

Biosynthesis of Amino Acids

TABLE 22–1 Amino Acid Biosynthetic Families,
Grouped by Metabolic Precursor

α -Ketoglutarate

Glutamate
Glutamine
Proline
Arginine

3-Phosphoglycerate

Serine
Glycine
Cysteine

Oxaloacetate

Aspartate
Asparagine
Methionine*
Threonine*
Lysine*

Pyruvate

Alanine
Valine*
Leucine*
Isoleucine*

**Phosphoenolpyruvate and
erythrose 4-phosphate**

Tryptophan*
Phenylalanine*
Tyrosine[†]

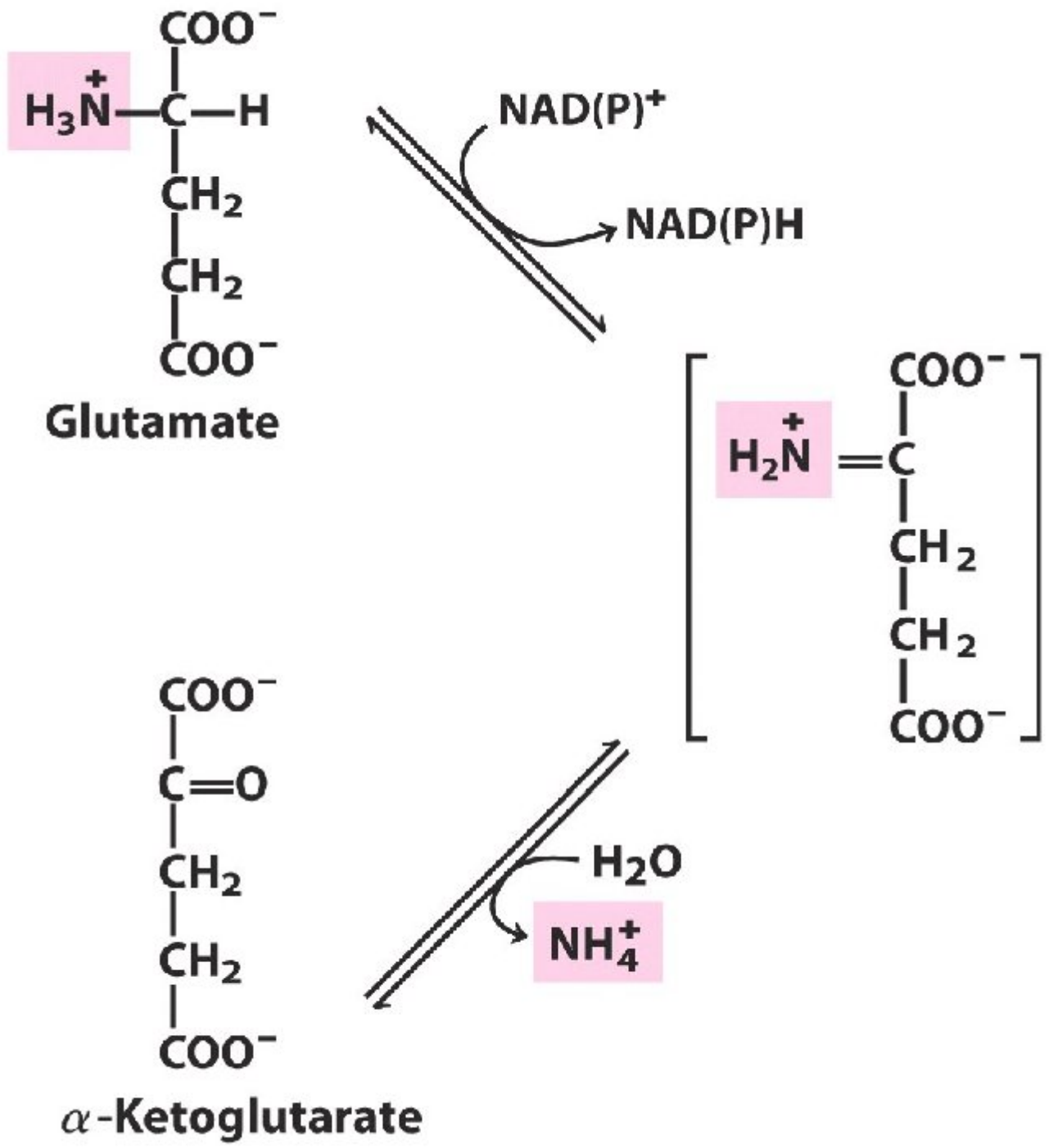
Ribose 5-phosphate

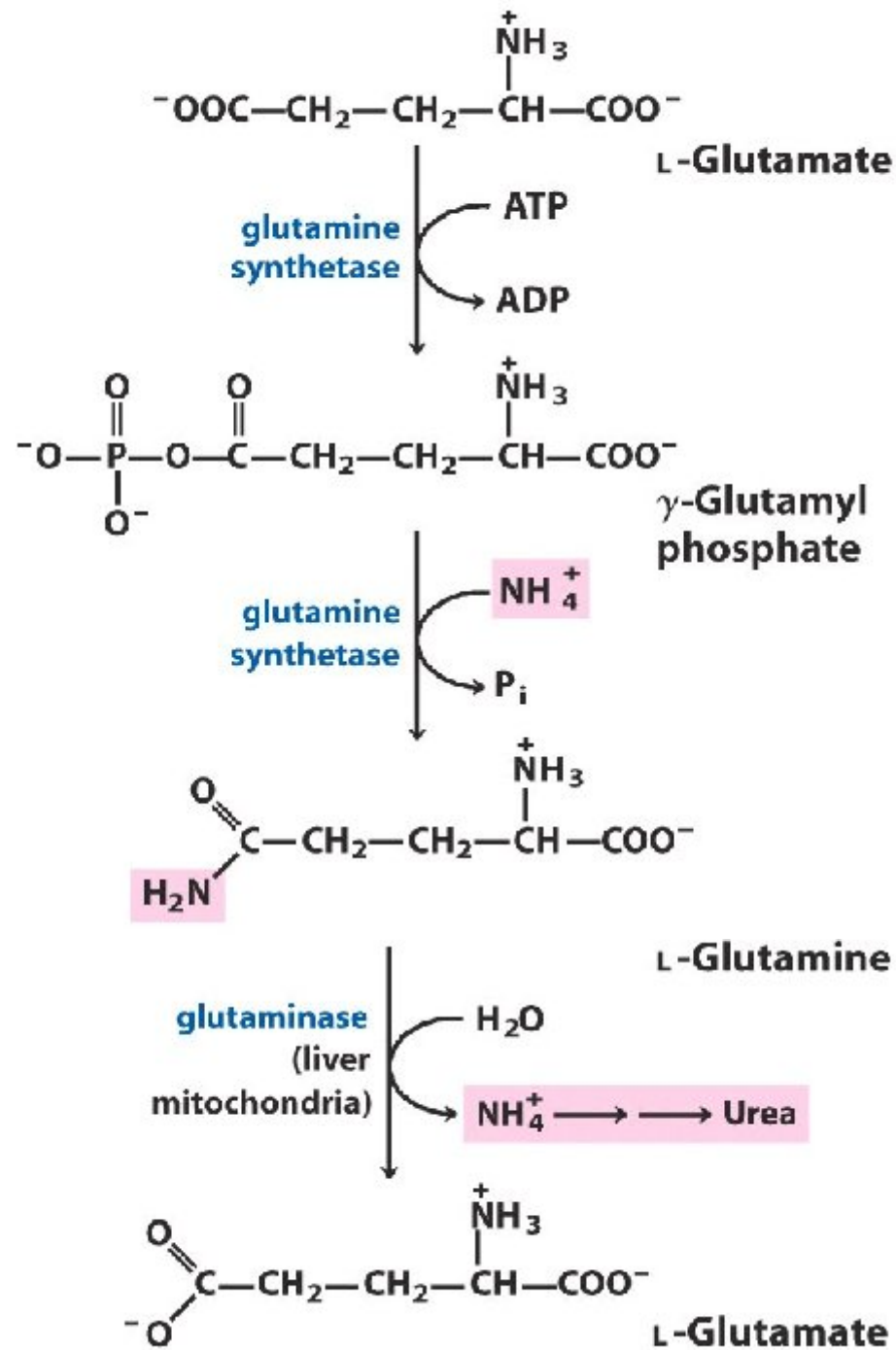
Histidine*

*Essential amino acids.

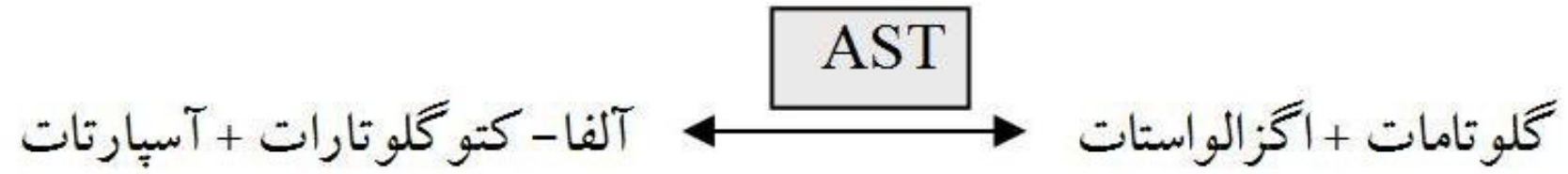
[†]Derived from phenylalanine in mammals.

