Comencemos con Gluconeogenesis
α-keto acids

Glycerol = Adipose tissue, phosphorylated by glycerol kinase to glycerol phosphate then is oxidized to DHA by glycerol phosphate dehydrogenase

Adipocytes do not have glycerol kinase so they cannot phosphorylate Glycerol
Figure 10.1

The gluconeogenesis pathway shown as part of the essential pathways of energy metabolism. The numbered reactions are unique to gluconeogenesis. (See Figure 8.2, p. 90 for a more detailed view of the metabolic map.)
Figure 8.23
Effect of insulin and glucagon on the synthesis of key enzymes of glycolysis in liver.

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Lactate is released by cells lacking mitochondria and by exercising skeletal muscle. Cori cycle lactate to glucose in the liver.

Amino acids: main source during a fast. α-ketoacids they can enter the TCA cycle and converted to OAA and then to PEP.
Allosteric regulation

High, activates Pyruvate dehydrogenase Complex inducing Acetyl CoA formation

Mit Malate dehydrogenase

Figure 10.3
Activation and transfer of CO2 to pyruvate, followed by transport of oxaloacetate to the cytosol and subsequent decarboxylation.
Bicarbonate + Pyruvate

\[ \text{HO-C-O} + \text{CH}_3-C-C-O^{-} \]

\[ \text{pyruvate carboxylase} \]

ATP

\[ \text{biotin} \]

\[ \text{ADP} + \text{P}_i \]

Oxaloacetate
This enzyme is also known as PEPCK.
Figure 10.1

The gluconeogenesis pathway shown as part of the essential pathways of energy metabolism. The numbered reactions are unique to gluconeogenesis. (See Figure 8.2, p. 90 for a more detailed view of the metabolic map.)
Figure 10.4
Dephosphorylation of fructose 1,6-bisphosphate.

Adenosine Monophosphate (AMP) found in Liver and Kidney FBP1
Figure 10.5
Effect of elevated glucagon on the intracellular concentration of fructose 2,6-bisphosphate in the liver.

PFN-2 = phosphofructokinase-2; FBP-2 = Fructose bisphosphate phosphatase-2.

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PKP-1 activity (% of $V_{\text{max}}$)

(a) [Fructose 6-phosphate] (mM)

(b) [Fructose 1,6-bisphosphate] (μM)

Fructose 2,6-bisphosphate
↑ Fructose 2,6-bisphosphate
Stimulates glycolysis, inhibits gluconeogenesis

↓ Fructose 2,6-bisphosphate
Inhibits glycolysis, stimulates gluconeogenesis

PKF-2 (active)
FBPase-2 (inactive)

ATP → ADP

Glucagon (↑ [cAMP]) → cAMP-dependent protein kinase

PKF-2 (inactive)
FBPase-2 (active)
Figure 10.1

The gluconeogenesis pathway shown as part of the essential pathways of energy metabolism. The numbered reactions are unique to gluconeogenesis. (See Figure 8.2, p. 90 for a more detailed view of the metabolic map.)
This process requires 2 enzymes. One that translocate the ER known as glucose 6 phosphate translocase and G6P found only in glucogenic cells. This enzyme is also required for the final step of glycogen degradation. Deficiency Responsible for 1a type glycogen storage disease. Von Gierke disease
Look for a mistake in this slide

To convert pyruvate to glucose; 11 reactions, 7 reversible 4 irreversible. There are 3 irreversible reactions in glycolysis which are circumvented by which enzymes. One carboxy and decarbolylation. How many high energy phosphates and NADH for a formation of a glucose molecule?
Figure 10.8
Covalent modification of pyruvate kinase results in inactivation of the enzyme. OAA = oxaloacetate.
Citric acid cycle

- Glucose → Acetyl-CoA → Oxaloacetate → Citrate → Isocitrate → α-Ketoglutarate → Succinyl-CoA
- Carbon dioxide (CO₂) is released at multiple points in the cycle.
### Table 20-3

**Glucogenic Amino Acids, Grouped by Site of Entry**

<table>
<thead>
<tr>
<th>Pyruvate</th>
<th>Succinyl-CoA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alanine</td>
<td>Isoleucine</td>
</tr>
<tr>
<td>Cysteine</td>
<td>Methionine</td>
</tr>
<tr>
<td>Glycine</td>
<td>Threonine</td>
</tr>
<tr>
<td>Serine</td>
<td>Valine</td>
</tr>
<tr>
<td>Tryptophan</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>α-Ketoglutarate</th>
<th>Fumarate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arginine</td>
<td>Phenylalanine</td>
</tr>
<tr>
<td>Glutamate</td>
<td>Tyrosine</td>
</tr>
<tr>
<td>Glutamine</td>
<td></td>
</tr>
<tr>
<td>Histidine</td>
<td>Oxaloacetate</td>
</tr>
<tr>
<td>Proline</td>
<td>Asparagine</td>
</tr>
<tr>
<td></td>
<td>Aspartate</td>
</tr>
</tbody>
</table>

*These amino acids are precursors of blood glucose or liver glycogen because they can be converted to pyruvate or citric acid cycle intermediates. Only leucine and lysine are unable to furnish carbon for net glucose synthesis.*

†These amino acids are also ketogenic (see Fig. 18-19).
Figure 10.9
Key concept map for gluconeogenesis.

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