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OF SCIENCE
Masaryk University

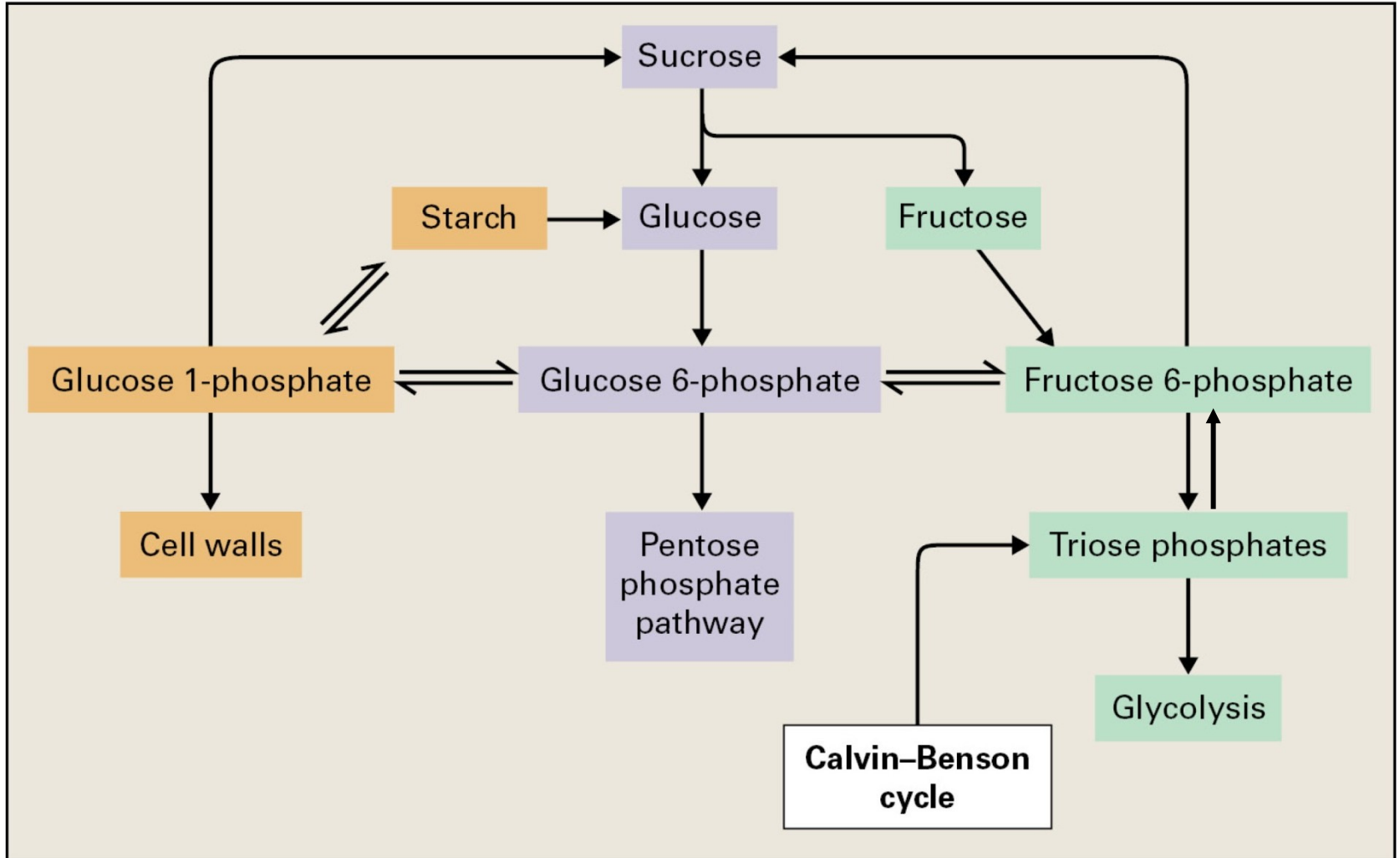


Carbohydrate and lipid metabolism



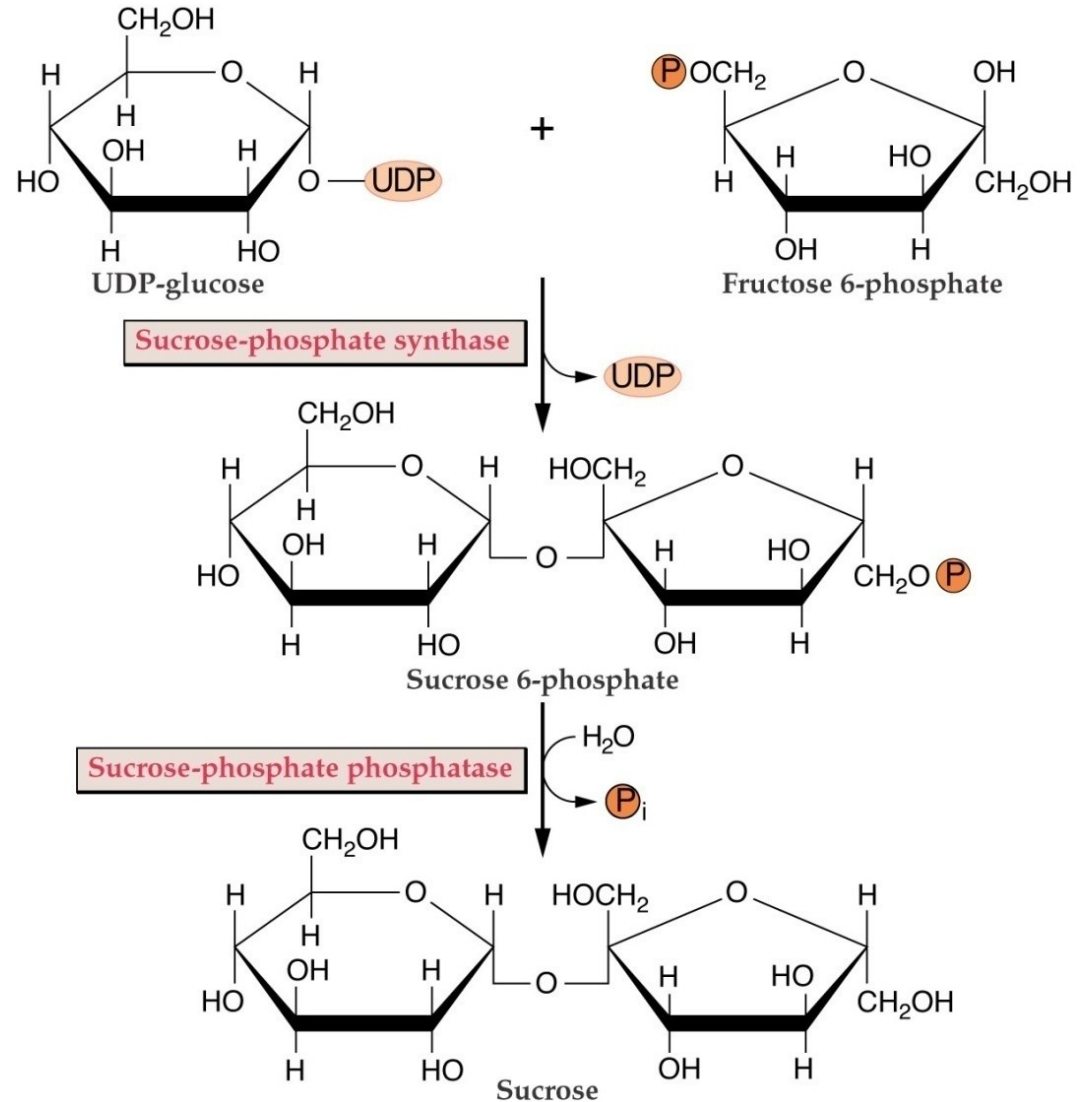
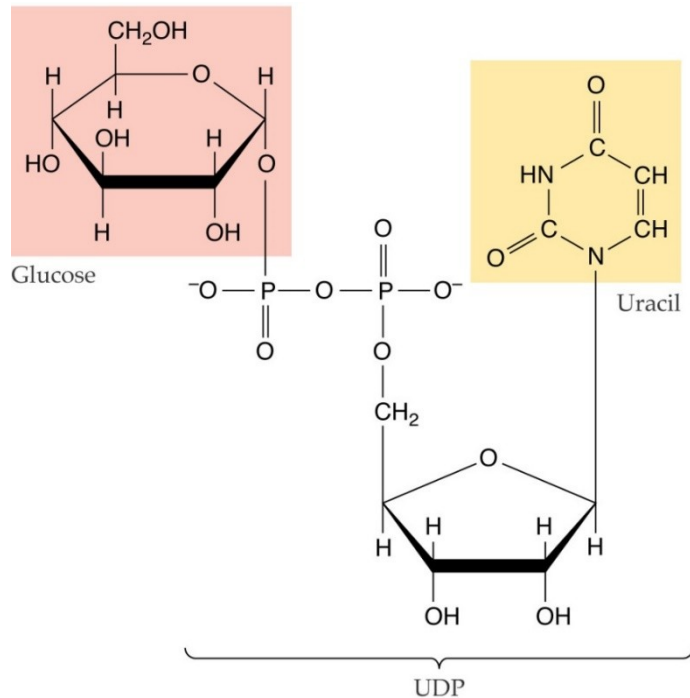
Katerina Dadakova, Department of Biochemistry