Glutamate & Glutamine





Aspartate & Asparagine



3-Phosphoglycerate



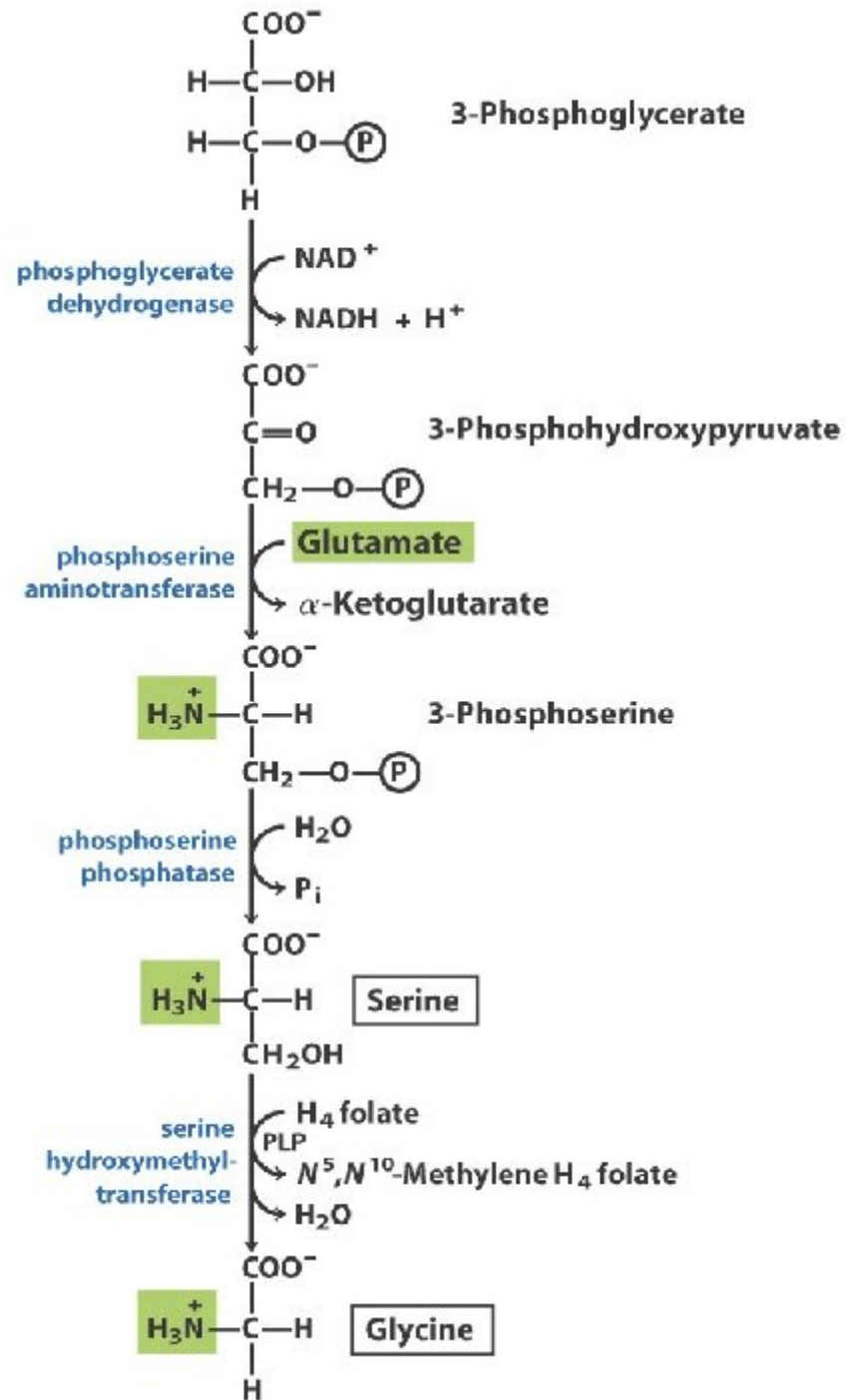
Serine

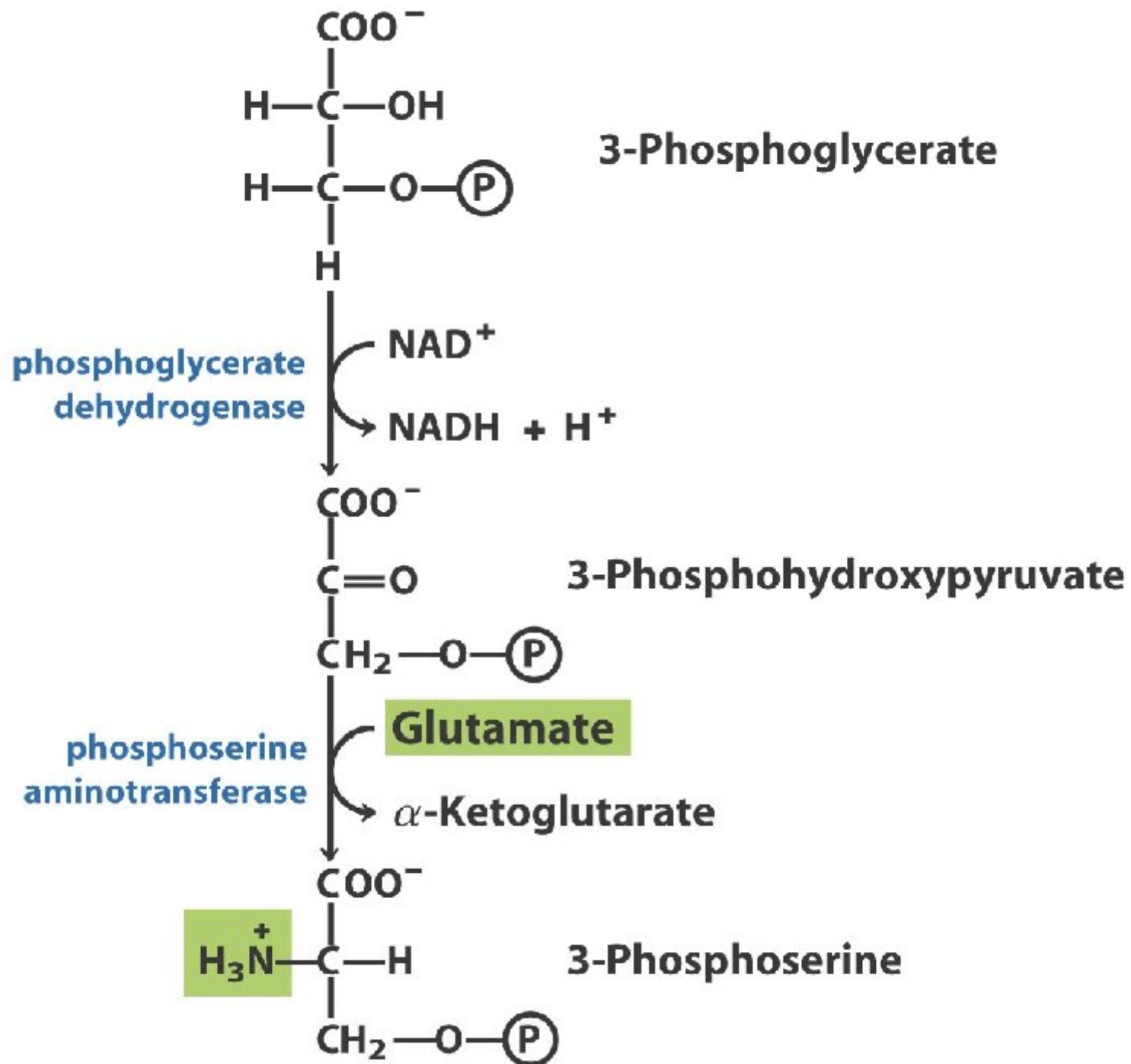


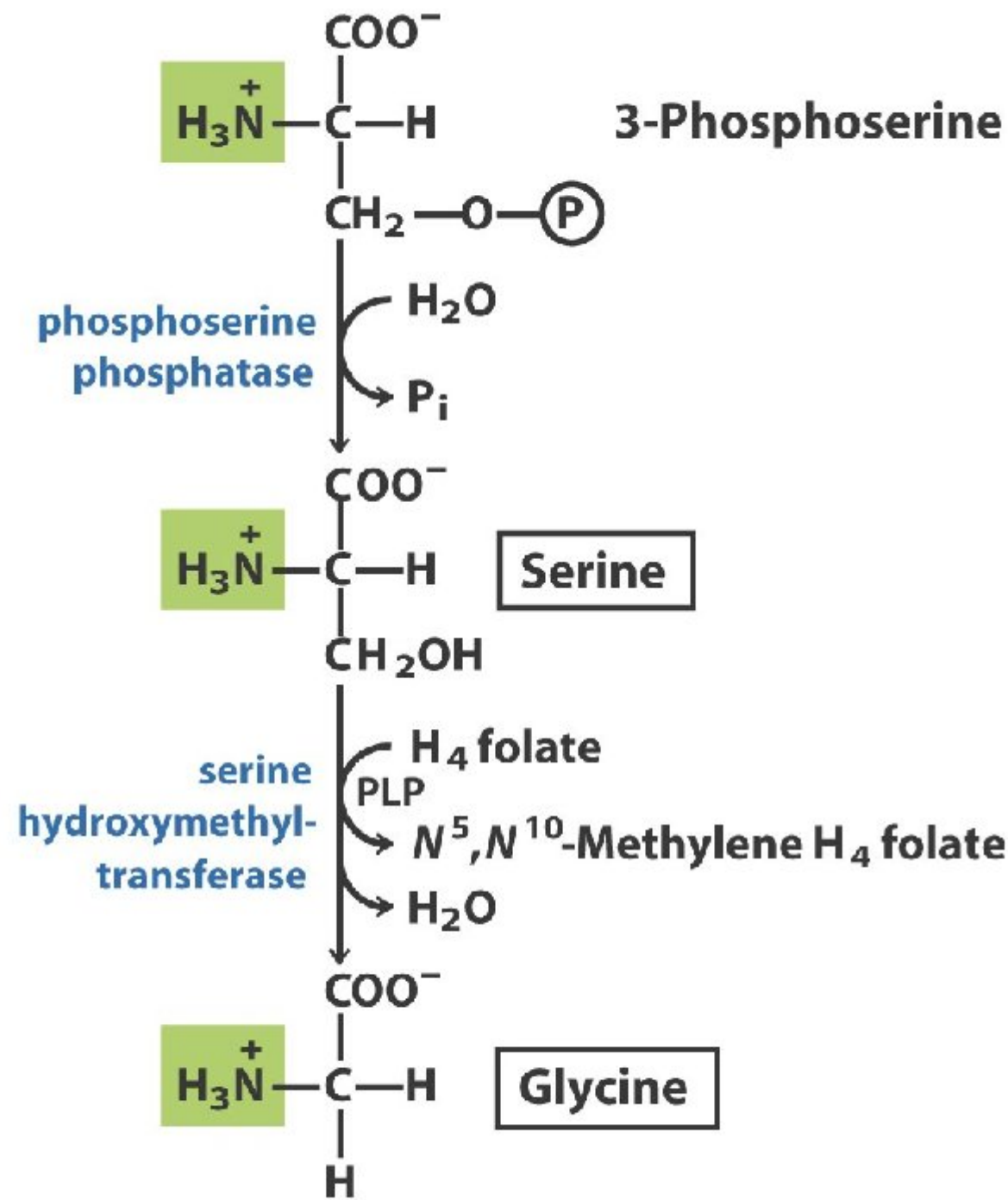
