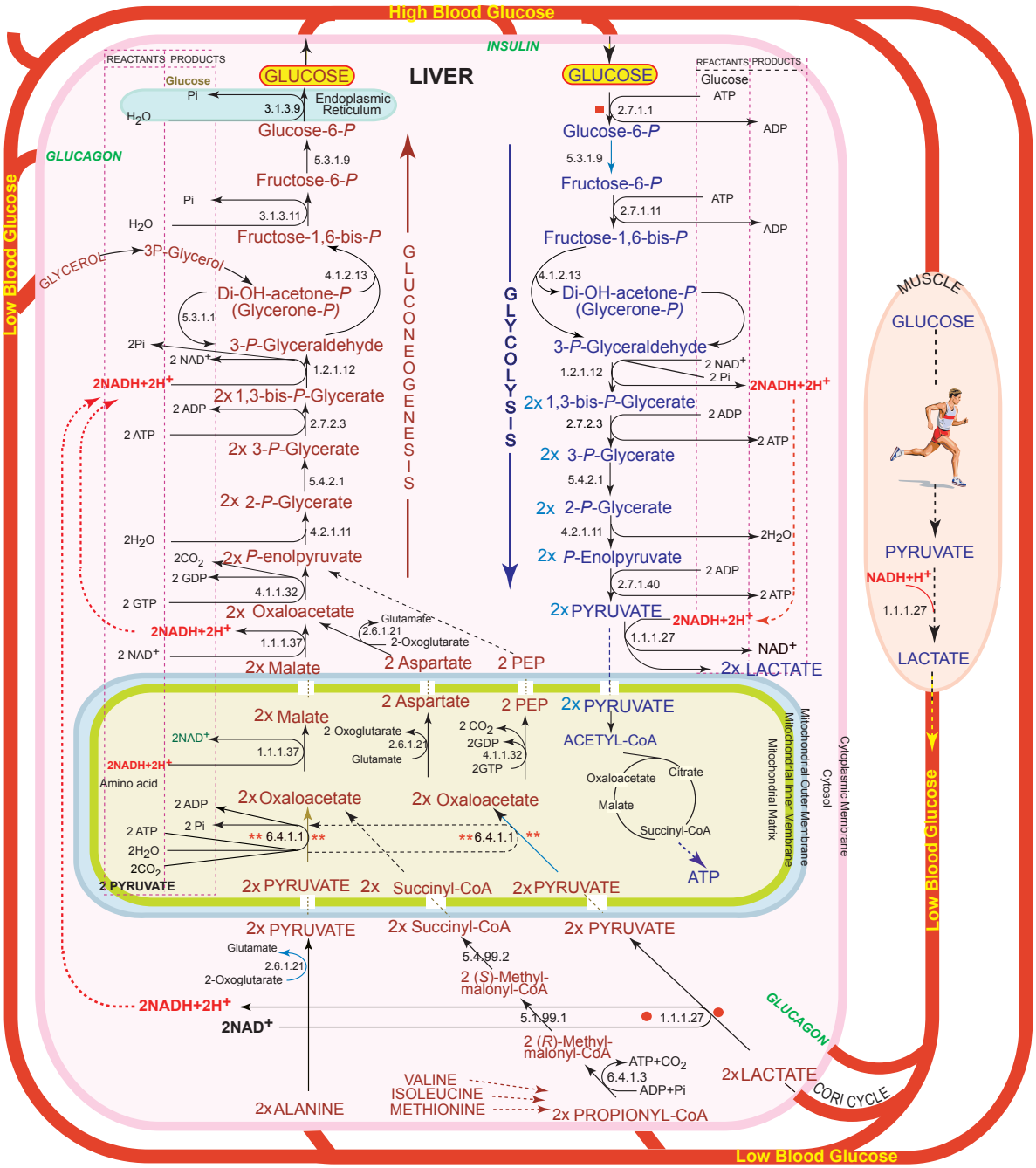
GLUCONEOGENESIS & GLYCOLYSIS



GLYCOLYSIS $\quad Glucose + 2ADP + 2P_i + 2NAD^+ \longrightarrow 2\ Pyruvate + 2ATP + 2NADH + 2H^+ + 2H_2O$

GLUCONEOGENESIS $\quad 2\ Pyruvate + 4ATP + 2GTP + 2NADH + 2H^+ + 6H_2O \longrightarrow Glucose + 4ADP + 2GDP + 6P_i + 2NAD^+$

Comparison of the two equations shows that:

OXIDATION of 1 GLUCOSE to 2 PYRUVATE produces 2ATP whereas REDUCTION of 2 PYRUVATE to 1 GLUCOSE requires 4ATP + 2GTP

To make GLUCONEOGENESIS thermodynamically possible requires the hydrolysis of the equivalent of 6ATP

Gluconeogenesis needs NADH for the reduction of 1,3-bis-P-glycerate to triose-P. For most precursors this is formed in the mitochondria and transported across the mitochondrial membrane via malate. Lactate is unique in that lactate dehydrogenase only occurs in the cytosol so that NADH is directly available in the cytosol for gluconeogenesis. However, the resulting pyruvate can only be converted into oxaloacetate within mitochondria since this is the only site of pyruvate carboxylase. The oxaloacetate so formed can then be transported into the cytosol by direct carboxylation to PEP or by transamination to aspartate in the mitochondria and then reverse transamination to oxaloacetate in the cytosol

ENZYMES

- ● 1.1.1.27 Lactate dehydrogenase (only in cytosol)
- 1.1.1.37 Malate dehydrogenase
- 1.2.1.12 Glyceraldehyde-3-*P* dehydrogenase
- ■ 2.7.1.1 Hexokinase
- 2.7.1.30 Glycerolkinase
- 2.7.1.11 6-Phosphofructokinase
- ■ Liver Hexokinase is Hexokinase D (or IV) (Often called Glucokinase)
- 2.7.1.40 Pyruvate kinase
- 2.7.2.3 Phosphoglycerate kinase
- 3.1.3.9 Glucose-6-phosphatase
- 3.1.3.11 Fructose-bisphosphatase
- 4.1.1.32 Phosphoenolpyruvate carboxykinase
- 4.1.2.13 Fructose-bisphosphatealdolase
- 4.2.1.11 Phosphopyruvate hydratase
- 5.1.99.1 Methylmalonyl-CoA epimerase
- 5.3.1.1 Triosephosphate isomerase
- 5.4.2.1 Phosphoglycerate mutase
- 5.4.99.2 Methylmalonyl-Co mutase
- 6.2.1.17 Propionate-CoA ligase
- ** 6.4.1.1 Pyruvate carboxylase (only in matrix)
- 6.4.1.3 Propionyl-CoA carboxylase

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