Figures adopted from Buchanan et al., Biochemistry & molecular biology of plants

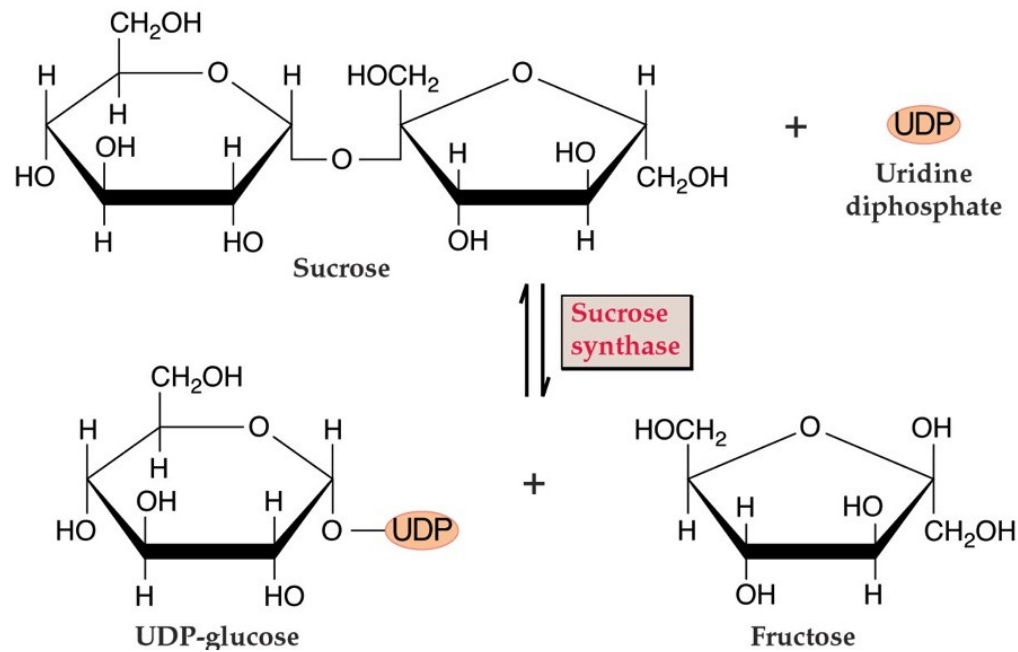
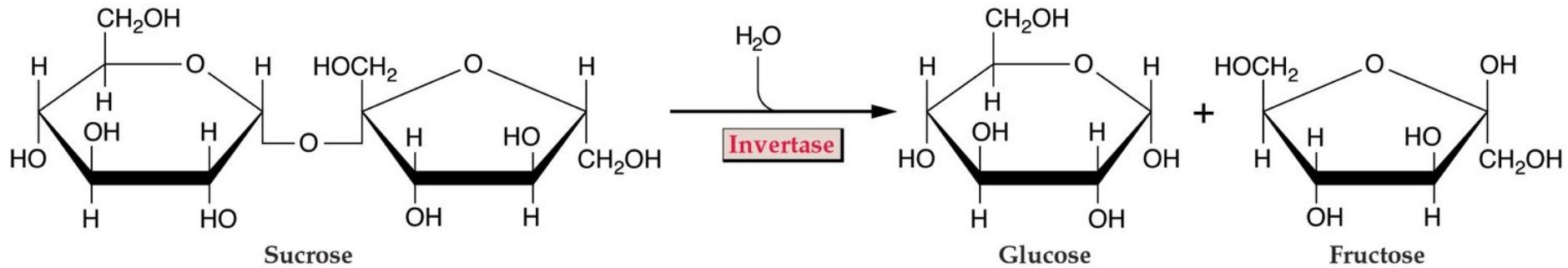