Glycine

Cysteine

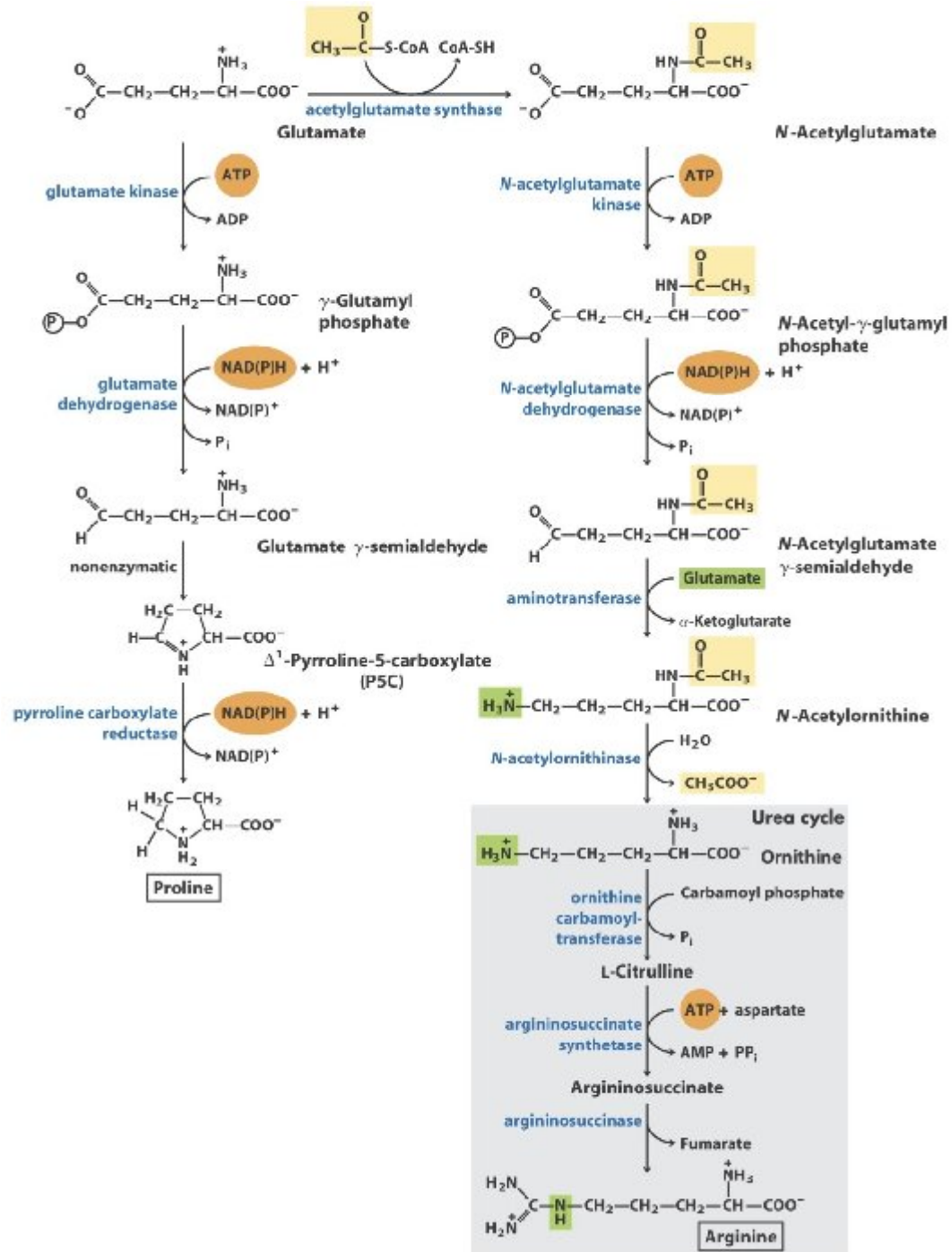
Glycine

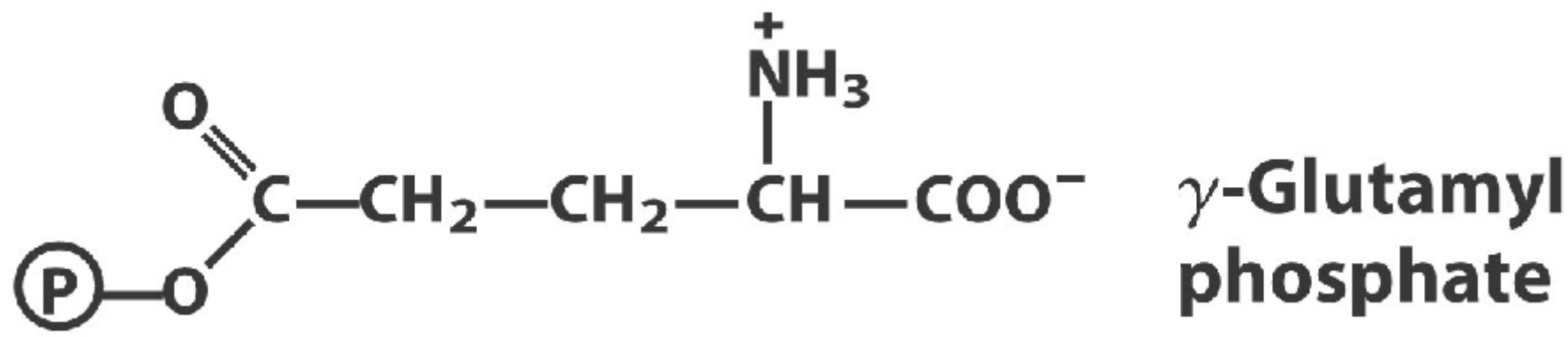
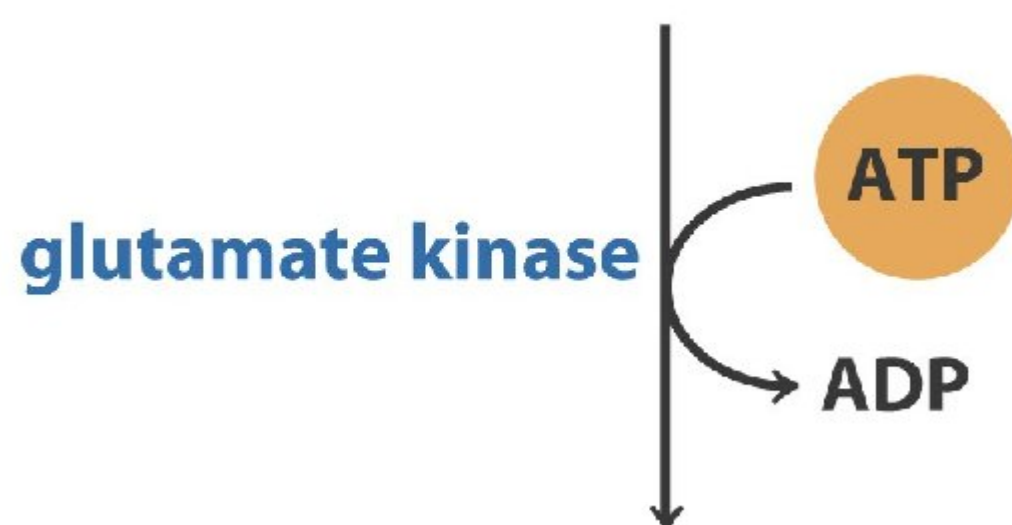
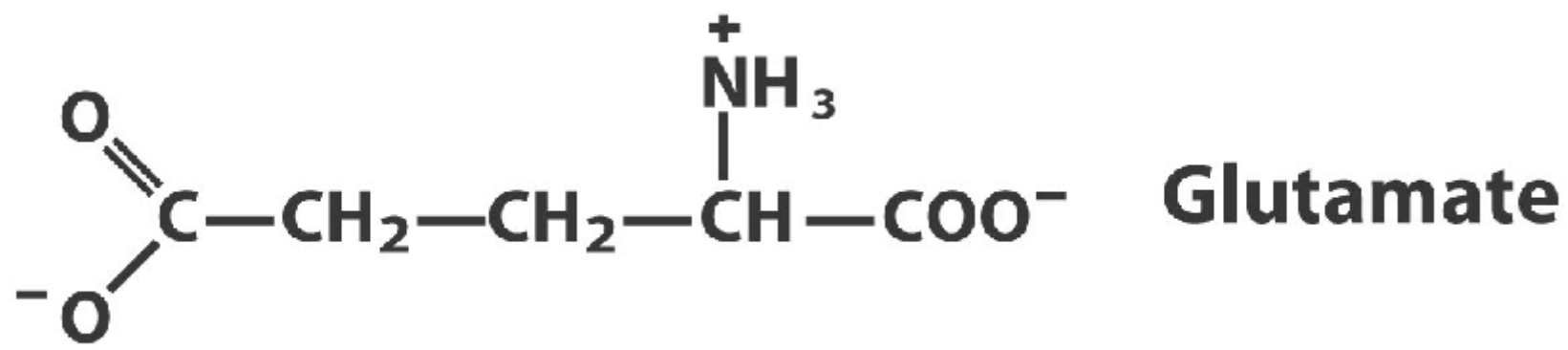


