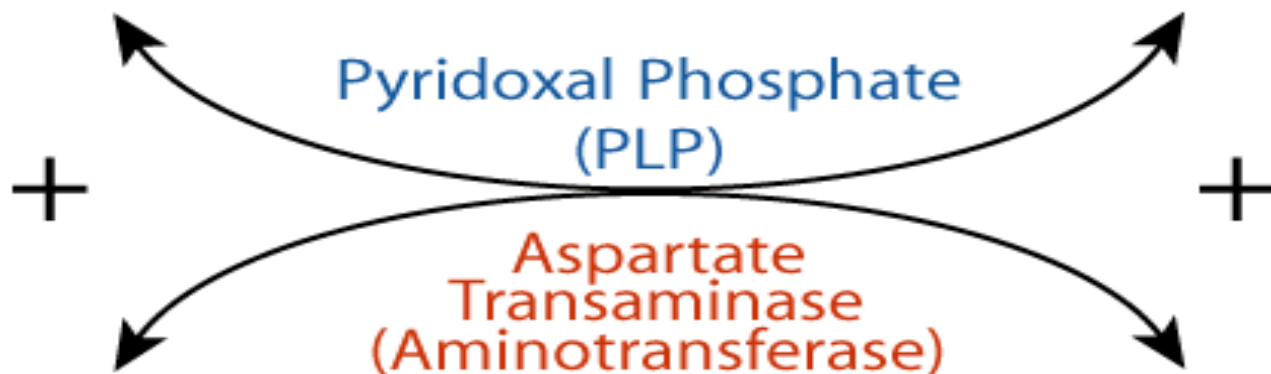
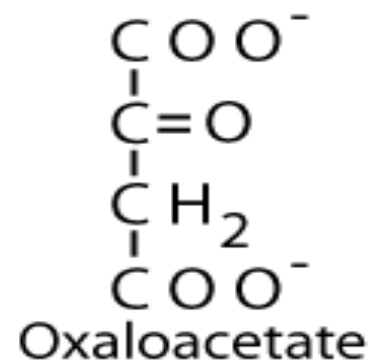
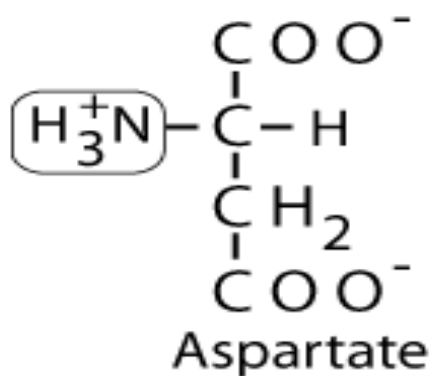
- **General reactions of amino acid metabolism.**
- **Urea cycle**
- **Lipoproteins**

General reactions of amino acid metabolism

1. Transamination

Transamination reactions always have an amino acid and an α -keto acid as substrates. The products of the reaction are also an amino acid (corresponding to the α -keto substrate) and an α -keto acid (corresponding to the amino acid substrate).

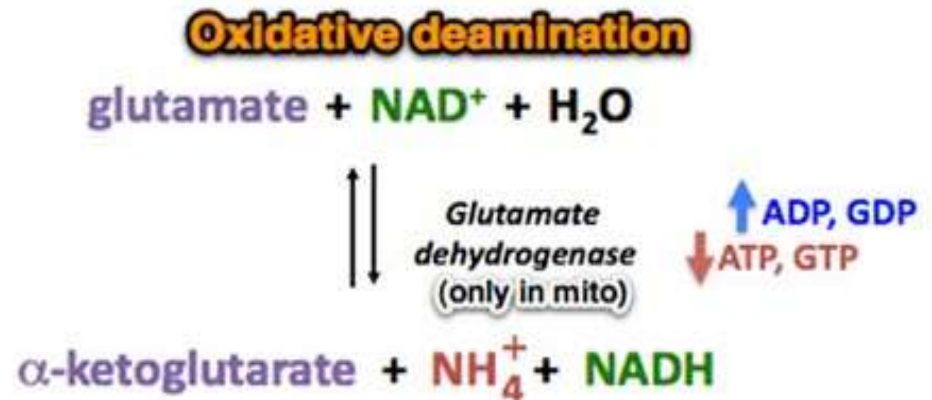
Three amino acid α -keto acid pairs commonly encountered in metabolism are: alanine/pyruvate, aspartate /oxaloacetate, and glutamate/ α -ketoglutarate ..