Sucrose synthesis

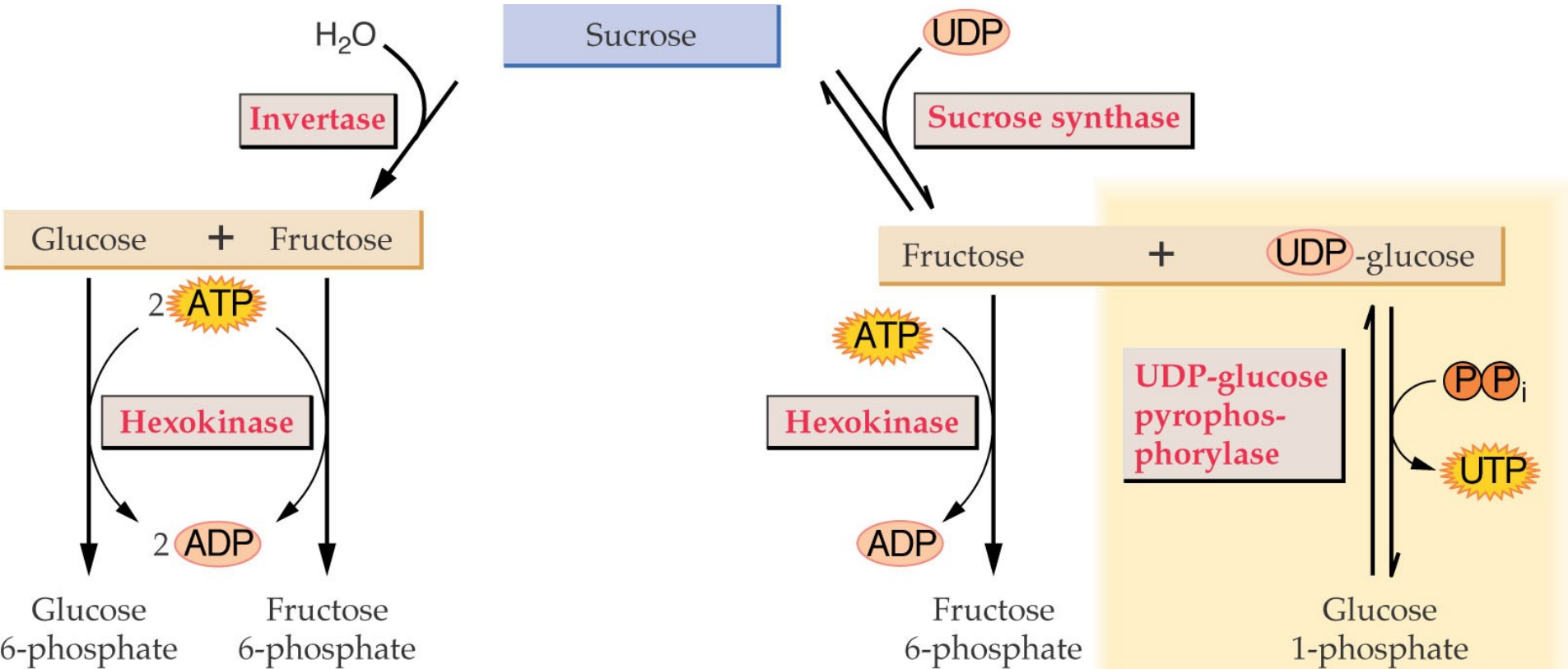
UDP-glucose



Sucrose degradation



Sucrose degradation

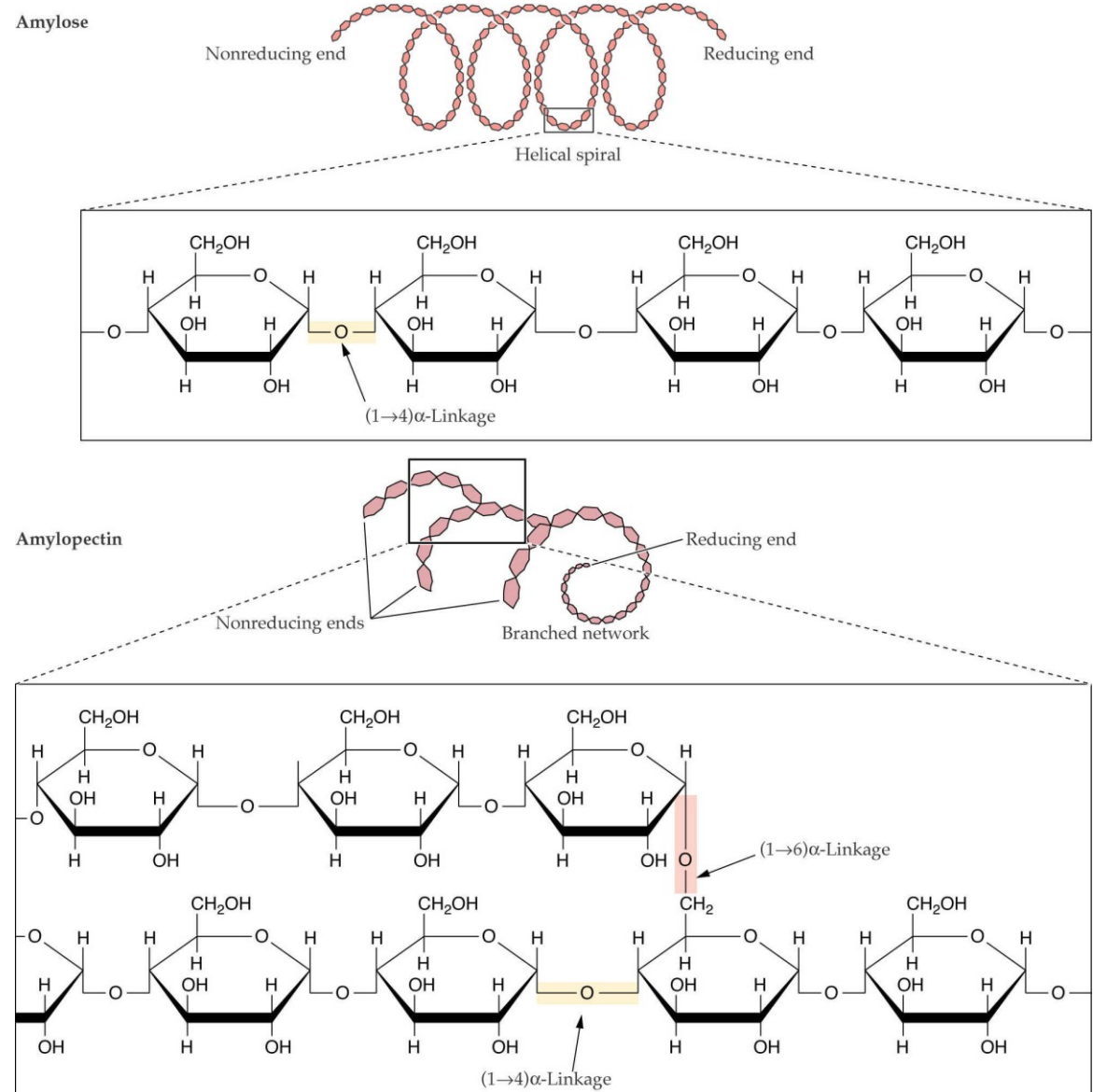


Starch

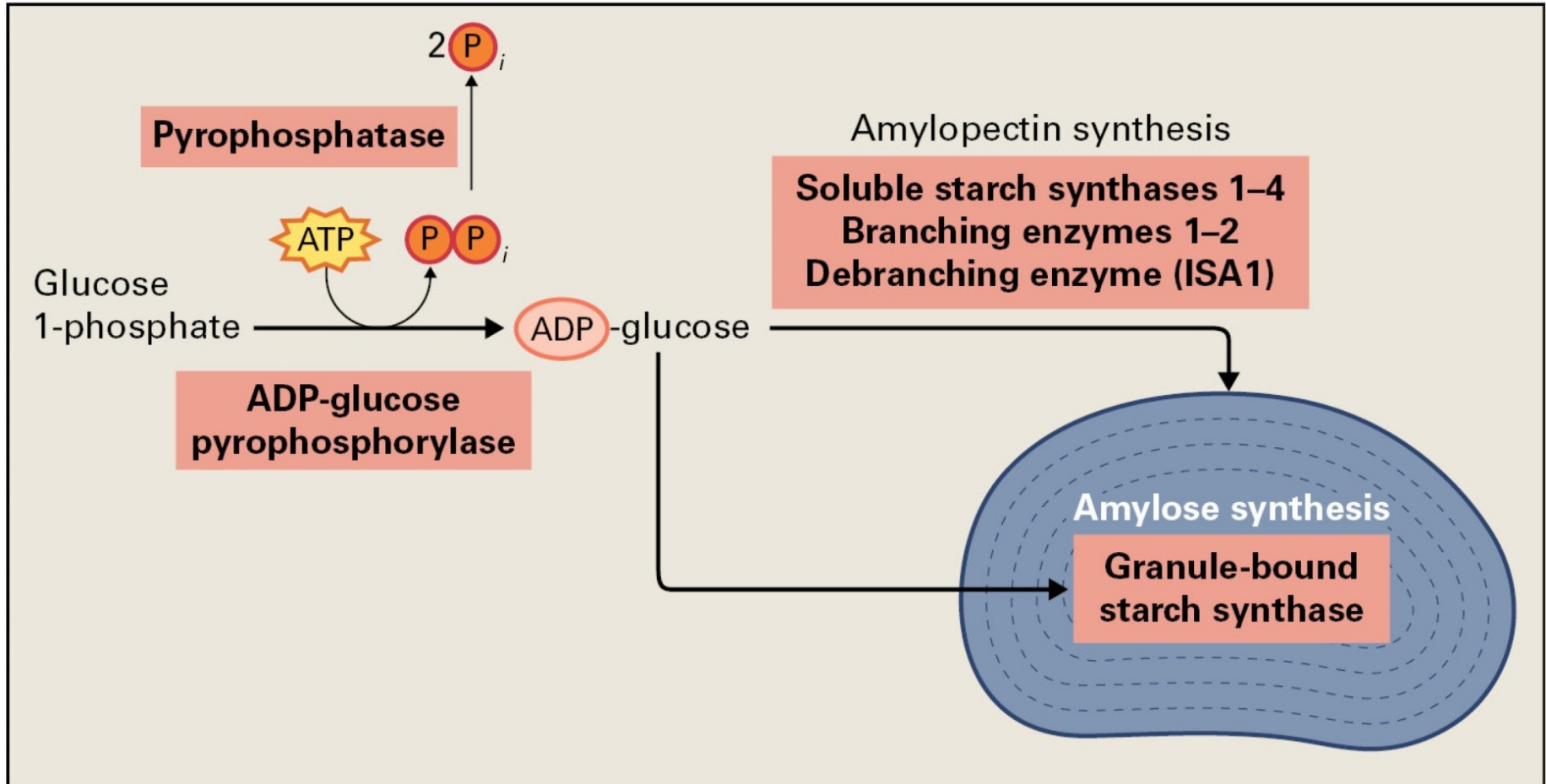
Starch, a polymer of glucose, is synthesized and stored in plastids.

Starch synthesis protects plastids from osmotic disruption.

Starch is organized into grains that grow by adding layers.