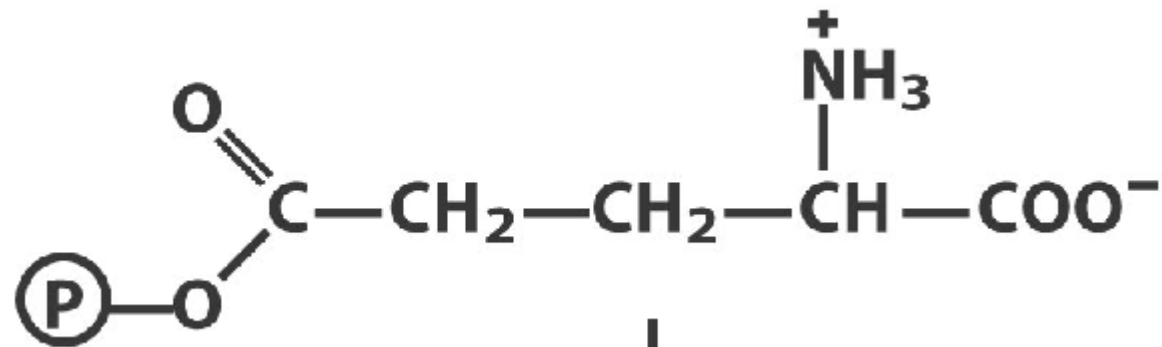




Proline

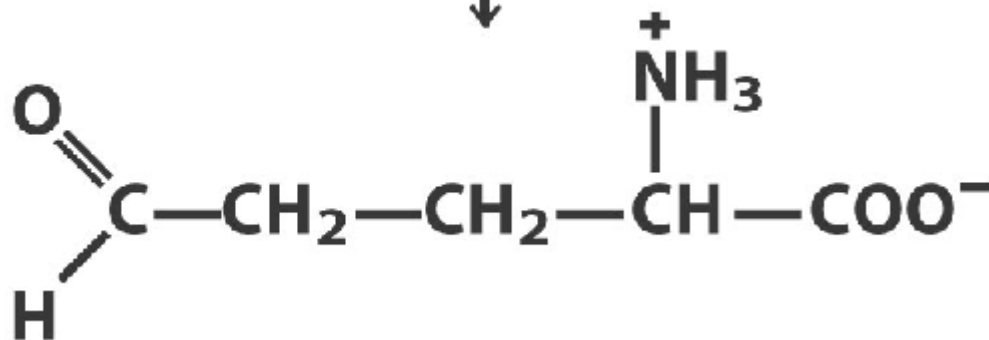




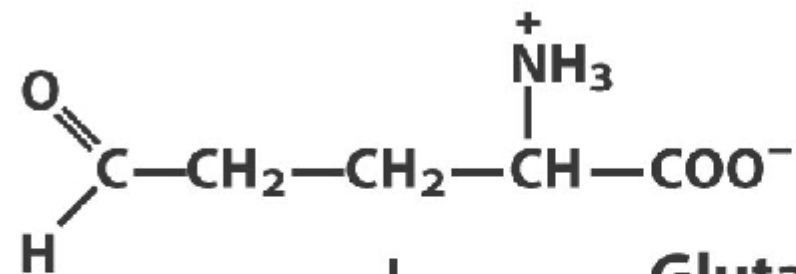


**γ -Glutamyl
phosphate**

**glutamate
dehydrogenase**

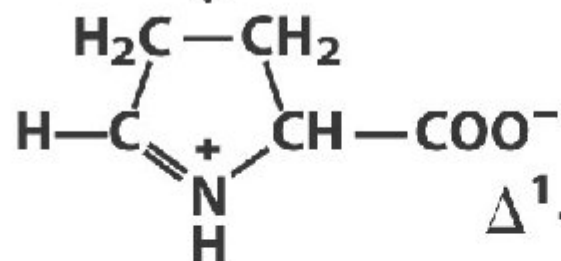


**Glutamate
 γ -semialdehyde**



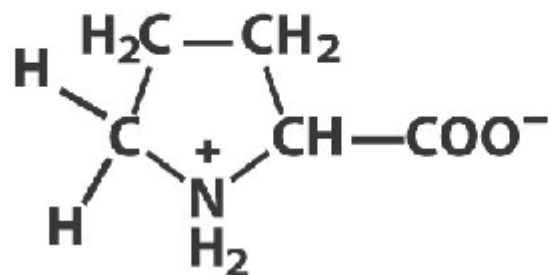
Glutamate γ -semialdehyde

nonenzymatic



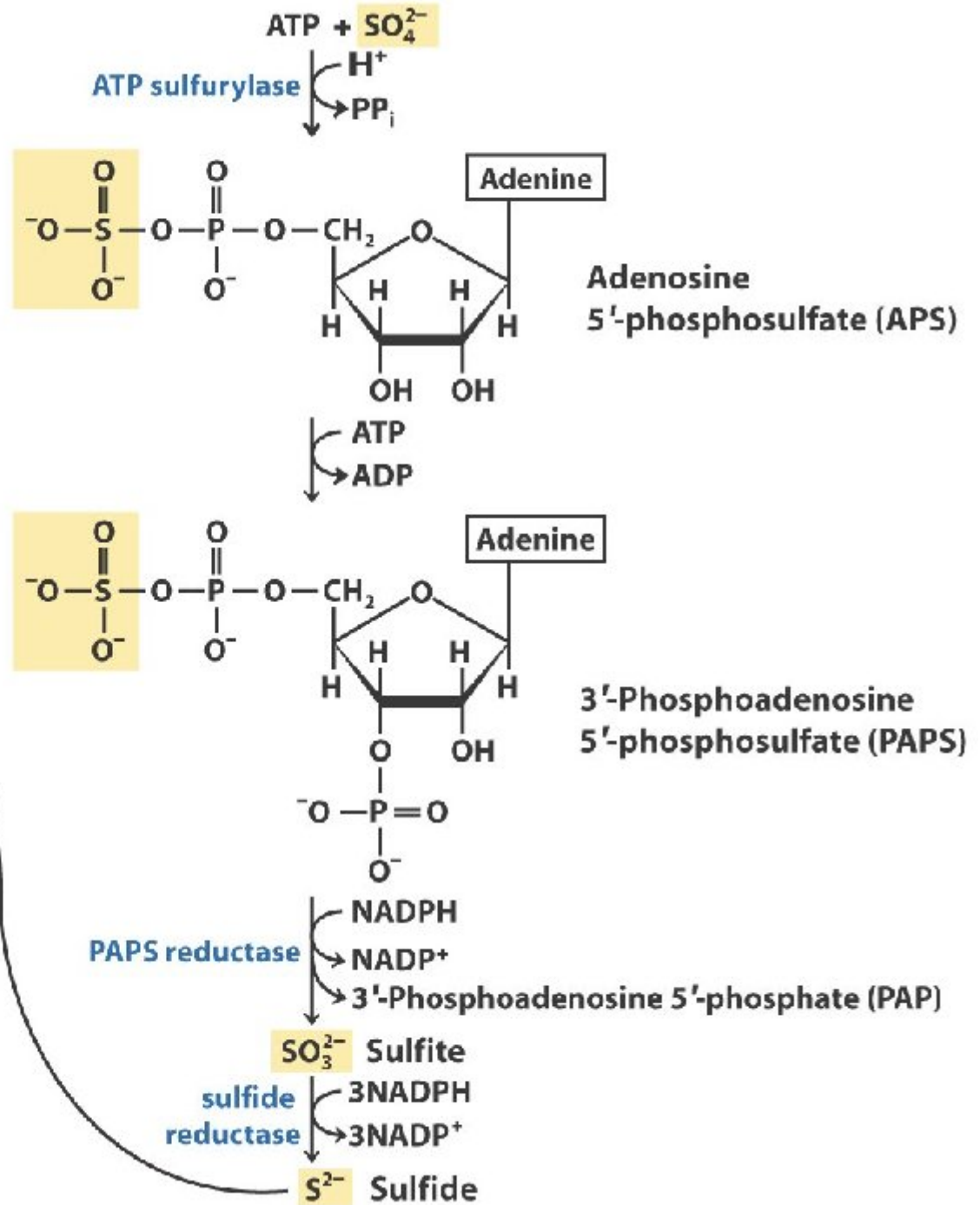
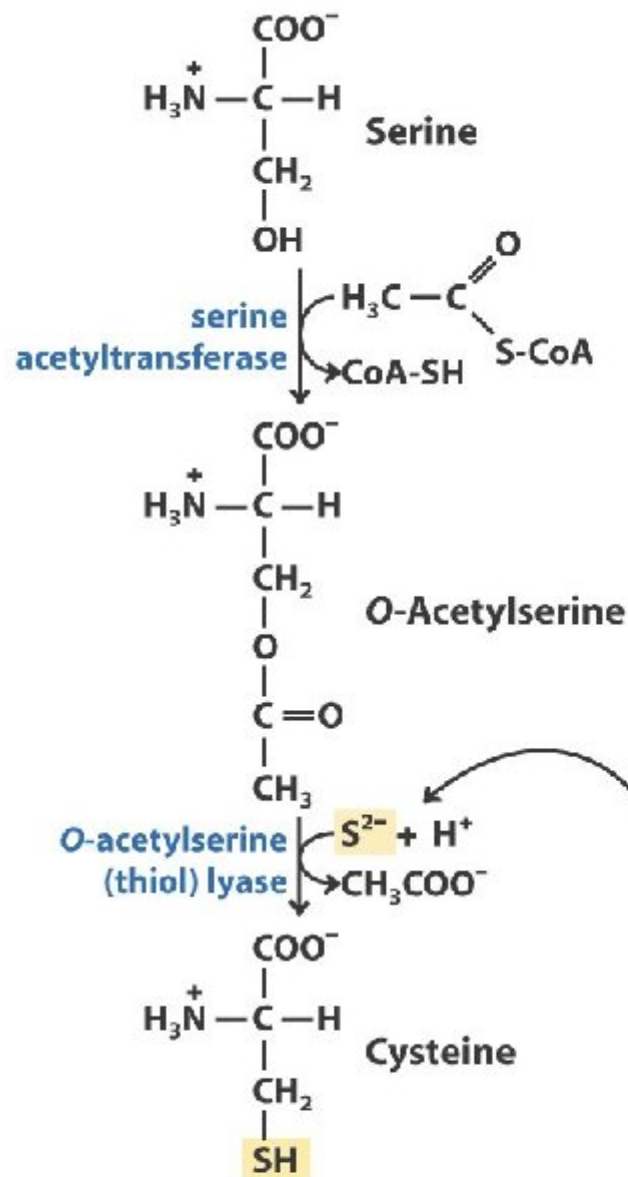
**Δ^1 -Pyrroline-5-carboxylate
(P5C)**