2. Oxidative Deamination

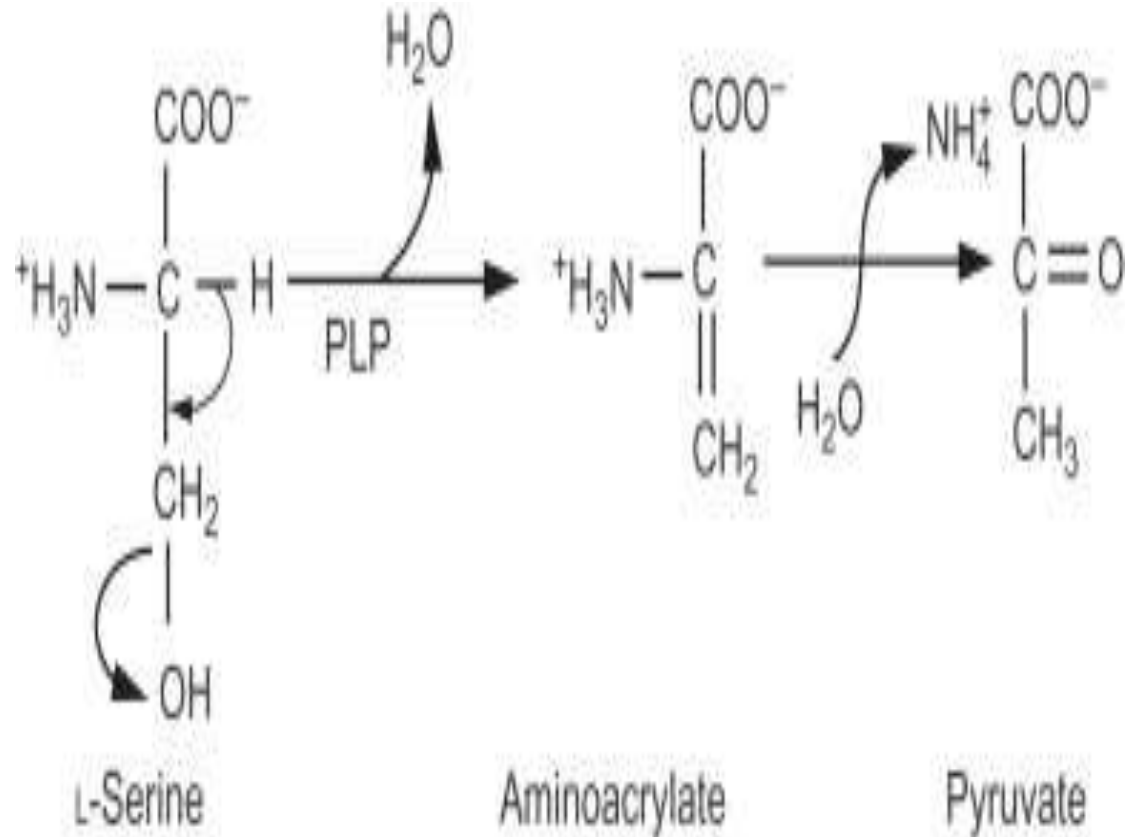
Glutamate is converted to α -ketoglutarate by through oxidative deamination by glutamate dehydrogenase.