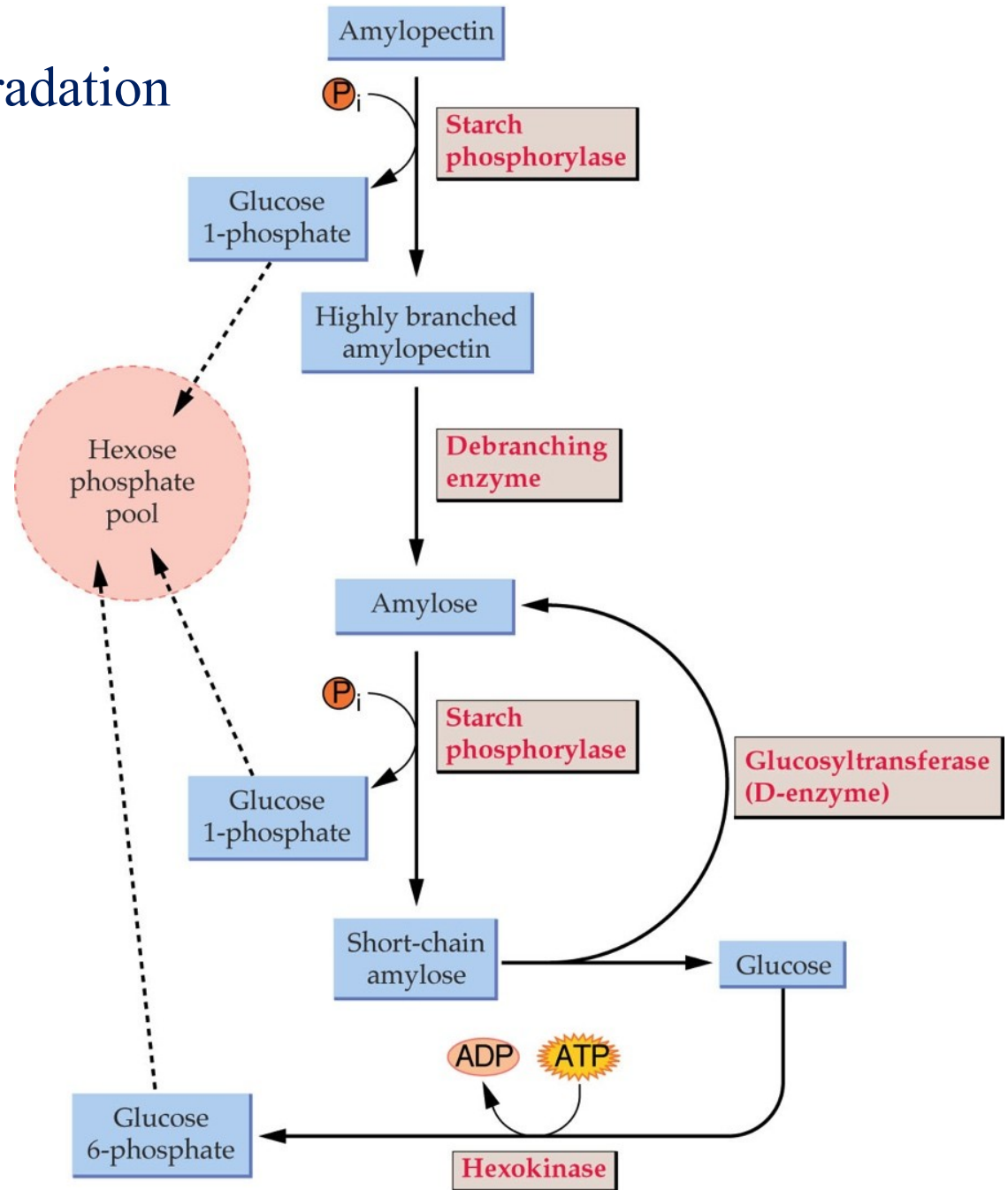


Starch synthesis

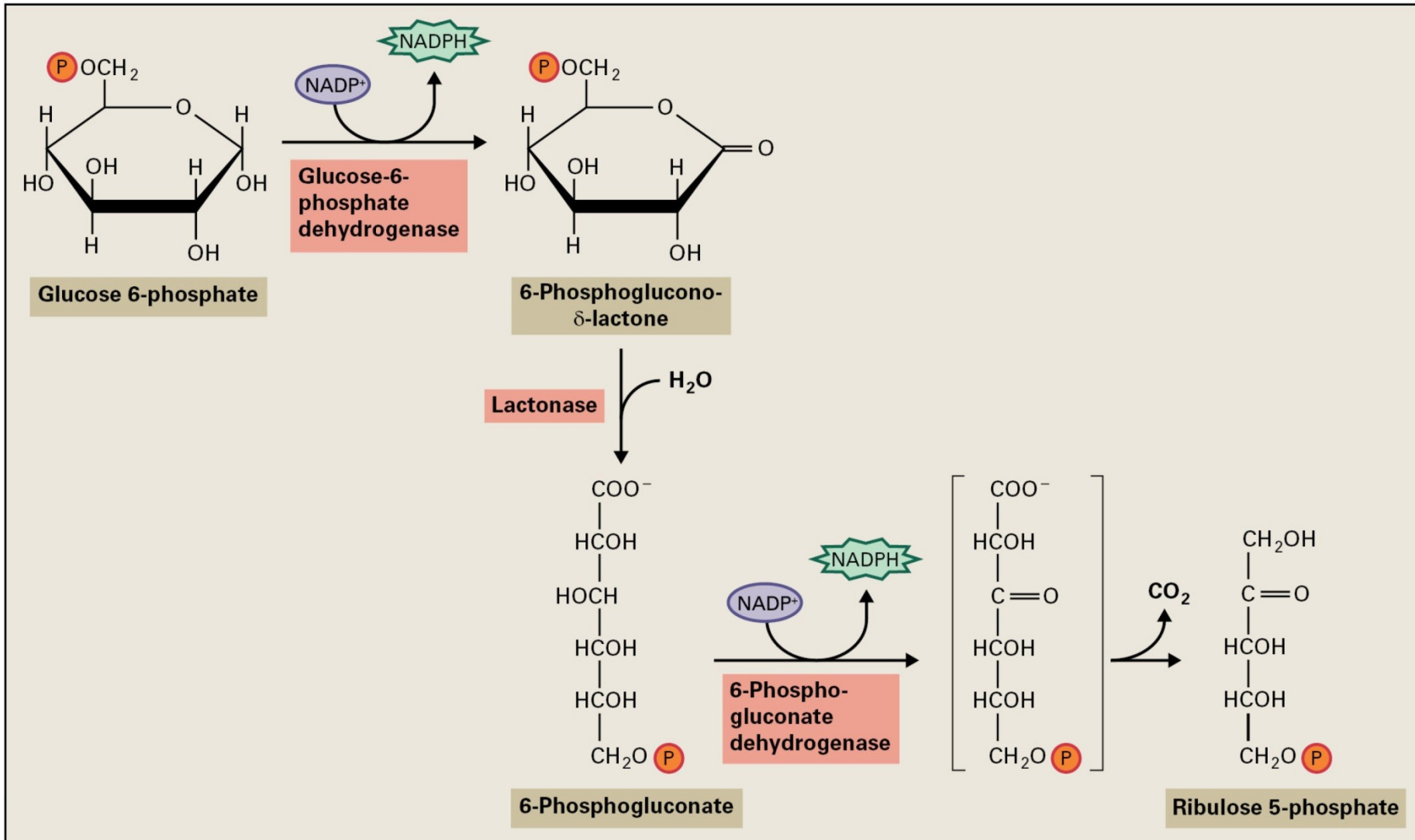




Starch degradation

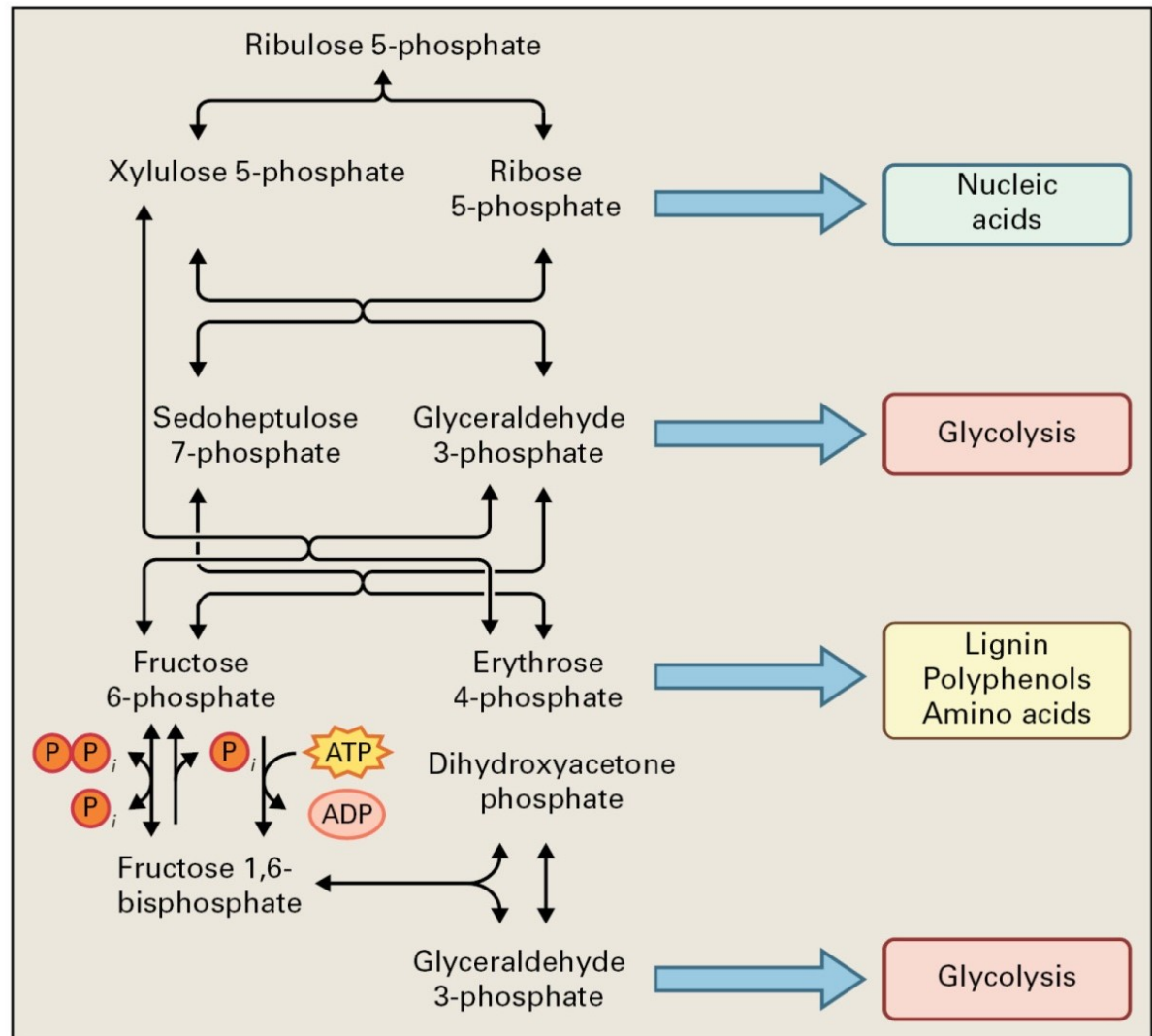


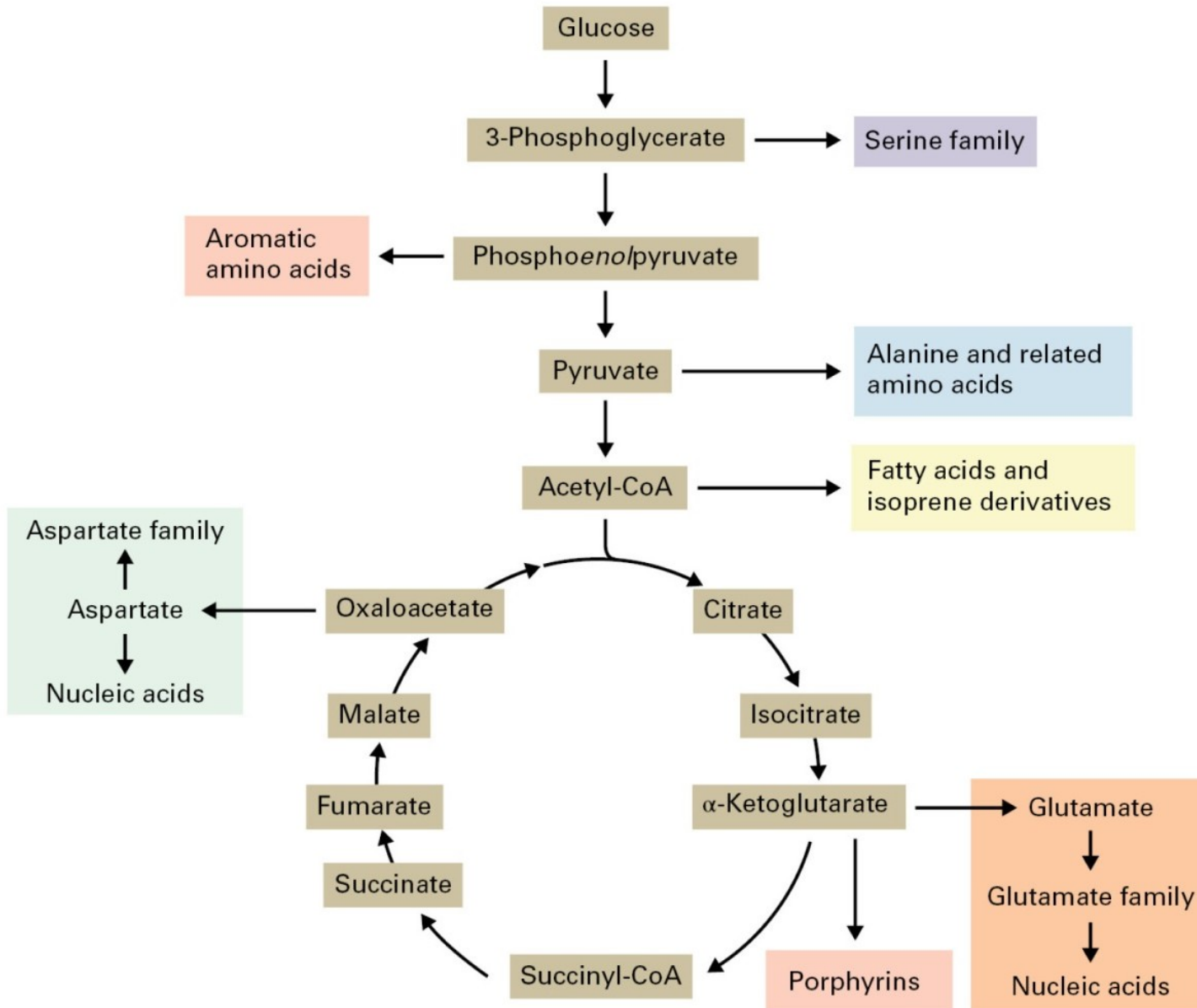
Pentose phosphate pathway – oxidative reactions



