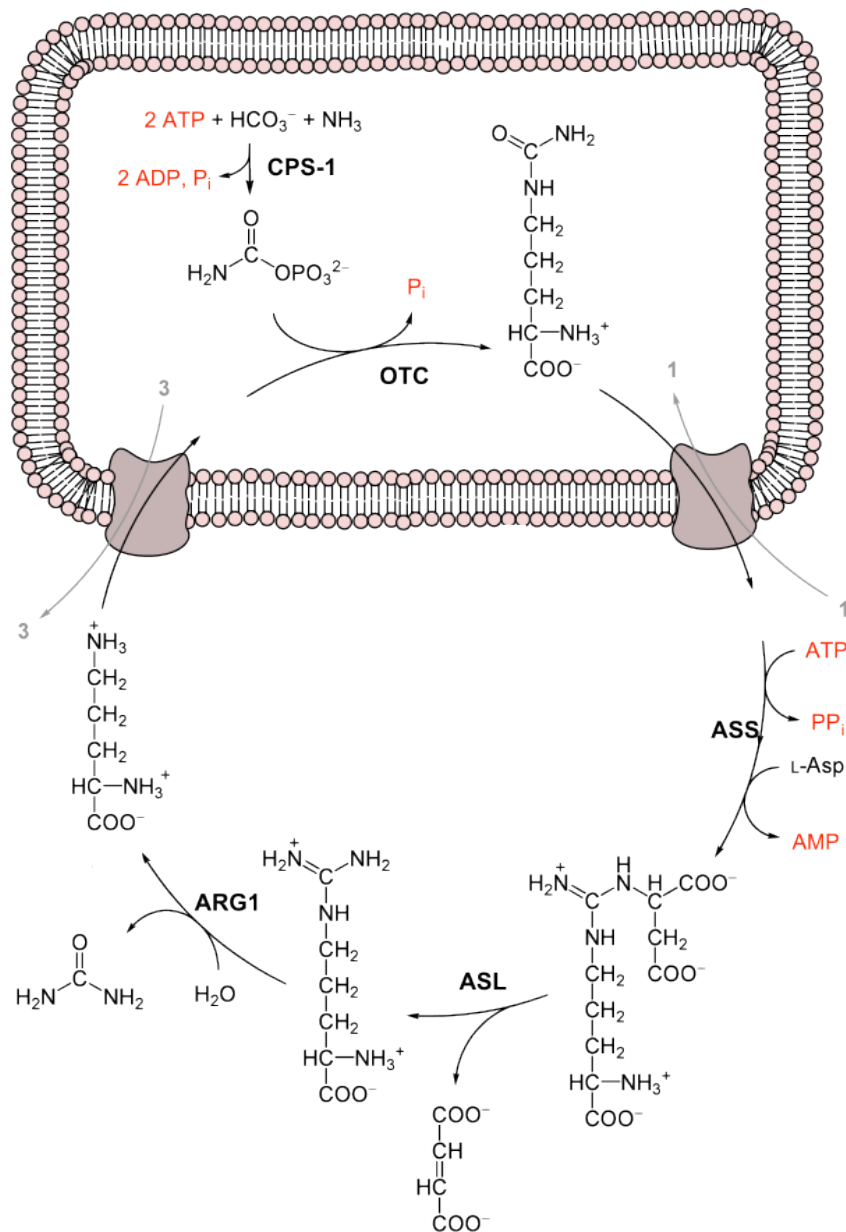


CONCEPT: AMINO ACID OXIDATION

- Urea cycle – occurs in liver, removes amino groups from amino acids so they may enter the citric acid cycle