Oxidative Deamination

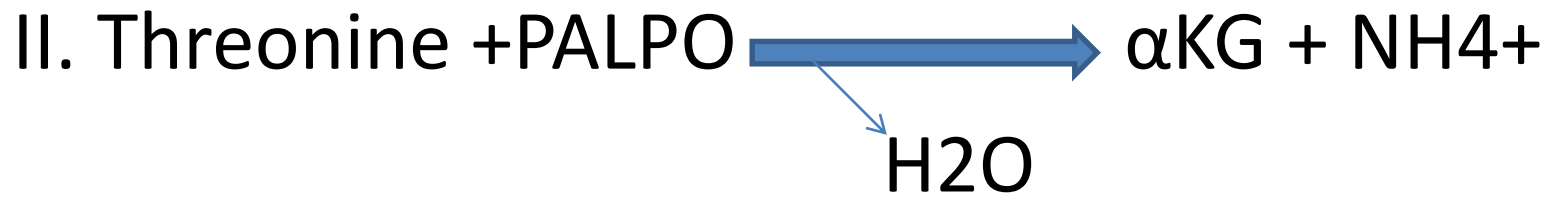


3. Hydrolytic Deamination

- I. Serine is converted to pyruvate by serine dehydrogenase

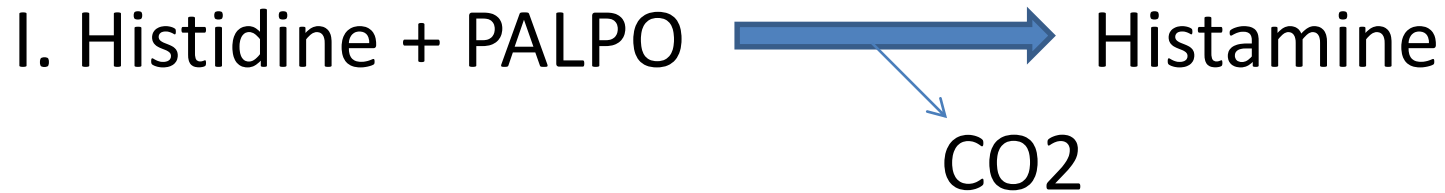


Dehydratase



4. Decarboxylation

Histidine decarboxylase

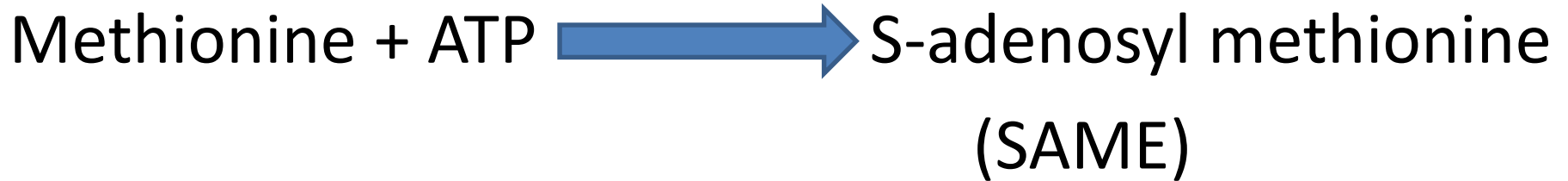


II. Tryptophan to Tryptamine

III. Arginine to Agmatine

5. Transmethylation

