TRIGLYCERIDE
(TRIACYLGLYCEROL)
DEGRADATION

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MOBILIZATION OF STORED FATS

- FAs stored primarily within adipocytes of adipose tissue in the form of neutral triacylglycerols serve as the body’s major fuel storage reserve.

- **Triacylglycerols** are the form in which we store reduced C for energy.

- In response to energy demands by peripheral tissues, FAs must be released from storage as triacylglycerols.
Each triacylglycerol has

- a glycerol backbone
- 3 fatty acids

(differ in chain length & number of double bonds)

Most triacylglycerols are “mixed.”
Lipases hydrolyze triacylglycerols, releasing fatty acids at a time, yielding diacylglycerols, monoacylglycerols, eventually glycerol.
The release of FAs from triacylglycerols is hormonally sensitive event, initiated by *hormone-sensitive lipase* that removes a FA from either C-1 or C-3 of the TAG.

Additional lipase, specific for monoacylglycerol or diacylglycerol removes the remaining FAs.
cAMP

Protein Kinase Tetramer

2 Regulatory Subunits

2 Catalytic Subunits

ATP

ADP

Inactive Lipase (Dephosphorylated)

Active Lipase (Phosphorylated)

\[ R_2-C-O-CH_2-O-C-R_3 \]

\[ H_2O \]

\[ 2 H_2O \]

hormone-independent lipases

\[ R_2-C-O + O-C-R_3 + HO-CH CH_2-OH \]

Degradation of triglycerides.
The release of metabolic energy, in the form of FAs, is controlled by a complex series of interrelated cascades that result in the activation of hormone-sensitive lipase.

- The stimulus to activate this cascade, in adipocytes, can be glucagon, epinephrine or β-corticotropin.
- These hormones bind cell-surface receptors that are coupled to the activation of adenylate cyclase upon ligand binding.
The resultant \( \uparrow \) in cAMP leads to activation of active protein kinase (PKA), which in turn phosphorylate and activates hormone-sensitive lipase. This enzyme hydrolyzes FAs from C atoms 1 or 3 of triacylglycerols.

The resulting diacylglycerols are substrates for either hormone-sensitive lipase or for the non-inducible enzyme mono- or diacylglycerol lipase.

Finally, the monoacylglycerols are substrates for monoacylglycerol lipase.
The net result of the action of these enzymes is:

- 3 moles of free FA
- 1 mole of glycerol

The free fatty acids
- diffuse from adipose cells,
- combine with albumin in the blood,
- transported to other tissues, where they passively diffuse into cells

In the presence of high plasma levels of insulin and glucose, hormone-sensitive lipase is dephosphorylated and becomes inactive
Fate of glycerol

- Glycerol cannot be metabolized by adipocytes because they lack glycerol kinase.

- Glycerol is transported through the blood to the liver which can phosphorylate it.

- The resulting glycerol phosphate:
  * can be use to form TAG in the liver
  * or be converted to DHAP by reversal of the glycerol dehydrogenase reaction

- DHAP can participate in glycolysis or gluconeogenesis.
Glycerol, from hydrolysis of triacylglycerols, is converted to the glycolysis intermediate dihydroxyacetone phosphate, by reactions catalyzed by:

1. Glycerol kinase
2. Glycerol phosphate dehydrogenase