AMİNO ASİT METABOLİZMASI

ÇEVİREN
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SAMSUN-2015

Amino acid metabolism

- Metabolism of amino acids differs, but 3 common reactions:
  - Transamination
  - Deamination
  - Decarboxylation

Amino asit metabolizması

- Amino asitlerin metabolizmaları farklılık göstermekle birlikte 3 ortak reaksiyon vardır:
  - Transaminasyon
  - Deaminasyon
  - Dekarboksilasyon

Transamination

In transamination

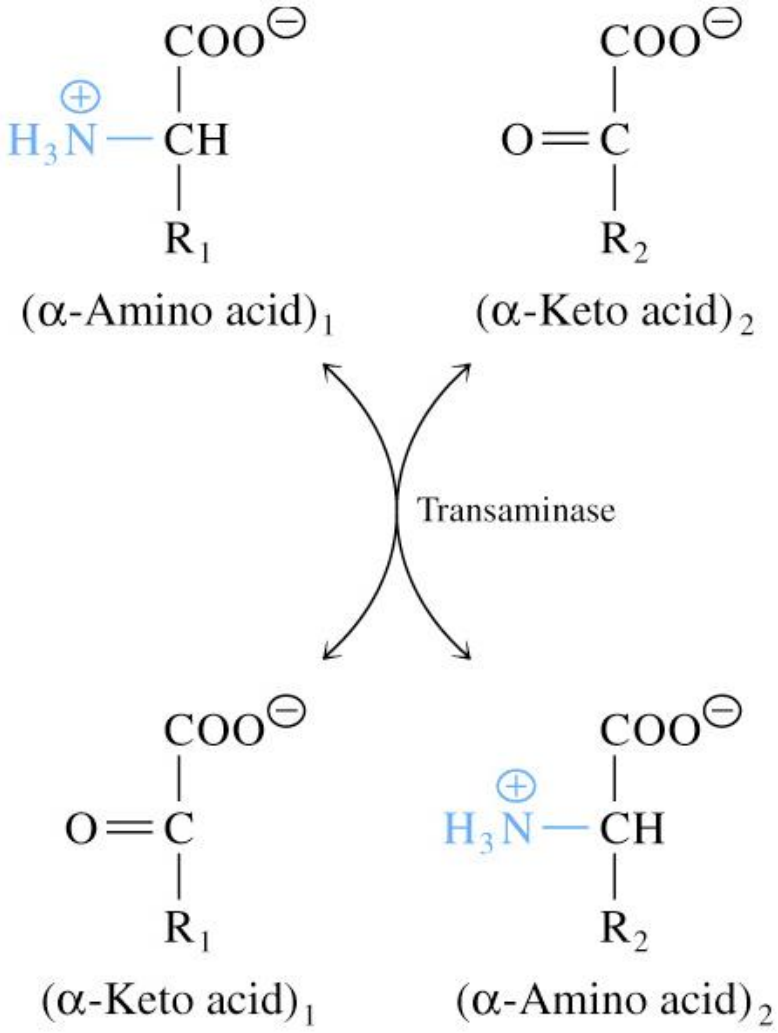
- Amino acids are degraded in the liver.
- An amino group is transferred from an amino acid to an α-keto acid, usually α-ketoglutarate.
- The reaction is catalyzed by a *transaminase or aminotransferase.*
- A new amino acid, usually glutamate, and a new α-keto acid are formed.

Transaminasyon

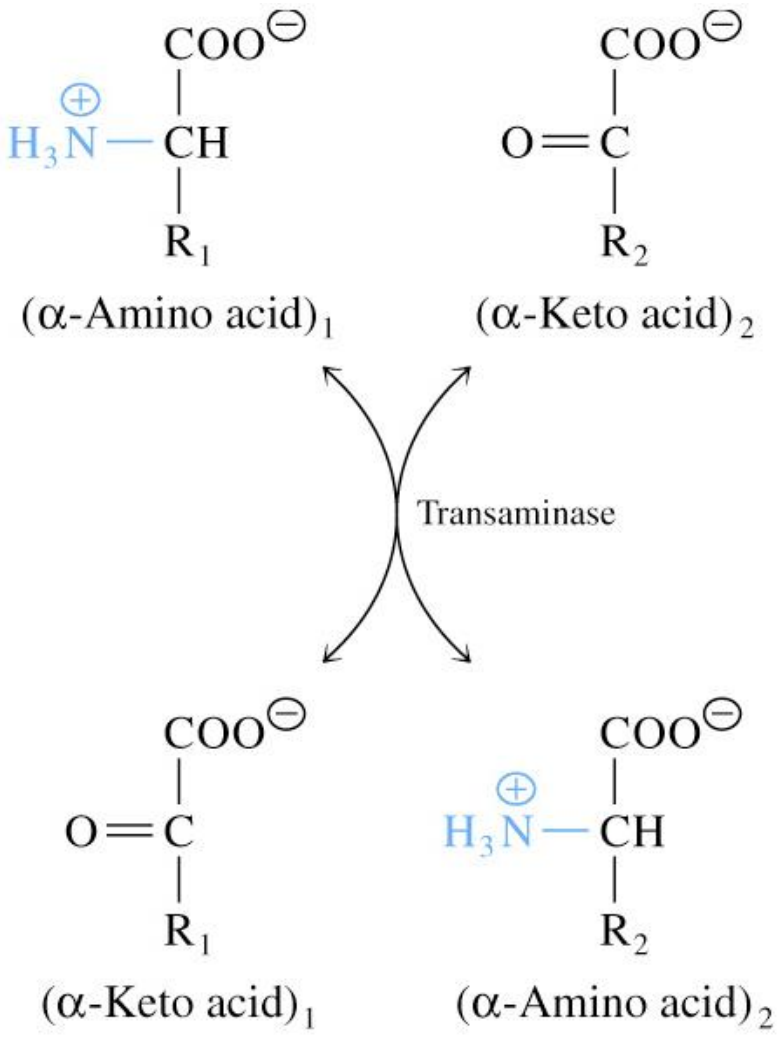
Transaminasyonda:

- Amino asitler karaciğerde parçalanır.
- Bir amino grubu bir amino asitten α-keto asite (genelde α-ketoglutarate) transfer olur.
- Bu reaksiyon bir *transaminaz* veya *amino transferaz* enzimi ile katalize edilir.
- Bu reaksiyon sonucunda yeni bir amino asit (genelde glutamat) ve yeni bir α-keto asit sentezlenir.

Transamination reactions



Transaminasyon reaksiyonları



Enzymatic Transamination

- Typically, α-ketoglutarate accepts amino groups
- L-Glutamine acts as a temporary storage of nitrogen
- L-Glutamine can donate the amino group when needed for amino acid biosynthesis
- All aminotransferases rely on the pyridoxal phosphate cofactor

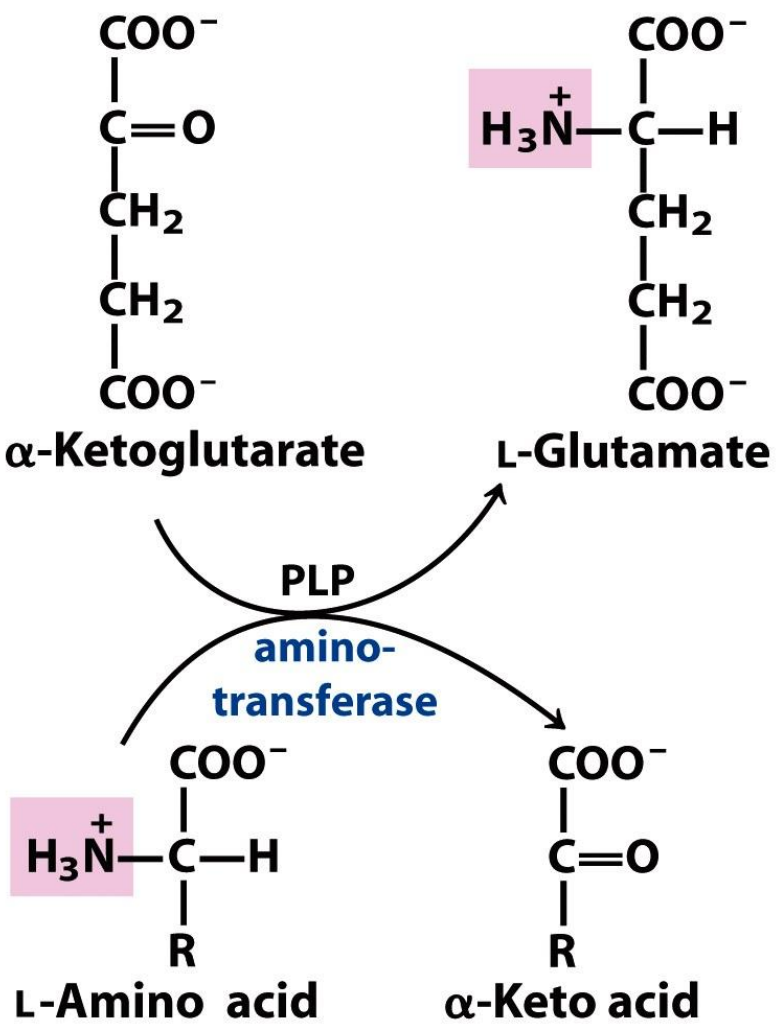


Figure 18-4
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Enzimatik Transaminasyon

- α-ketoglutarat amino gruplarını kabul eder
- L-Glutamin azot için geçici bir depo görevi üstlenir (görür)
- L-Glutamin amino asit biyosentezi için amino grubu ihtiyacı hasıl olduğunda bu ihtiyacı karşılar
- Tüm aminotransferaz enzimleri pyridoxal phosphate kofaktörüne ihtiyaç duyar.