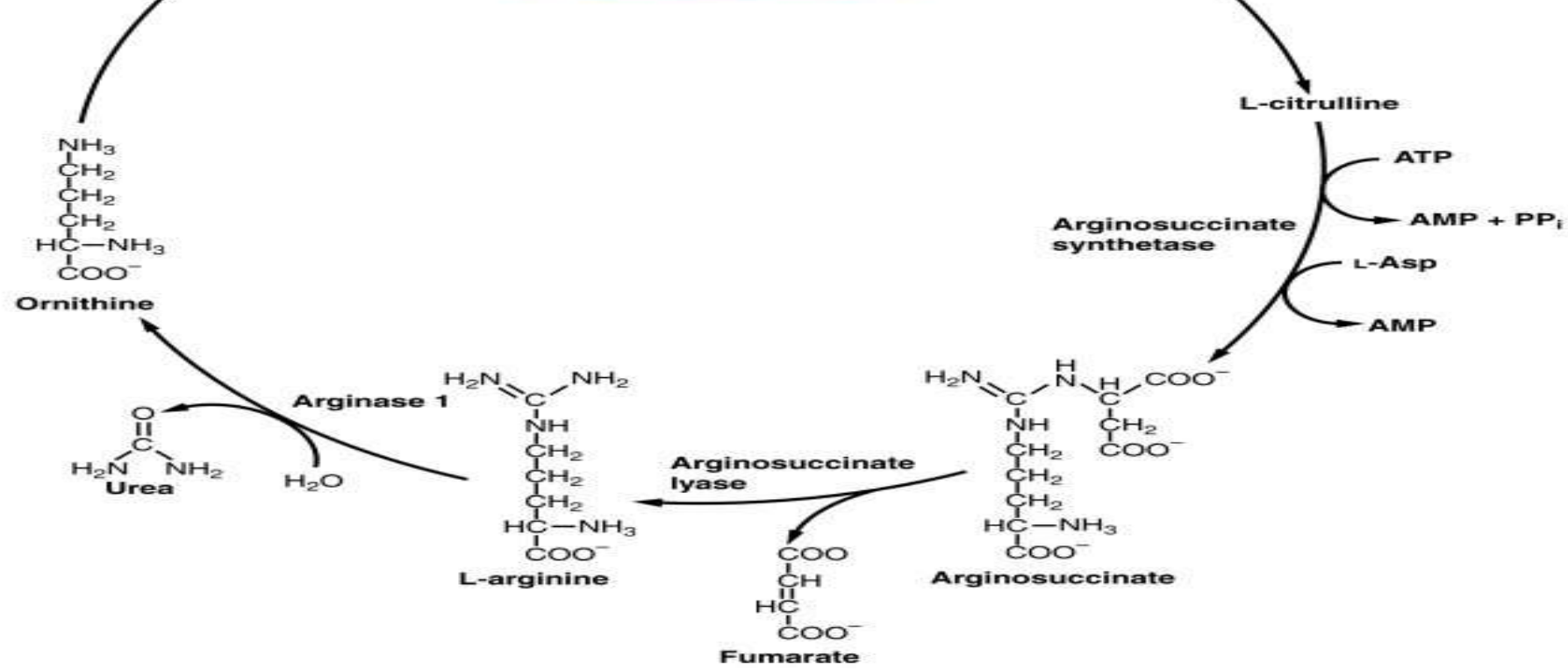
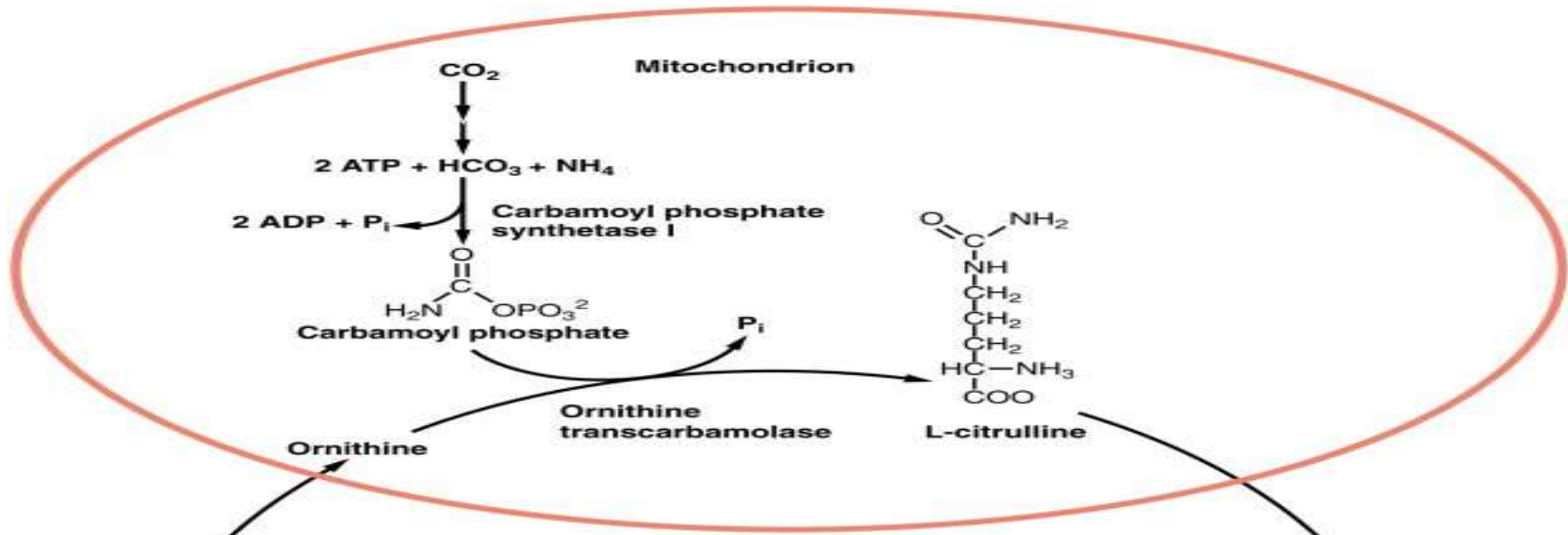
Methionine adenosyl transferase



Uses of SAME:

- i. Phosphatidyl ethalonamine is converted to phosphatidyl choline by using 3 molecules of SAME and phosphatidyl ethalonamine methyl transferase, when dietary choline is insufficient.
- ii. SAME is methyl group donor of biological system.