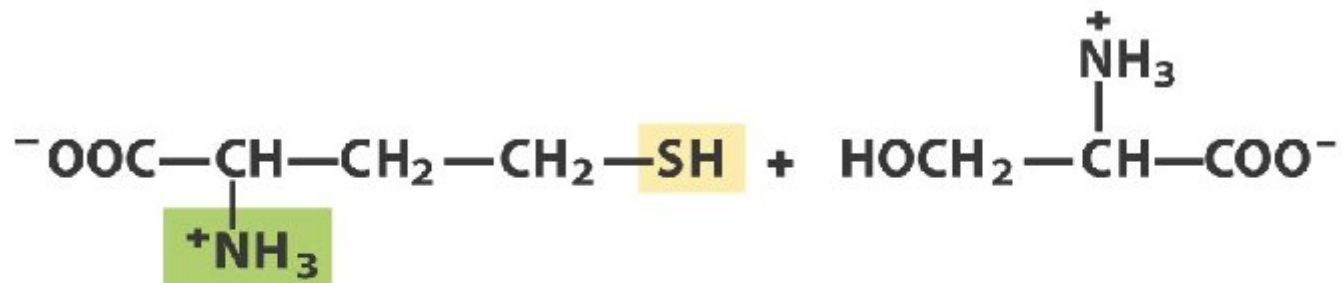
pyrroline carboxylate
reductase



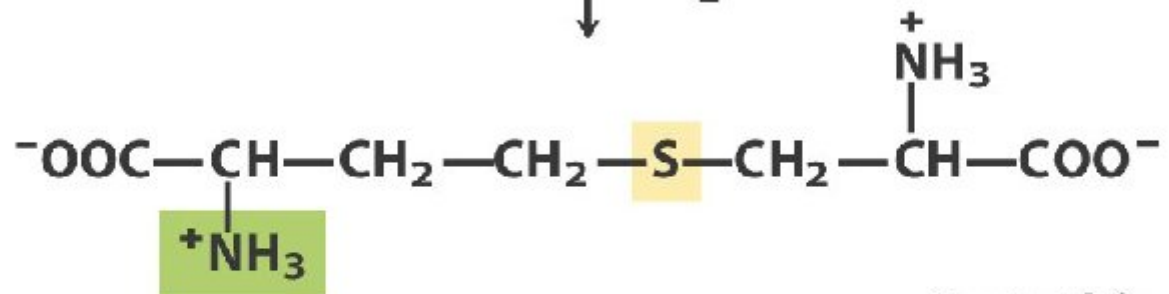
Proline

Cysteine

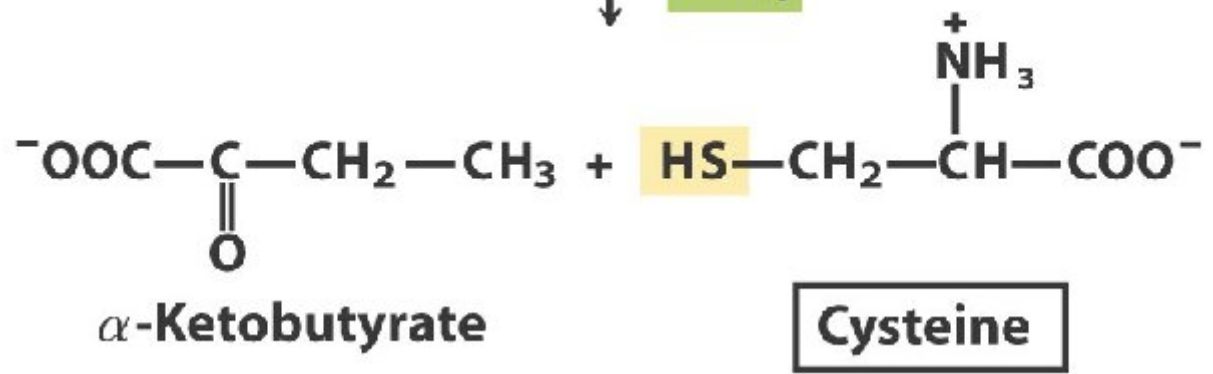


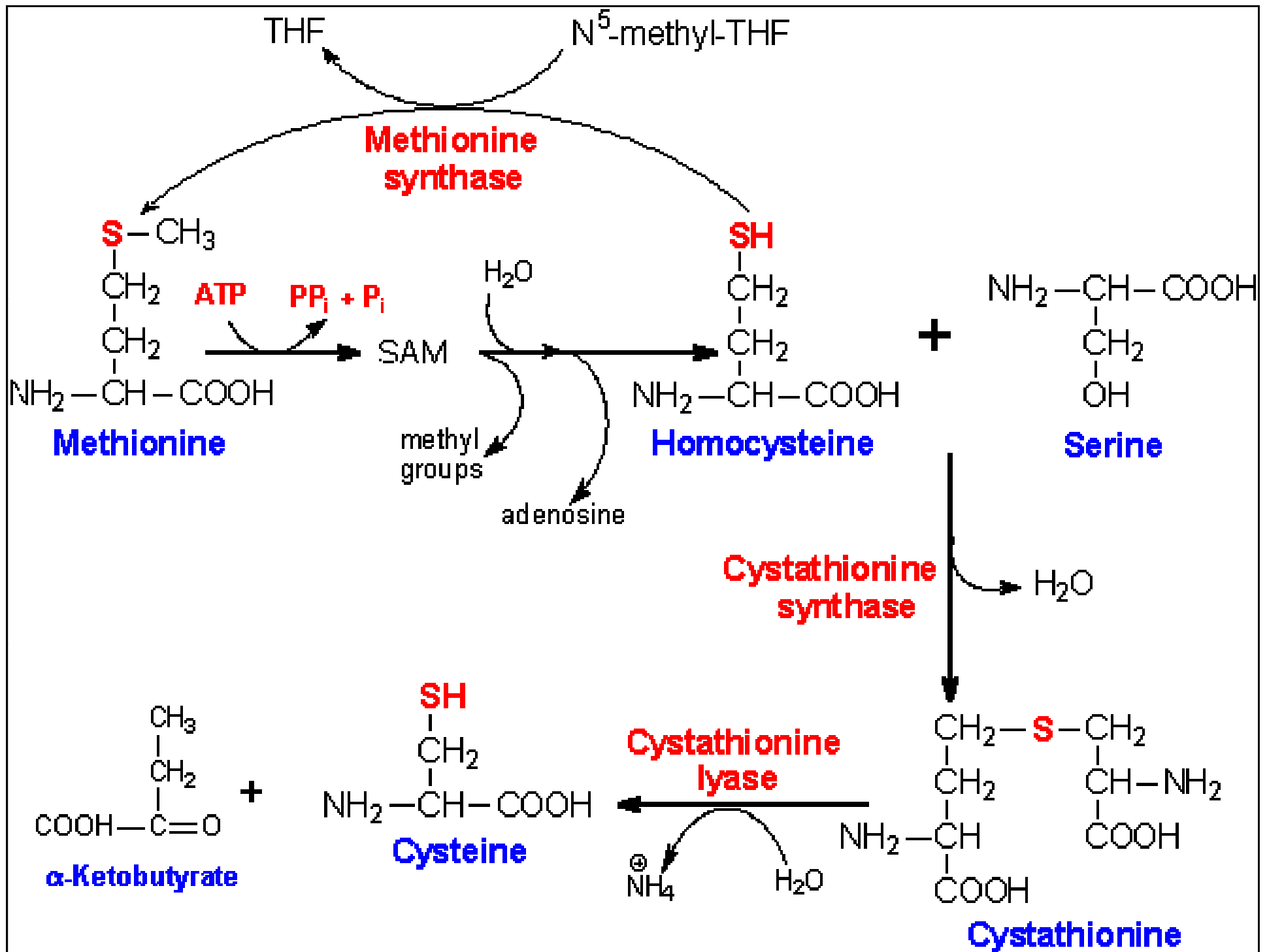


cystathionine β -synthase $\xrightarrow[\text{H}_2\text{O}]{\text{PLP}}$