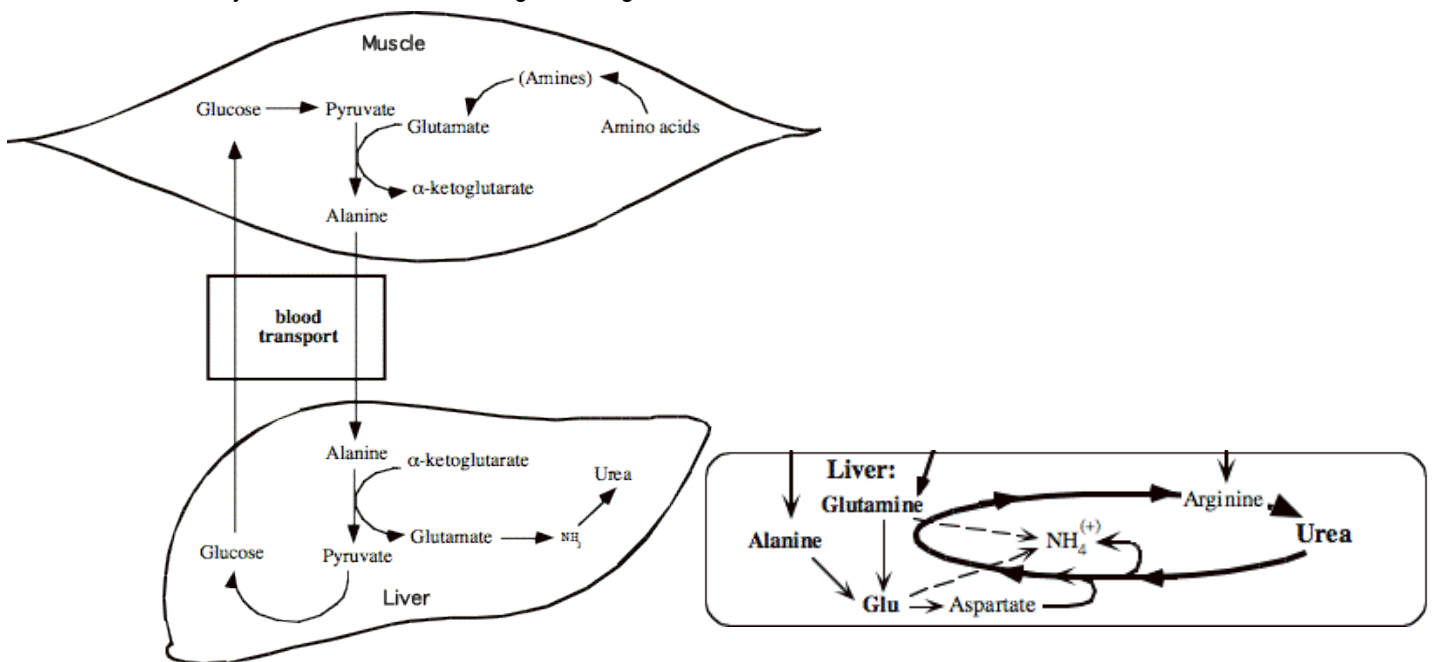
□ 2 nitrogen enter the cycle to ultimately leave the body as urea, and it costs 3 ATP

1. Carbamoyl phosphate is formed from $\text{HCO}_3^- + \text{NH}_4^+$, 2ATP is consumed in the process
2. Ornithine enters the mitochondria and combines with carbamoyl phosphate, releasing P_i
3. Citrulline moves back to cytosol and combines with Asp, $\text{ATP} \rightarrow \text{AMP} + \text{PP}_i$ (pyrophosphatase hydrolyzes into 2 P_i)
4. Argininosuccinate is cleaved into fumarate and arginine
5. Arginine is cleaved into urea and ornithine

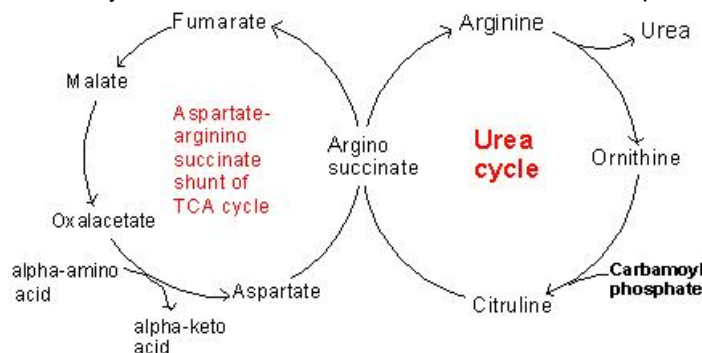


CONCEPT: AMINO ACID OXIDATION

- Glutamine synthetase makes glutamine to send to the liver (glutamate + ATP + NH_4^+ \rightarrow glutamine + ADP + Pi)
 - Glutamine enters the mitochondria, and is broken down into glutamate and NH_4^+ by glutaminase
 - Glutamate dehydrogenase converts glutamate to α -ketoglutarate, releases NH_4^+ and reduces $\text{NAD(P)}^+ \rightarrow \text{NAD(P)H}$
 - Some glutamate is used to add NH_4^+ to oxaloacetate, forming aspartate
 - Glucose-alanine cycle occurs in muscles only, and can send alanine to liver
 - Convert pyruvate to alanine via a transaminase that transfers an amino group from glutamate
 - In liver, alanine is converted to pyruvate by transferring the amino group to α -ketoglutarate, forming glutamate
- Pyruvate can be used for gluconeogenesis in the liver



- Fumarate can enter the citric acid cycle, and oxaloacetate can be converted to aspartate to enter the urea cycle



- Transaminases – amino-keto to amino-keto, indicator of tissue damage
 - (S)GPT and (S)GOT indicate liver damage (S)CK indicate heart attack or infection
- *N*-acetylglutamate stimulates carbamoyl phosphate synthetase
 - *N*-acetylglutamate synthase – acetyl-CoA + glutamate \rightarrow *N*-acetylglutamate (stimulated by R)