Urea Cycle



LIPOPROTEIN

Lipoproteins

- **Definition:** Lipoproteins are lipids combined with proteins in the tissues. The lipid component is phospholipid, cholesterol or triglycerides. The holding bonds are secondary bonds.
- They include:
 1. **Structural lipoproteins:**

These are widely distributed in tissues being present in cellular and subcellular membranes. In lung tissues acting as a surfactant in a complex of a protein and lecithin. In the eye, rhodopsin **of rods** is a lipoprotein complex.
 - **Transport lipoproteins:**

These are the forms present in blood plasma. They are composed of a protein called **apolipoprotein** and different types of lipids. (Cholesterol, cholesterol esters, phospholipids and triglycerides). As the lipid content increases, the density of plasma lipoproteins decreases

Types of Lipoprotein

(all contain characteristic amounts TAG, cholesterol, cholesterol esters, phospholipids and Apoproteins - NMR Spectroscopy)

Class	Diameter (nm)	Source and Function	Major Apolipoproteins
Chylomicrons (CM)	500 Largest	Intestine. Transport of <u>dietary</u> TAG	A, B48, C(I,II,III) E
Very low density lipoproteins (VLDL)	43	Liver. Transport of <u>endogenously</u> synthesised TAG	B100, C(I,II,III) , E
Low density lipoproteins (LDL)	22	Formed in circulation by partial breakdown of IDL. Delivers cholesterol to peripheral tissues	B100
High density lipoproteins (HDL)	8 Smallest	Liver. Removes "used" cholesterol from tissues and takes it to liver. Donates apolipoproteins to CM and VLDL	A, C(I,II,III), D, E

Increasing density



Particle	Chol	Trig	Function
Chylomicrons	+	++++	Transport of dietary (exogenous) triglycerides from gut to peripheral tissues.
VLDL	+	++++	Transport of triglycerides synthesised in the liver (endogenous) to peripheral tissues.
Chylomicron Remnant (CR)	+++	+++	Derived from chylomicrons. Usually rapidly cleared by the liver.
IDL	+++	+++	Derived from VLDL. Usually rapidly cleared by the liver or converted to LDL
LDL	+++++	+	Derived from IDL. Transport of cholesterol and fat soluble vitamins to peripheral tissues.
HDL	++++	+	Reverse transport of cholesterol from peripheral tissues to the liver; antioxidant

Major Lipoproteins and their function

- Chylomicrons:
 - Chylomicrons transport triglycerides from intestine
- Very Low Density Lipoproteins (VLDL) and Intermediate Density Lipoproteins (IDL) :
 - VLDL produced in liver . Carry cholesterol and triglycerides
- Low Density Lipoproteins (LDL)
 - LDL result from metabolism of VLDL and IDL and carry cholesterol. LDL are important cause of heart disease
- High Density Lipoproteins(HDL)
 - □HDL is “good” cholesterol. It removes cholesterol and protects against heart disease



Ultracentrifugation



Lipo-
proteins
(density g/L)

Chylomicron

VLDL

IDL

LDL

HDL

FFA

Electrophoresis

Negative



Lipo-
proteins
(mobility)

Chylomi-
cron (origin)

LDL (beta)

IDL (broad β)

VLDL (pre- β)