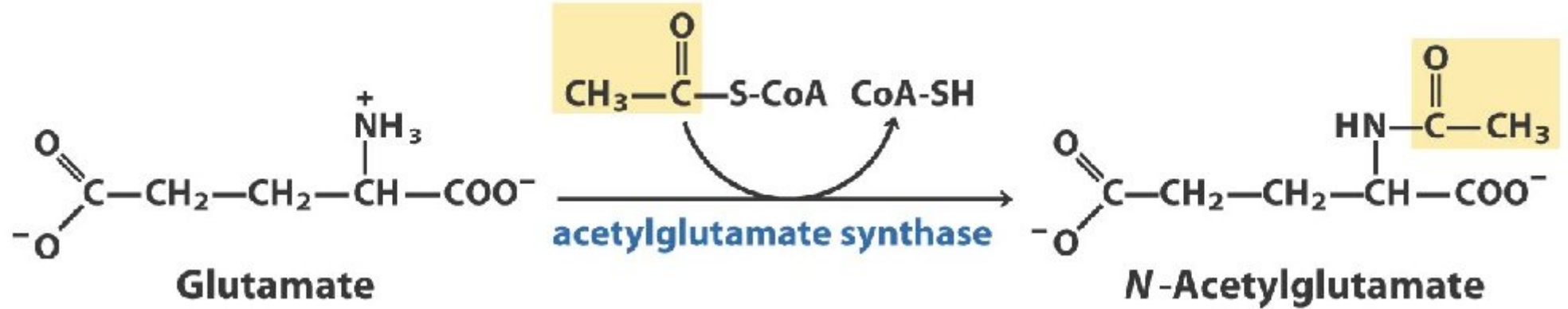


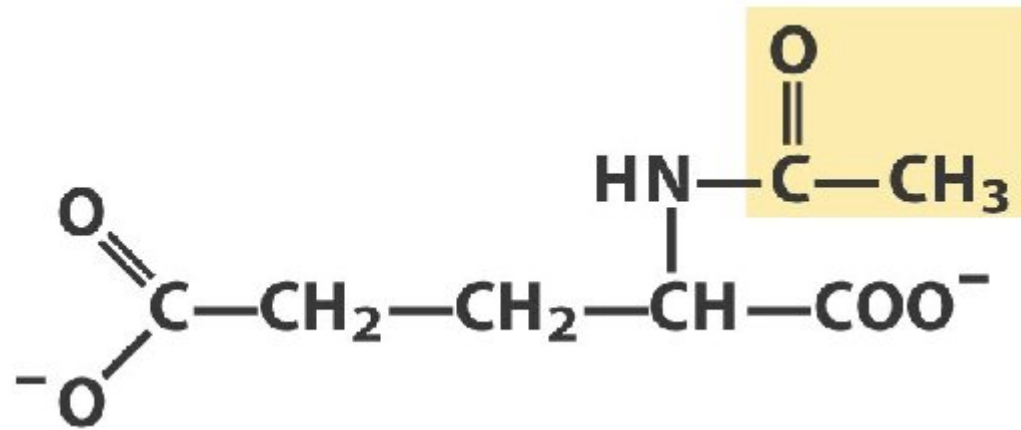
cystathionine γ -lyase $\xrightarrow[\text{NH}_4^+]{\text{PLP}} \text{H}_2\text{O}$



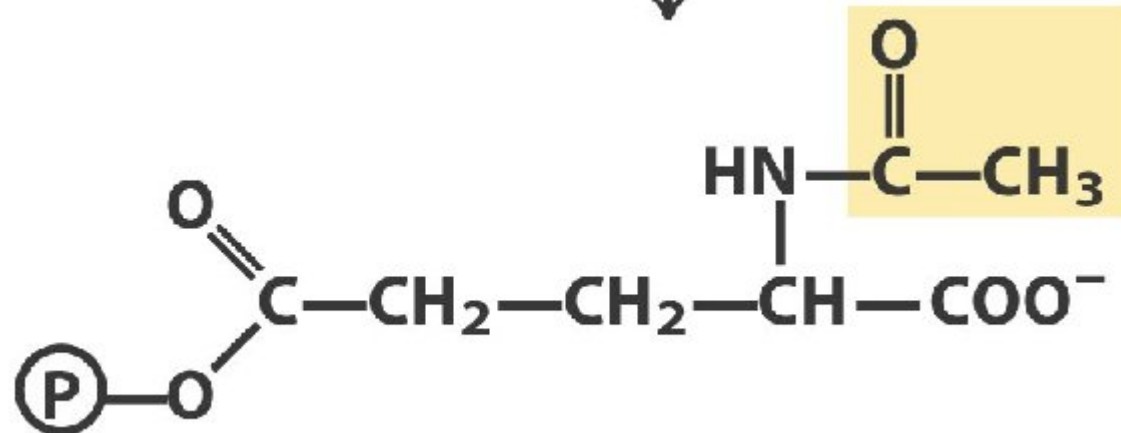
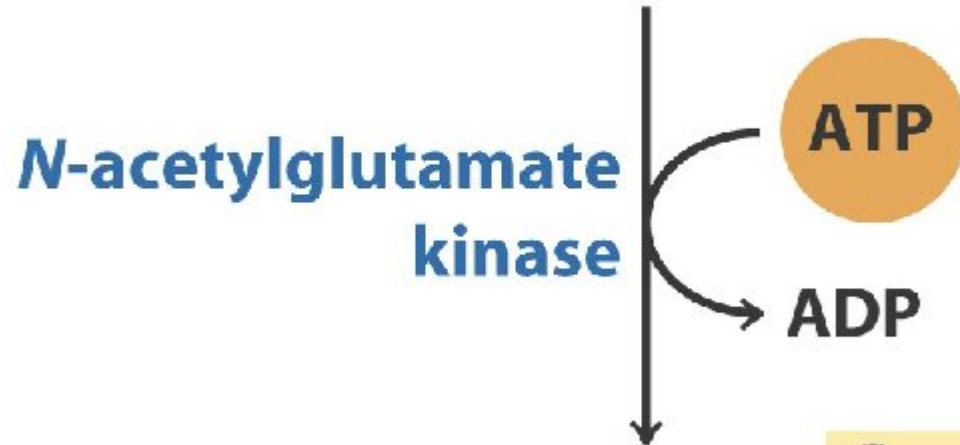