Pentose phosphate pathway – reversible reactions

Glycolysis, the pentose phosphate pathway, and various biosynthetic pathways are interconnected in plants



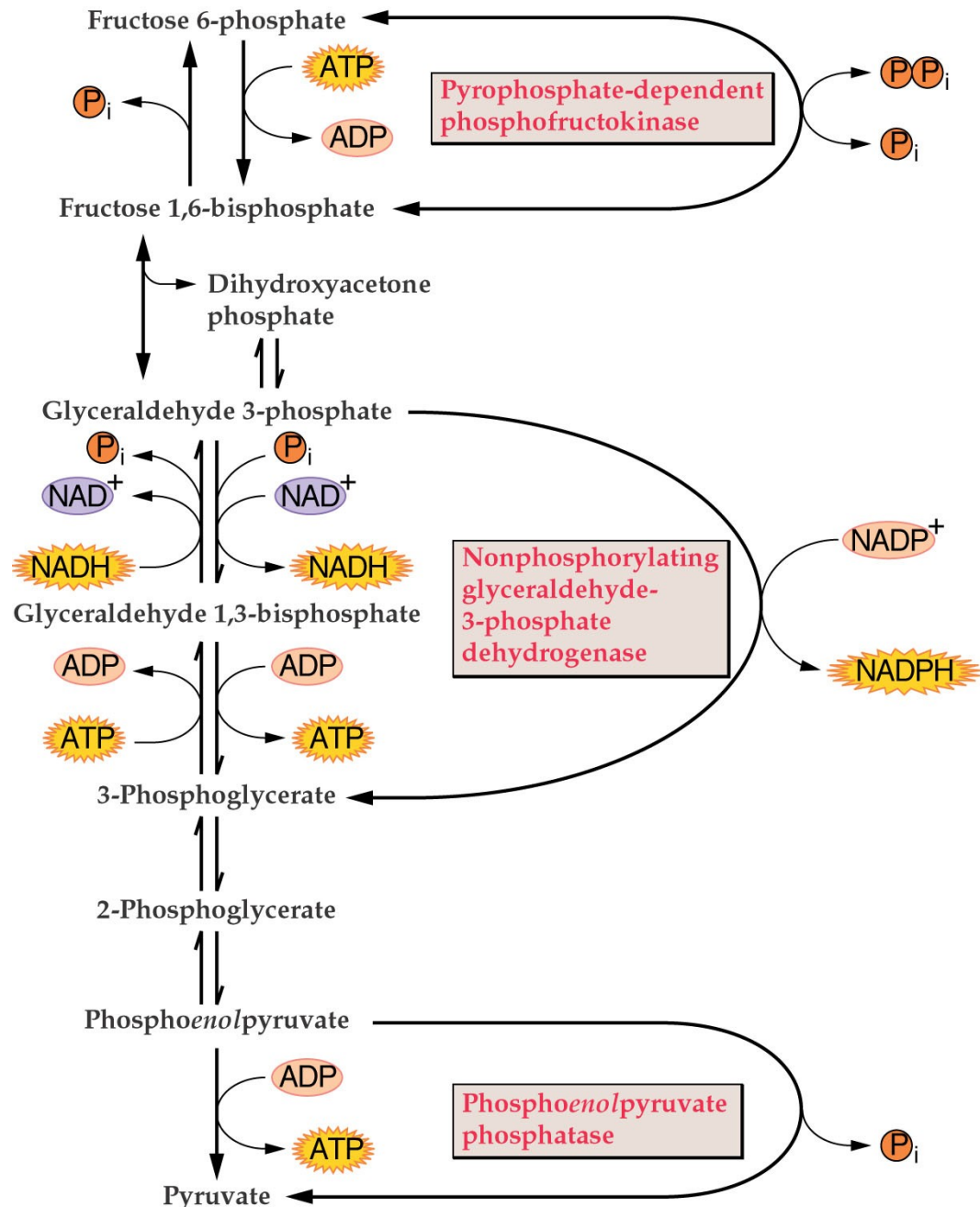


Glycolysis

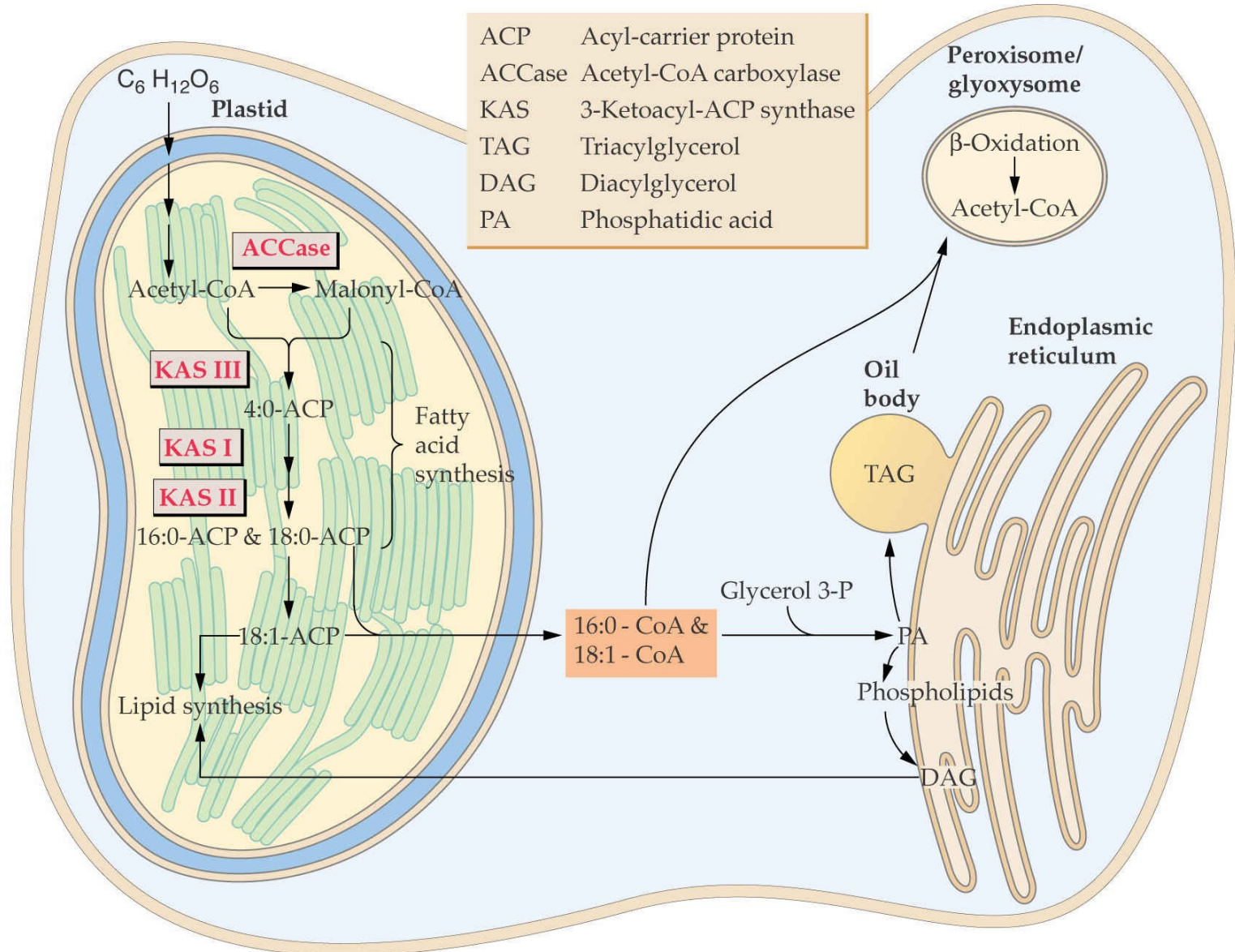
Functions:

- ATP production
- Supply of reducing power
- Funneling carbon for oxidative phosphorylation
- Production of biosynthetic precursors

Bypass reactions give plants metabolic flexibility



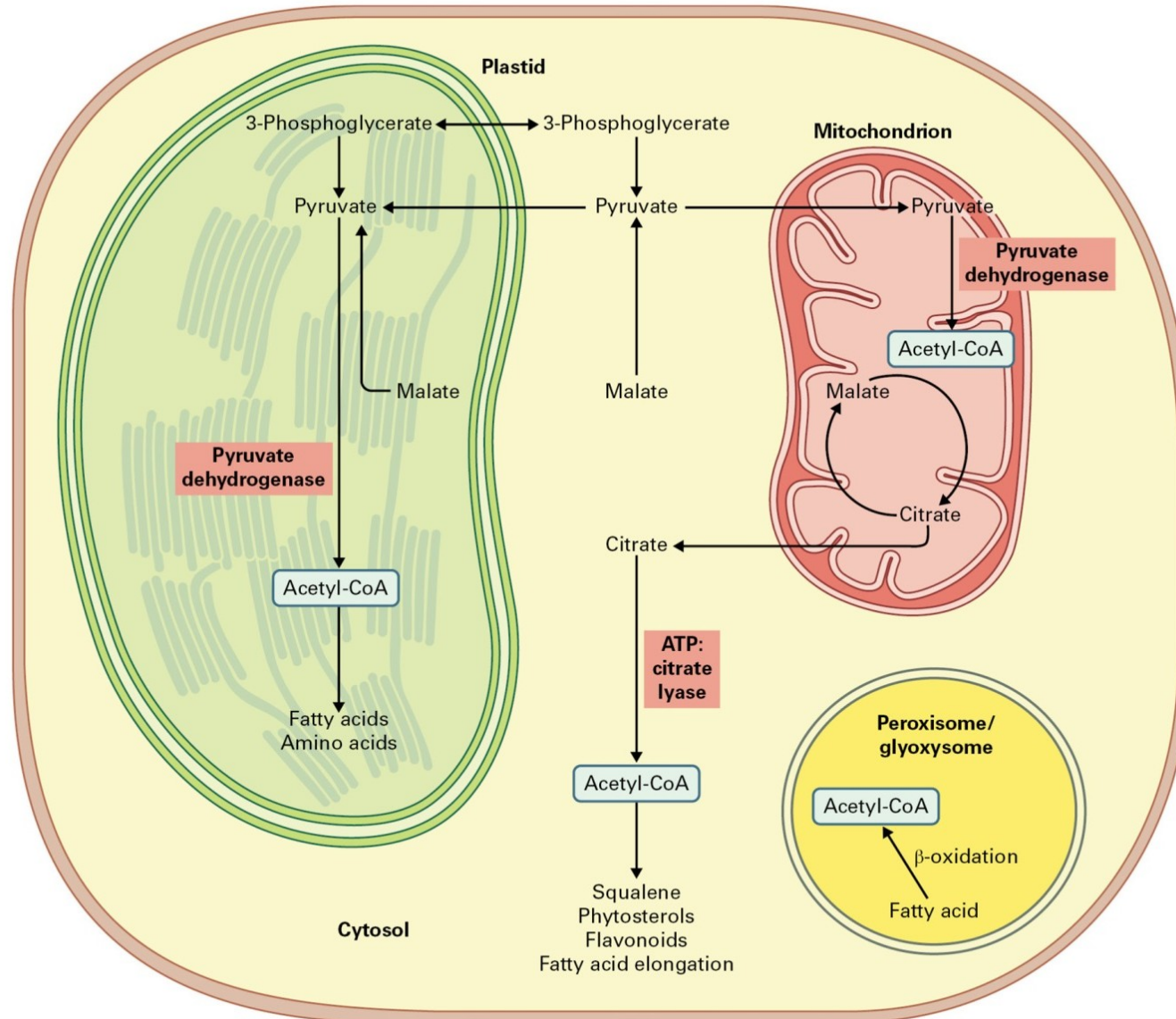
Lipids



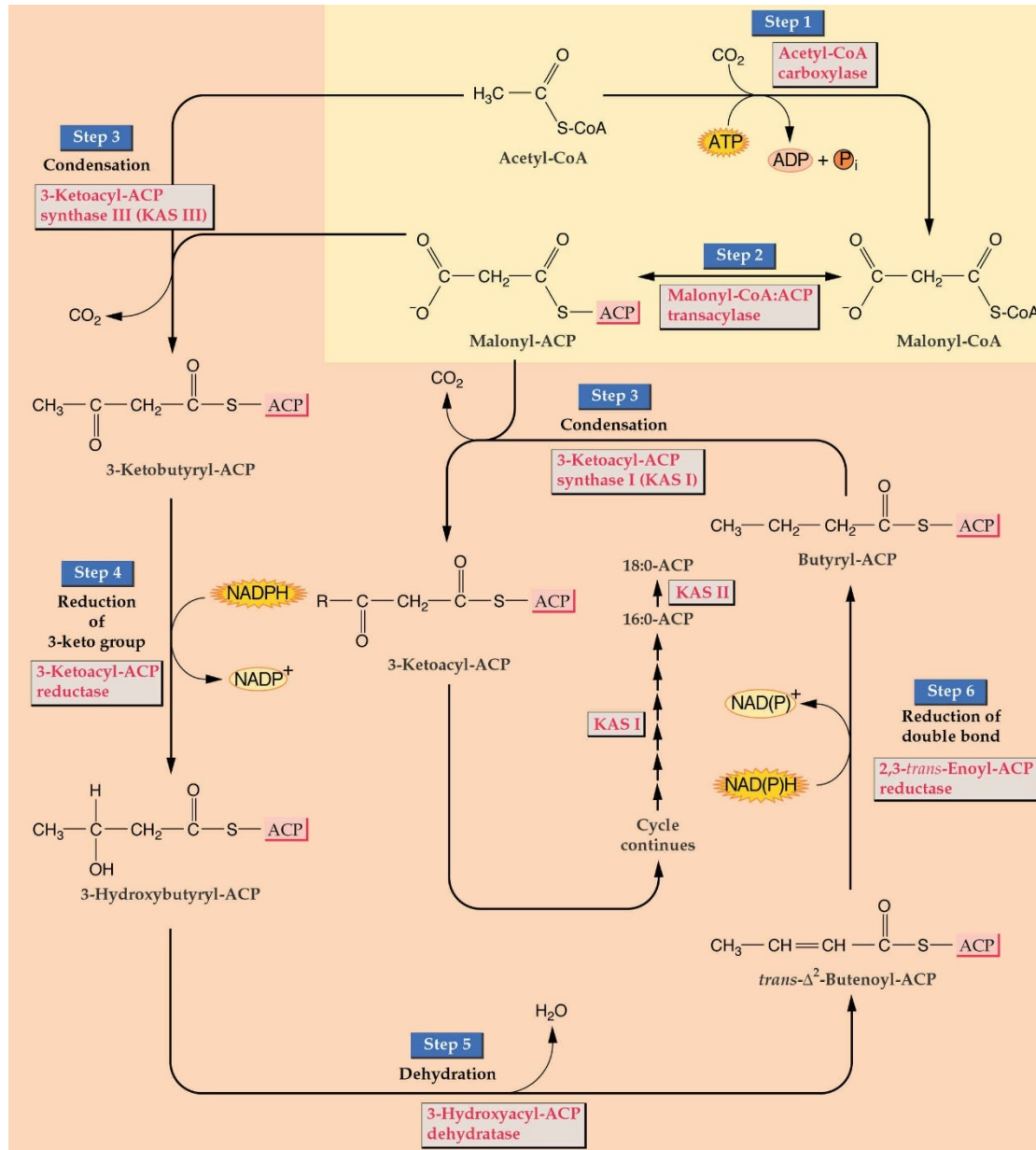
Lipid functions

Function	Lipid types involved ^a
Membrane structural components	Glycerolipids Sphingolipids Sterols
Storage compounds	Triacylglycerols Waxes
Compounds active in electron transfer reactions	Chlorophyll and other pigments Ubiquinone, plastoquinone
Photoprotection	Carotenoids (xanthophyll cycle)
Protection of membranes against damage from free radicals	Tocopherols
Waterproofing and surface protection	Long-chain and very-long-chain fatty acids and their derivatives (cutin, suberin, surface waxes) Triterpenes
Protein modification	
Addition of membrane anchors	
Acylation	Mainly 14:0 and 16:0 fatty acids
Prenylation	Farnesyl and geranylgeranyl pyrophosphate
Other membrane anchor components	Phosphatidylinositol, ceramide
Glycosylation	Dolichol
Signaling	
Internal	Abscisic acid, gibberellins, brassinosteroids 18:3 Fatty acid precursors of jasmonate Inositol phosphates Diacylglycerols
External	Jasmonate Volatile insect attractants
Defense and antifeeding compounds	Essential oils Latex components (rubber, etc.) Resin components (terpenes)