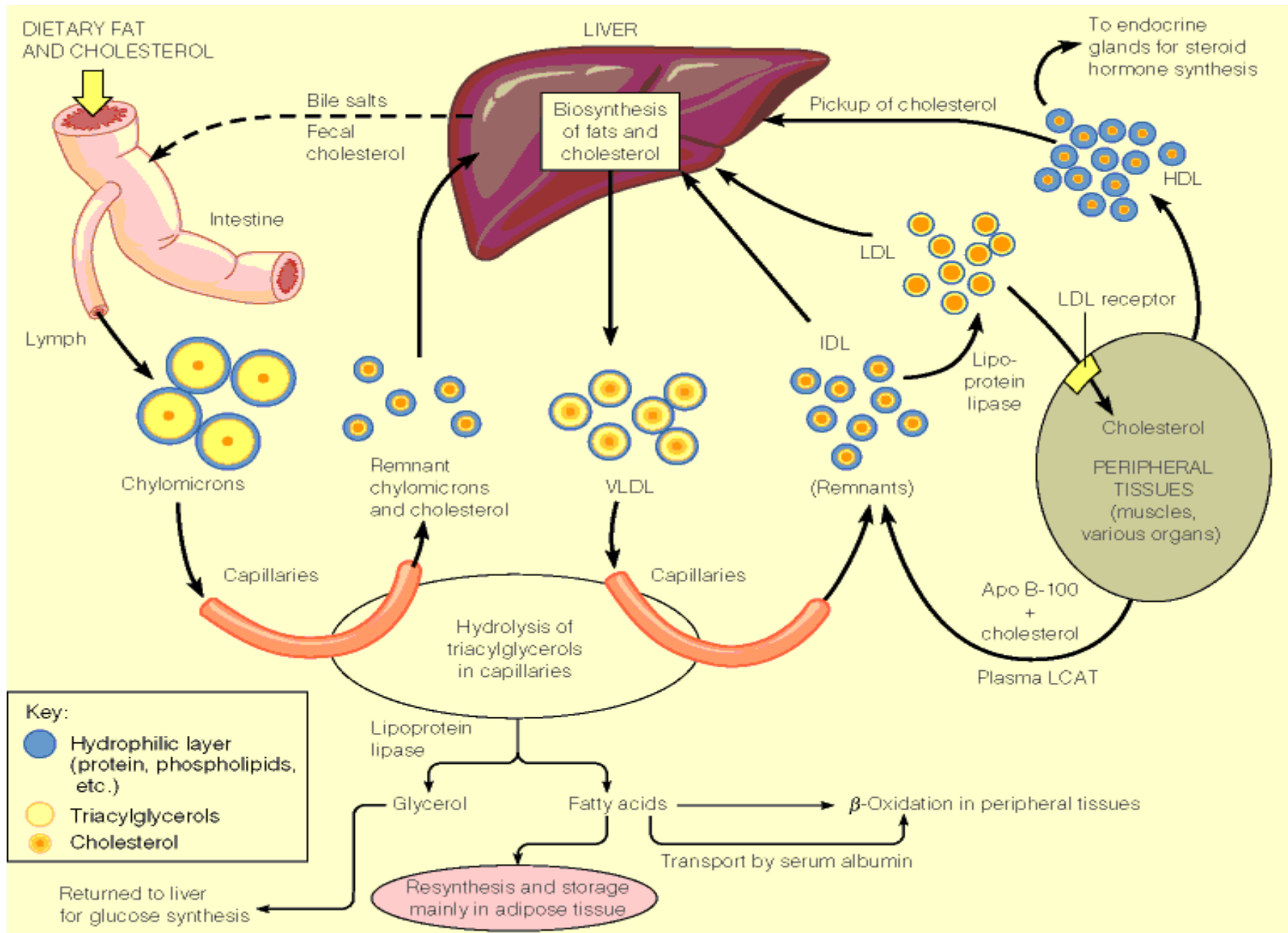
HDL (alpha)