Arginine

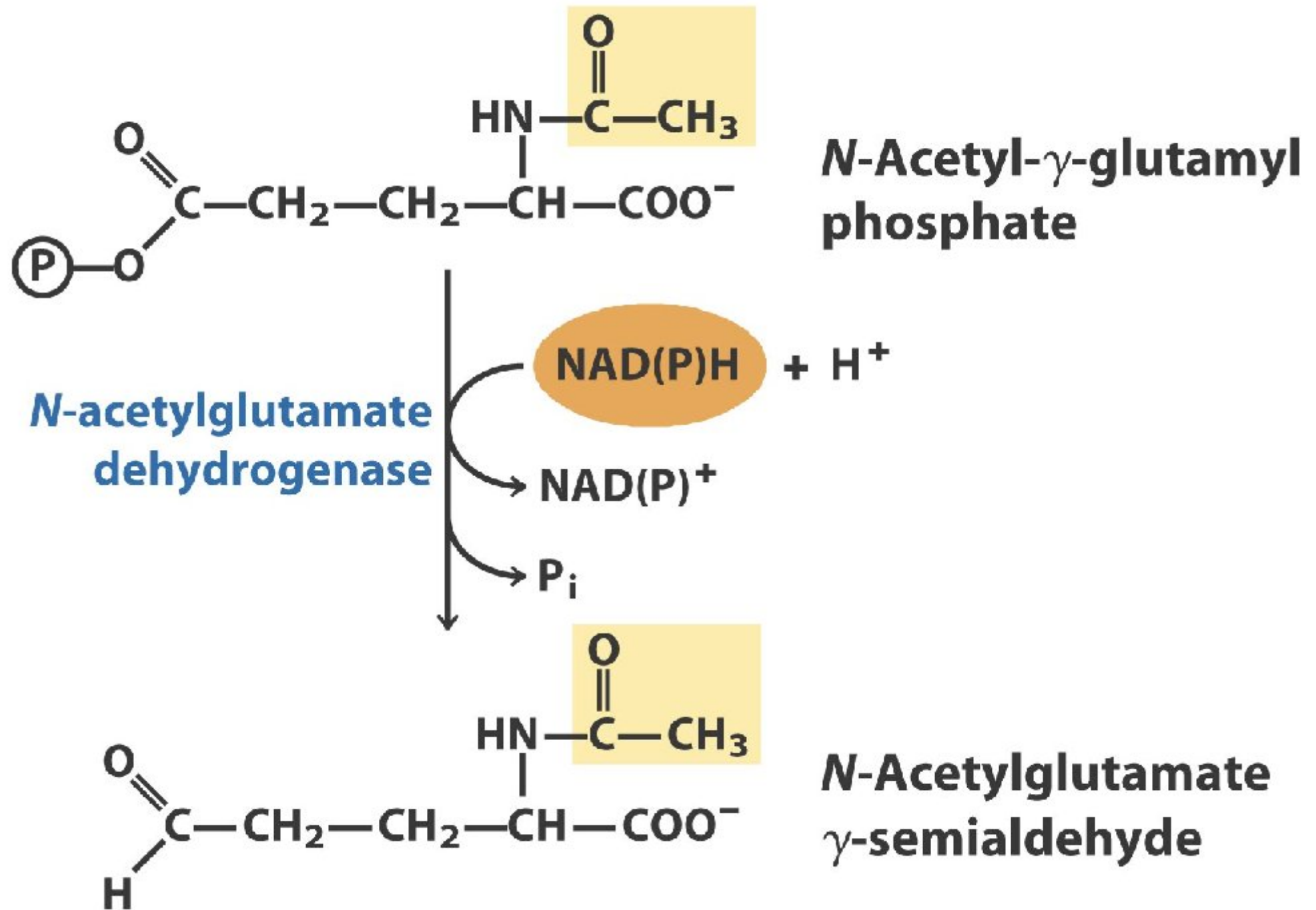


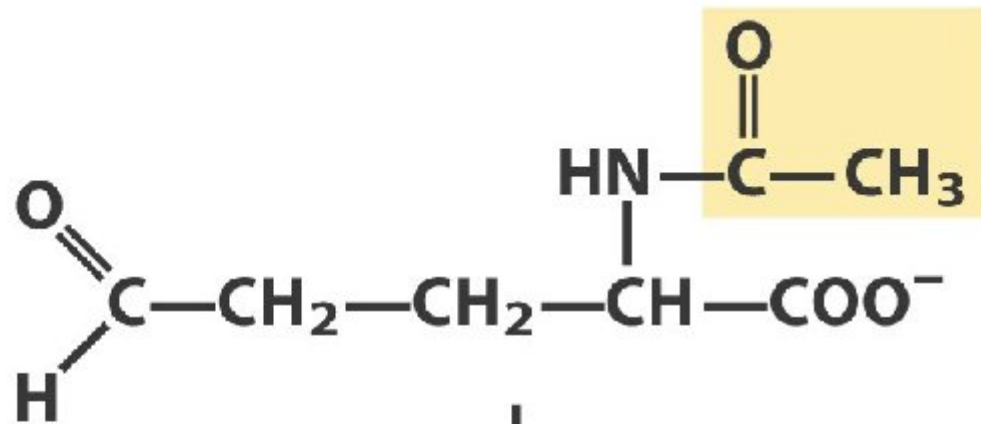


***N*-Acetylglutamate**



***N*-Acetyl- γ -glutamyl
phosphate**



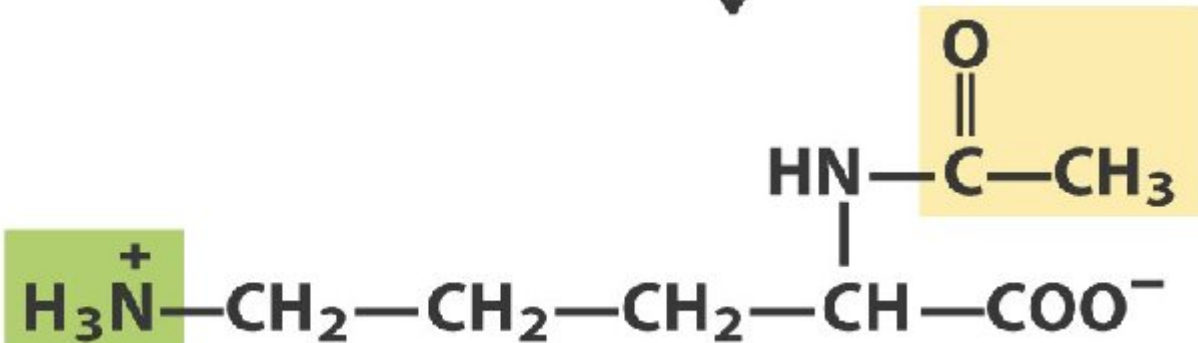


***N*-Acetylglutamate
 γ -semialdehyde**

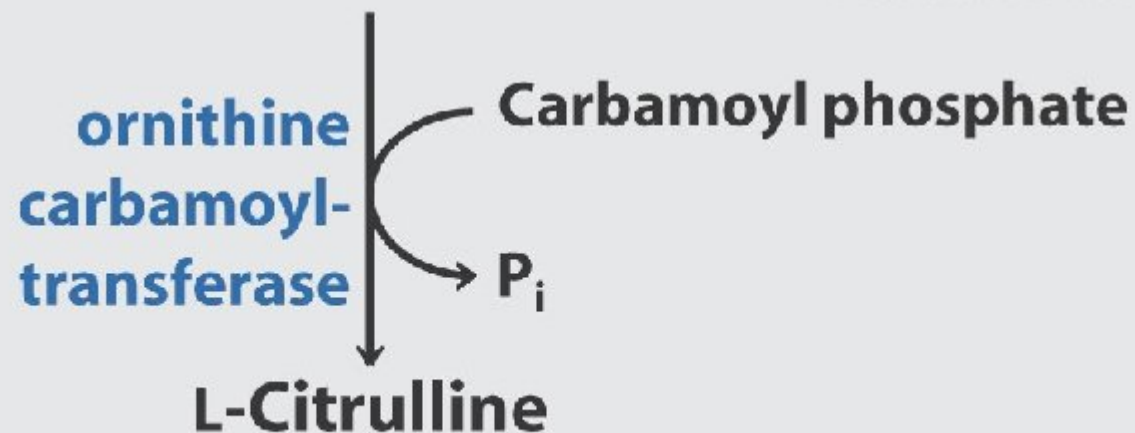
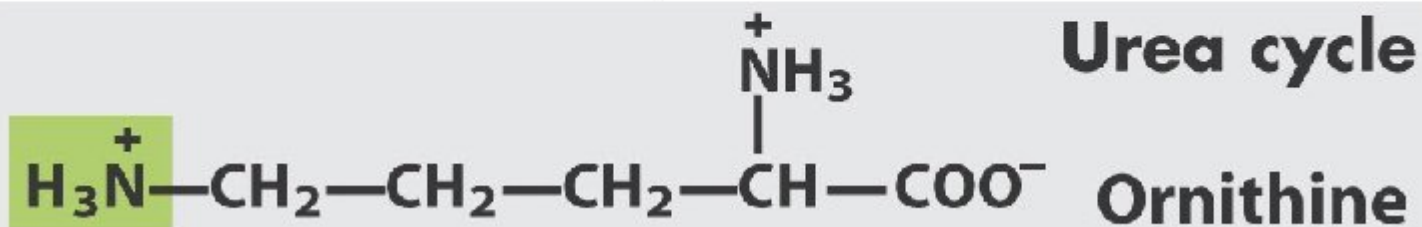
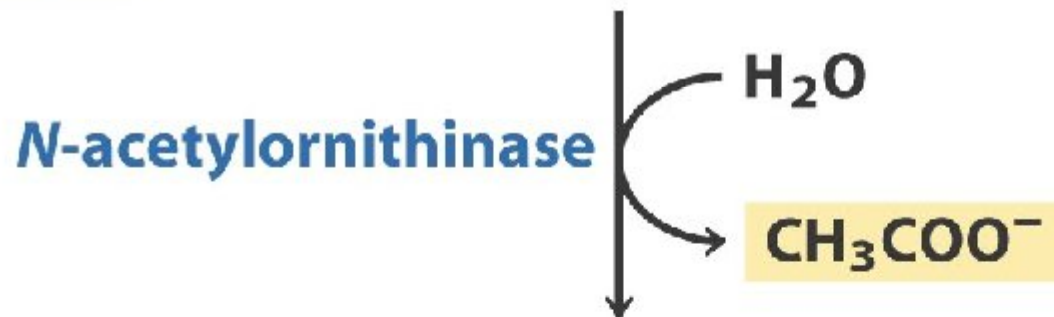
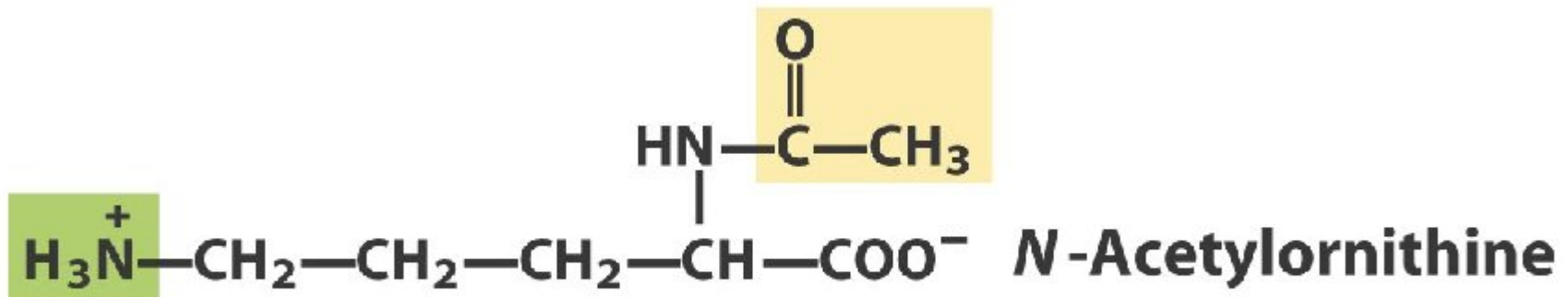
aminotransferase