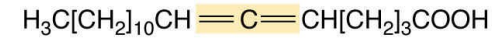
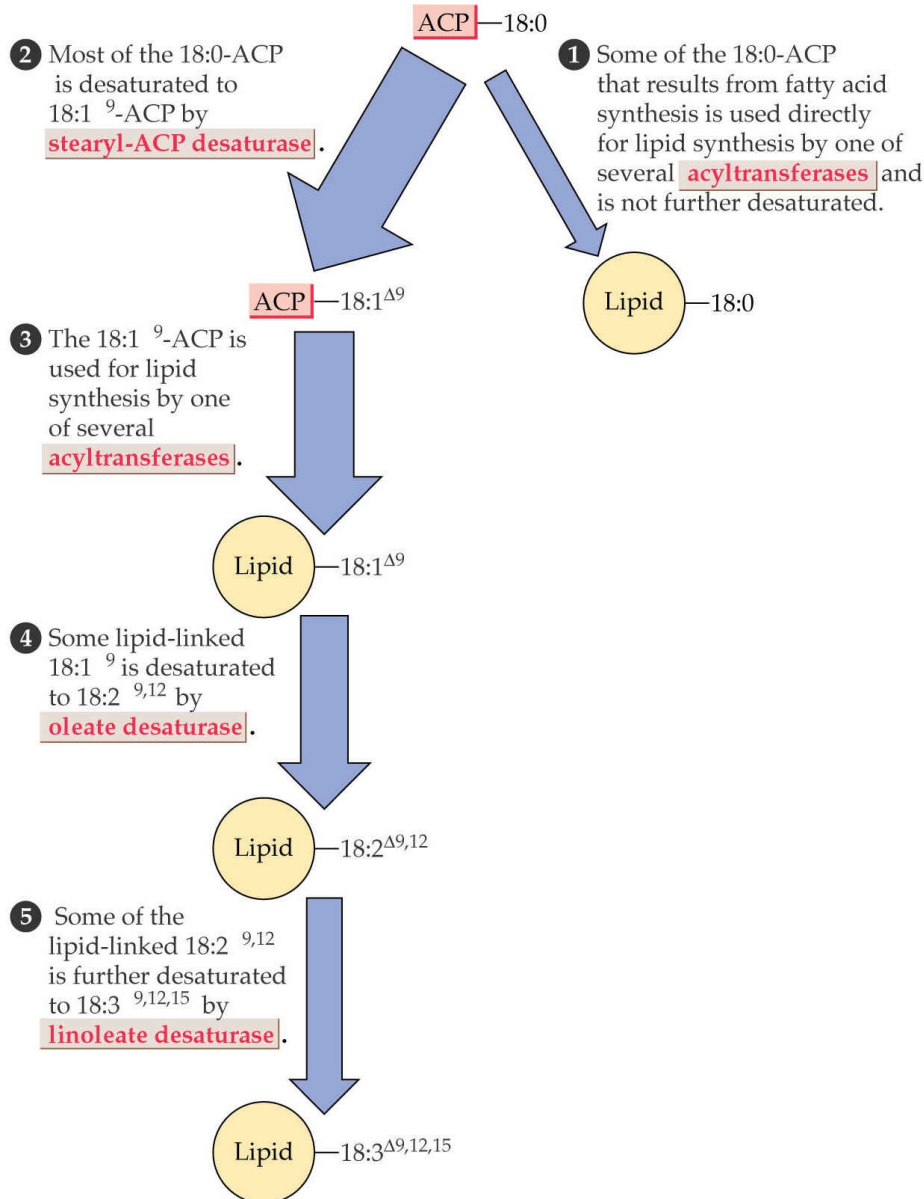
The central role of acetyl-CoA in metabolism



Fatty acid synthesis



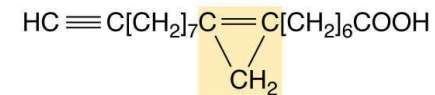
Fatty acid synthesis



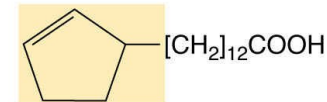
Laballic acid, an allenic acid



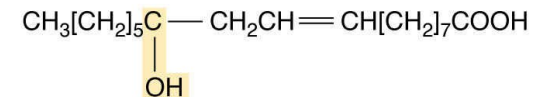
Stearolic acid, a monoacetylenic acid



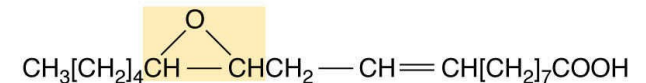
Sterculynic acid, a cyclopropene-containing acid



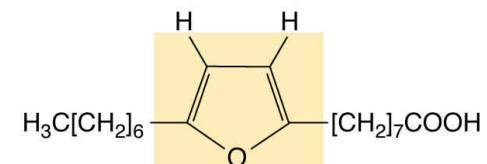
Chaulmoogric acid, a cyclopentenyl acid



Ricinoleic acid, a hydroxy fatty acid

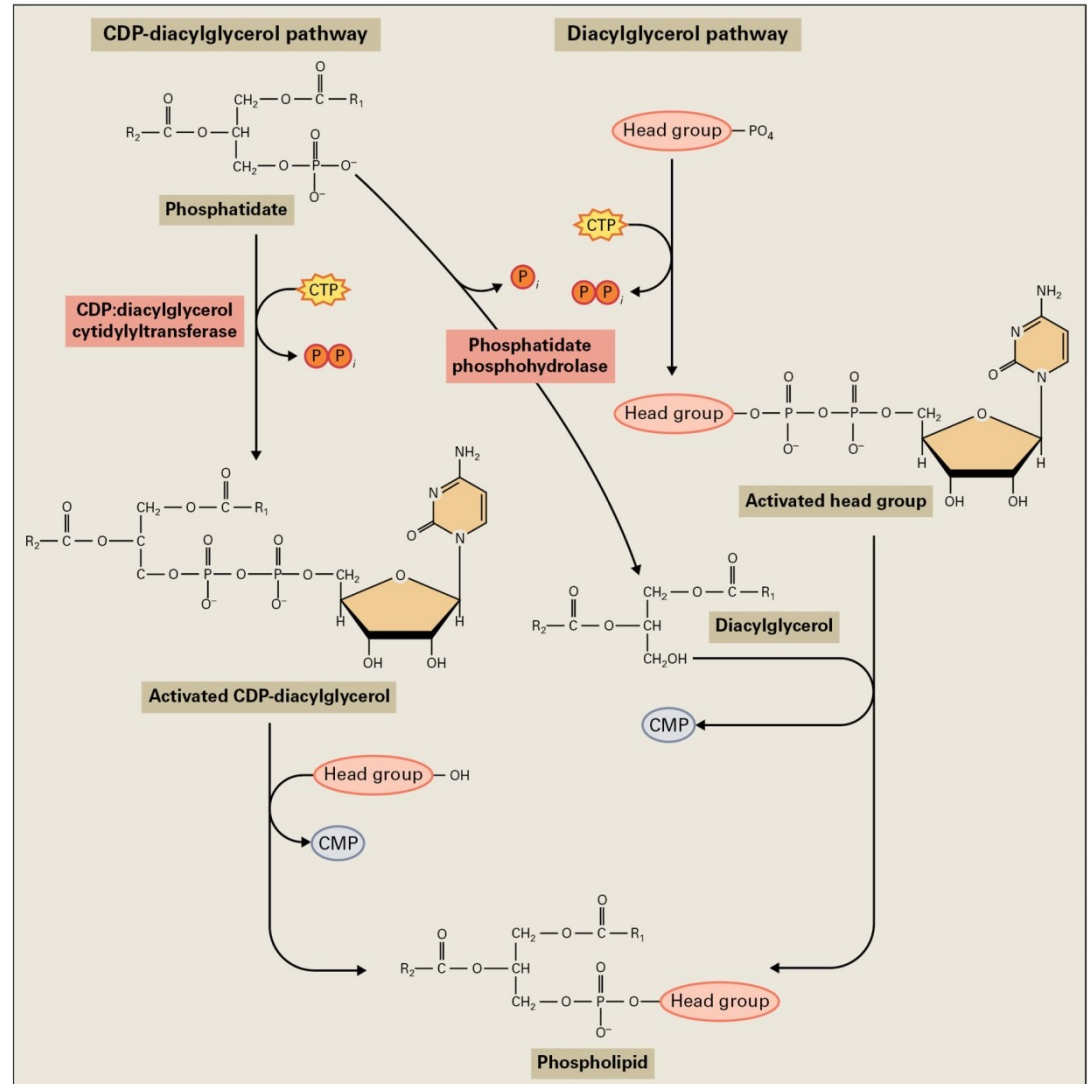
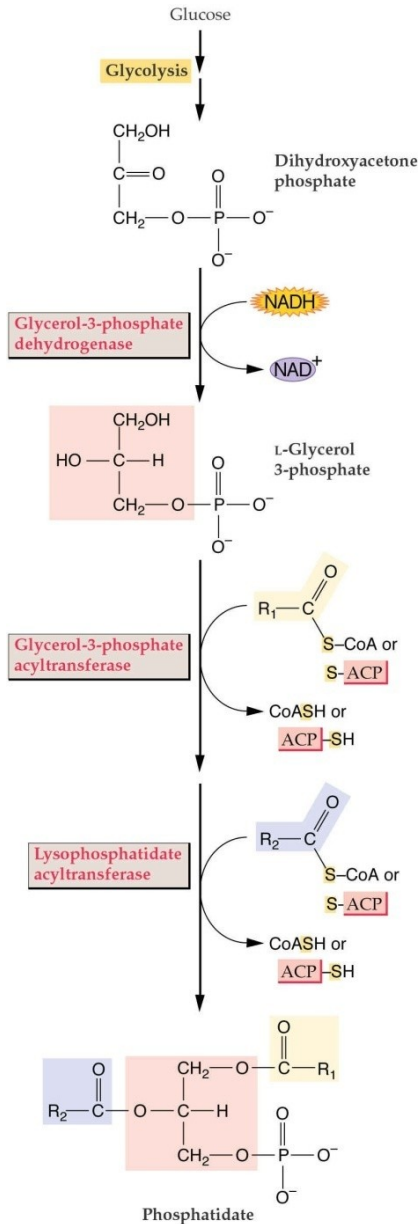