FFA-albumin

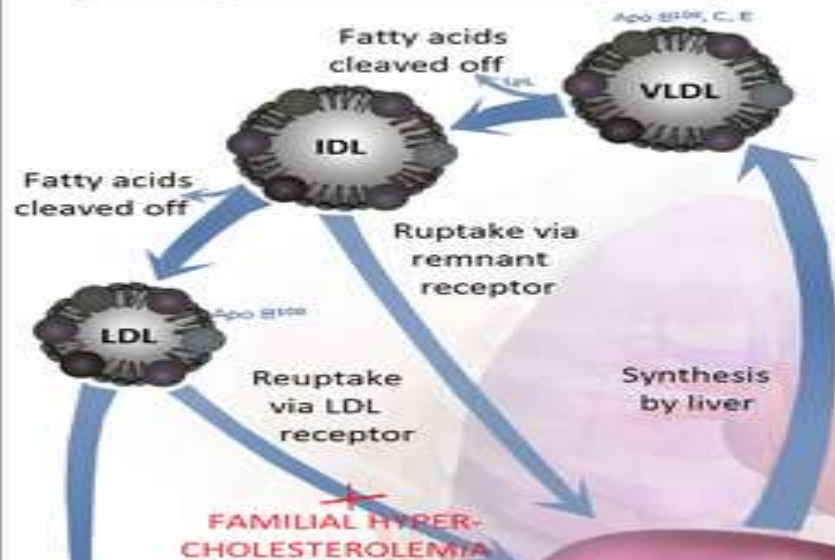
Positive

There are many types of apolipoproteins

Apoprotein	Lipoproteins	Function(s)
Apo B-100	VLDL, IDL, LDL	<ol style="list-style-type: none"> 1) Secretion of VLDL from liver 2) Structural protein of VLDL, IDL, and HDL 3) Ligand for LDL receptor (LDLR)
Apo B-48	Chylomicrons, remnants	Secretion of chylomicrons from intestine
Apo E	Chylomicrons, VLDL, IDL, HDL	Ligand for binding of IDL & remnants to LDLR
Apo A-I	HDL, chylomicrons	<ol style="list-style-type: none"> 1) Major structural protein of HDL 2) Activator of LCAT
Apo A-II	HDL, chylomicrons	Unknown
Apo C-I	Chylomicrons, VLDL, IDL, HDL	Activation of LCAT
Apo C-II	Chylomicrons, VLDL, IDL, HDL	Activator of LPL
Apo C-III	Chylomicrons, VLDL, IDL, HDL	Inhibitor of LPL activity



Endogenous Pathway (LDL)

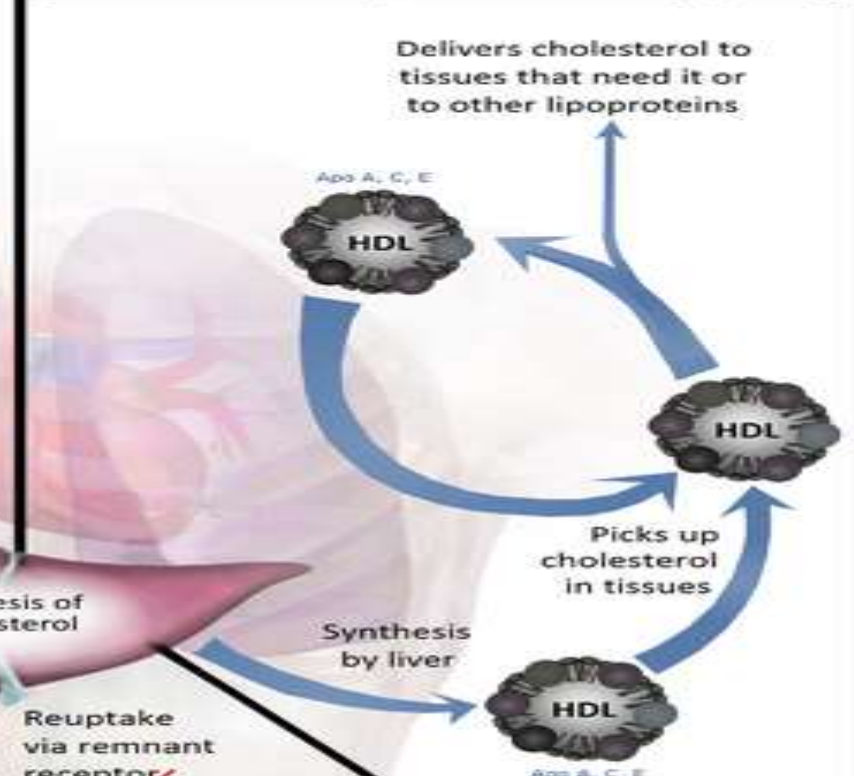


FAMILIAL HYPERCHOLESTEROLEMIA

A residual fraction of LDLs bind low affinity scavenger receptors on macrophages and are phagocytized.

These turn to foam cells and deposit in atherosclerotic plaques.

Reverse Transport Pathway (HDL)



FAMILIAL DYSBETALIPOPROTEINEMIA

Exogenous Pathway (chylomicrons)

Dietary triglycerides, phospholipids and cholesterol absorbed into enterocytes of the small bowel