Glutamate

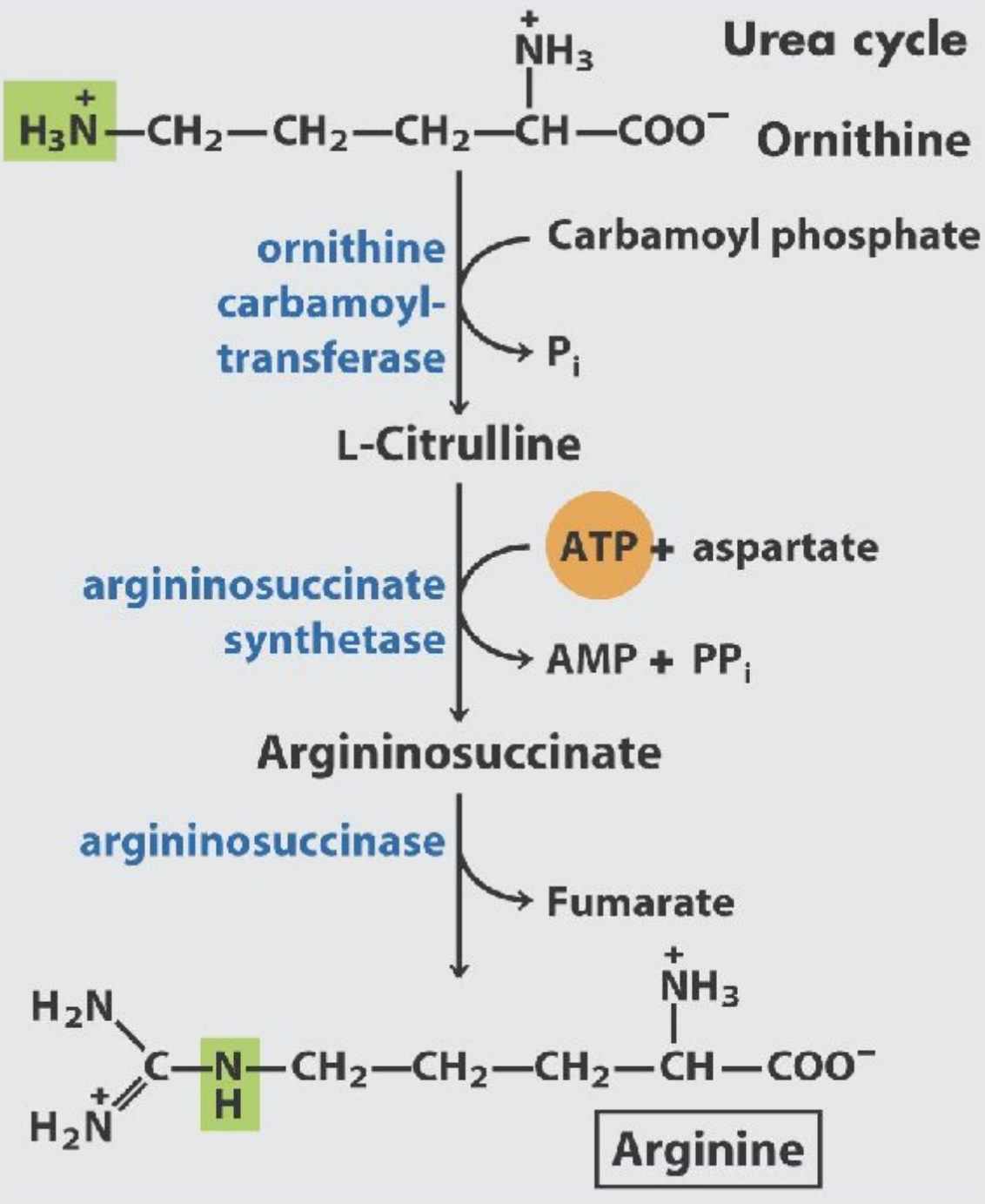
α -Ketoglutarate



***N*-Acetyloronithine**



Urea cycle



Tyrosine

Phosphoenolpyruvate

+

Erythrose 4-phosphate



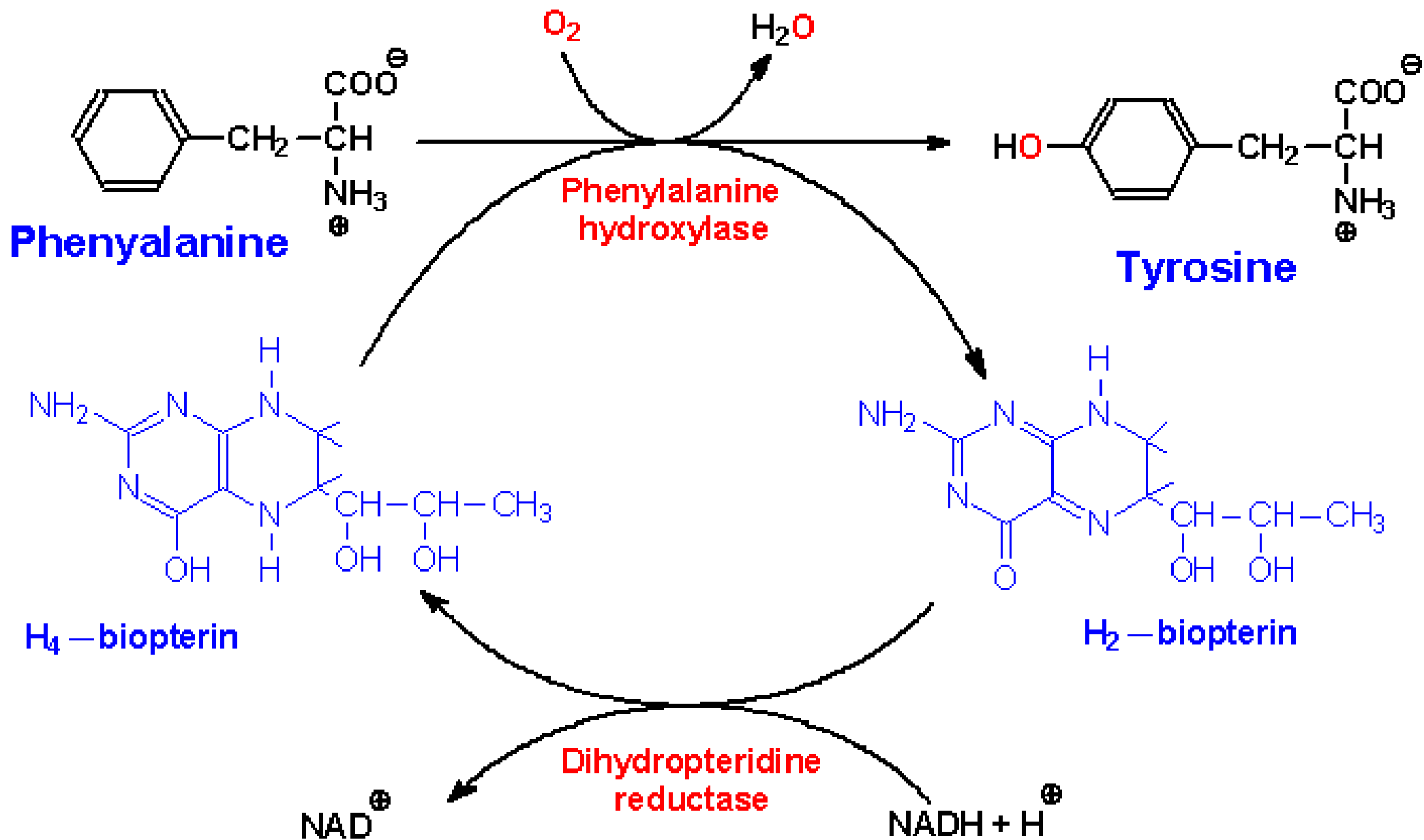
Phenylalanine

Tyrosine

Tryptophan



Tyrosine



Alanine