Vernolic acid, an epoxy fatty acid

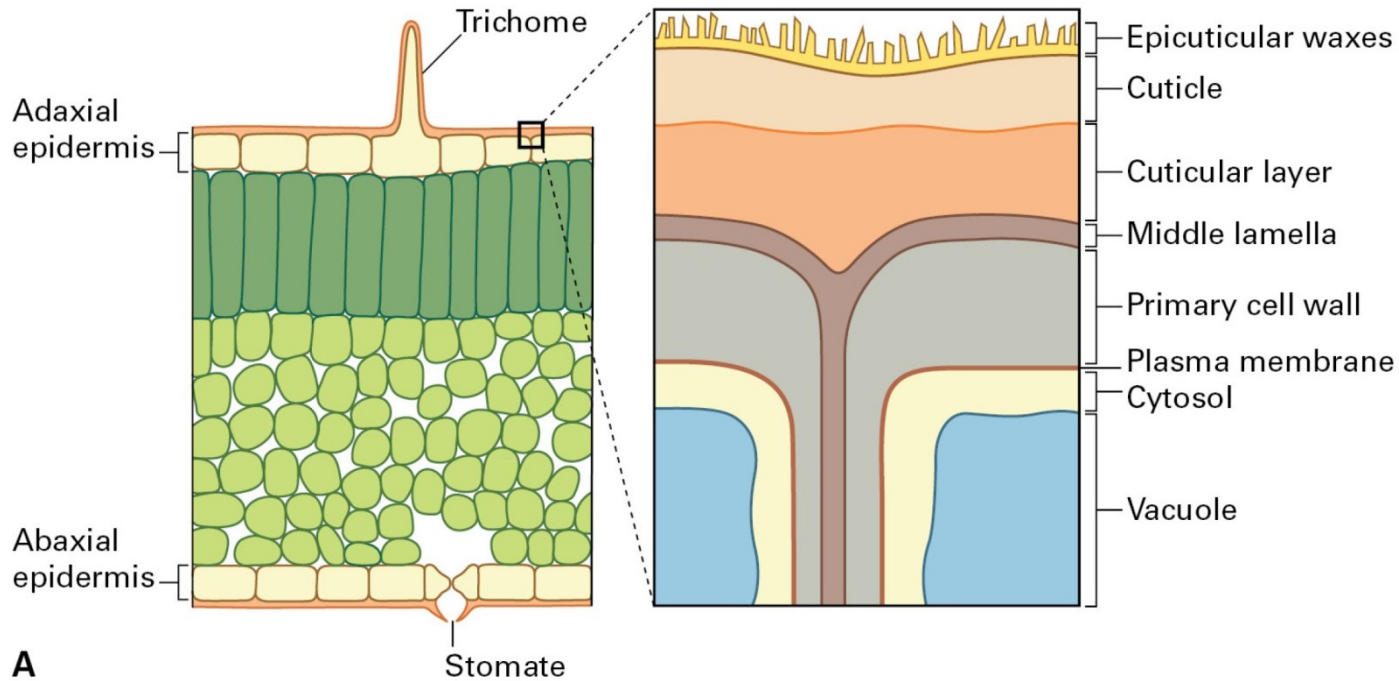


A furan-containing fatty acid

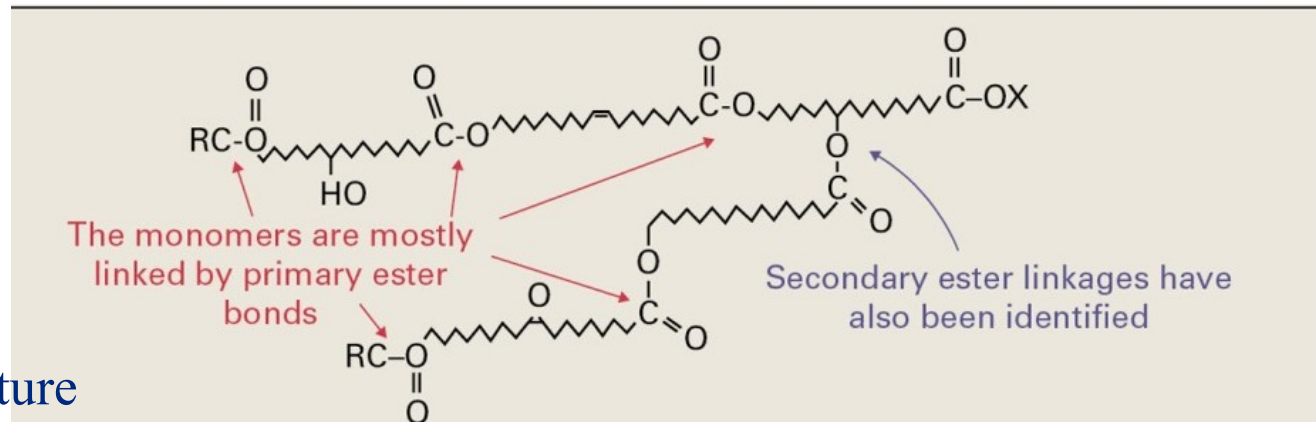
Membrane lipids



Structural lipids

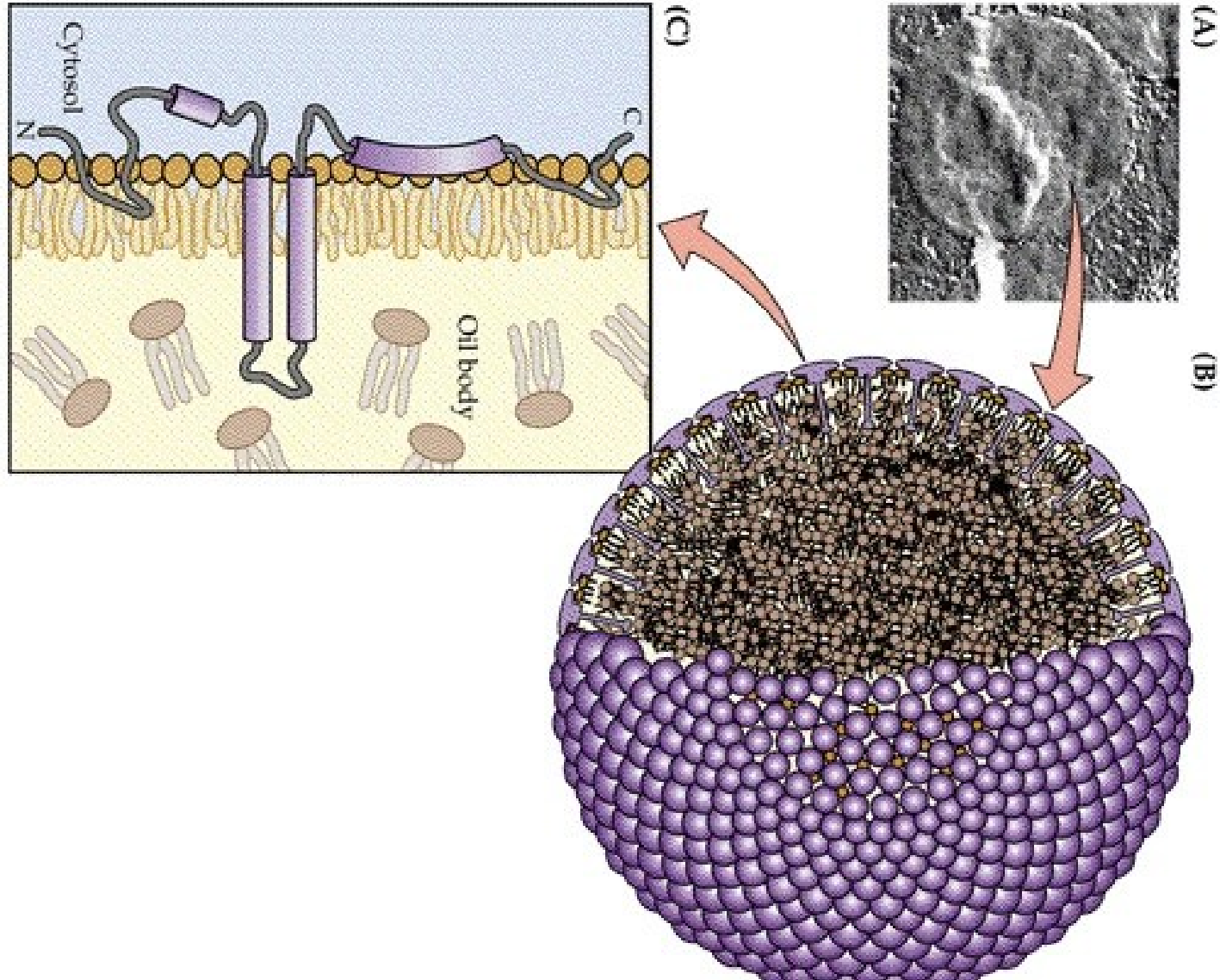


A



Cutin structure

Storage lipids



Genetic engineering of lipids