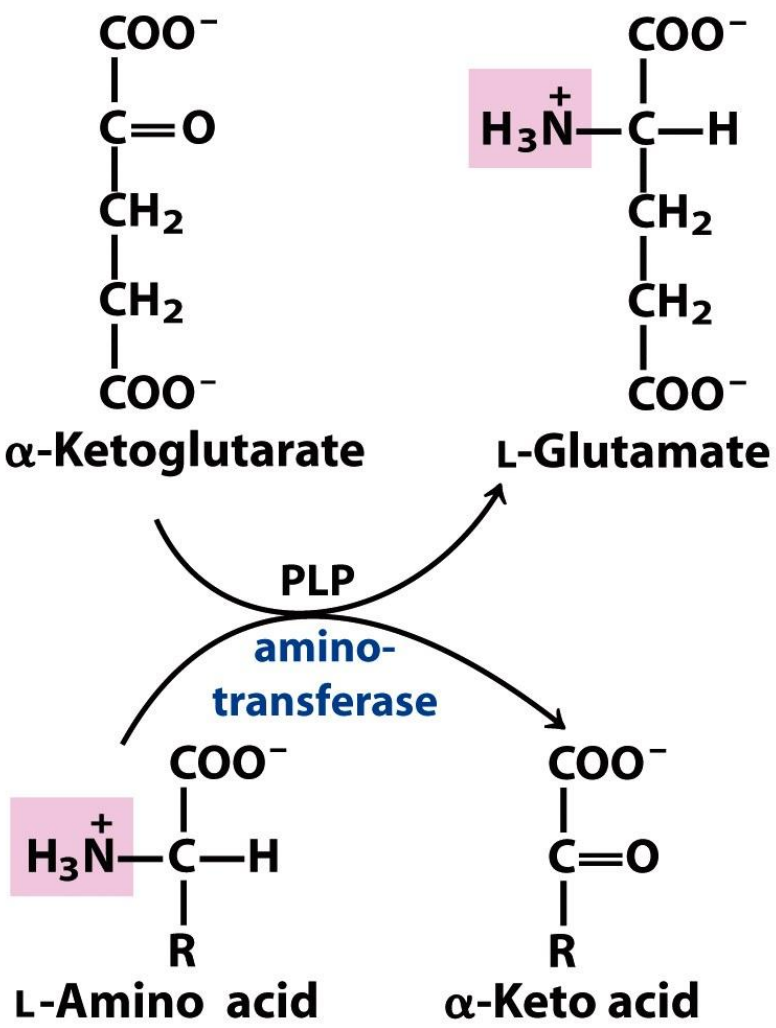

Figure 18-4
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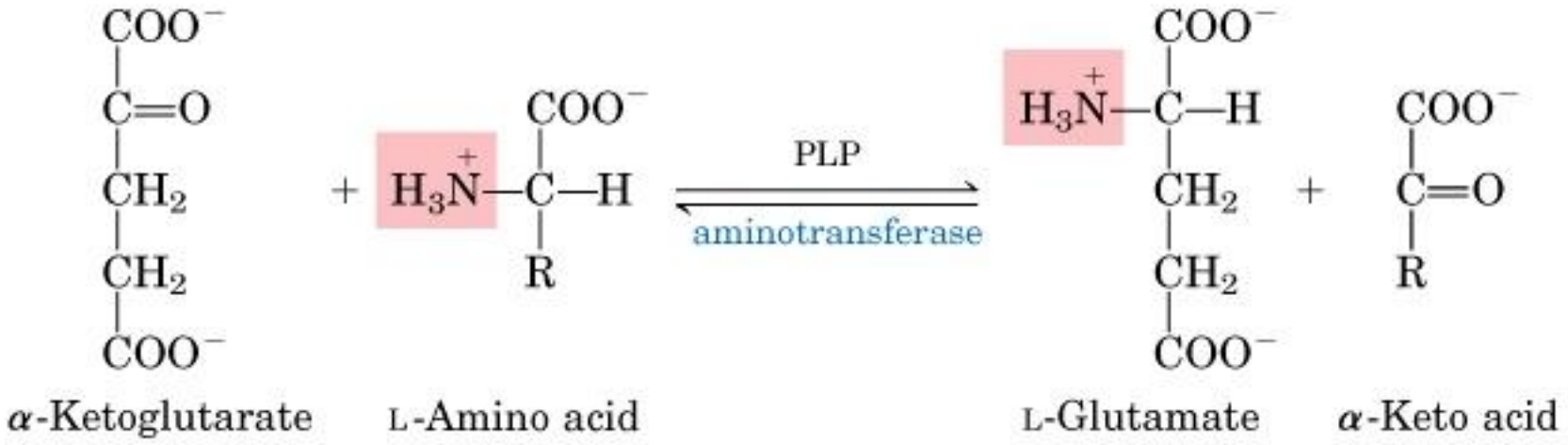
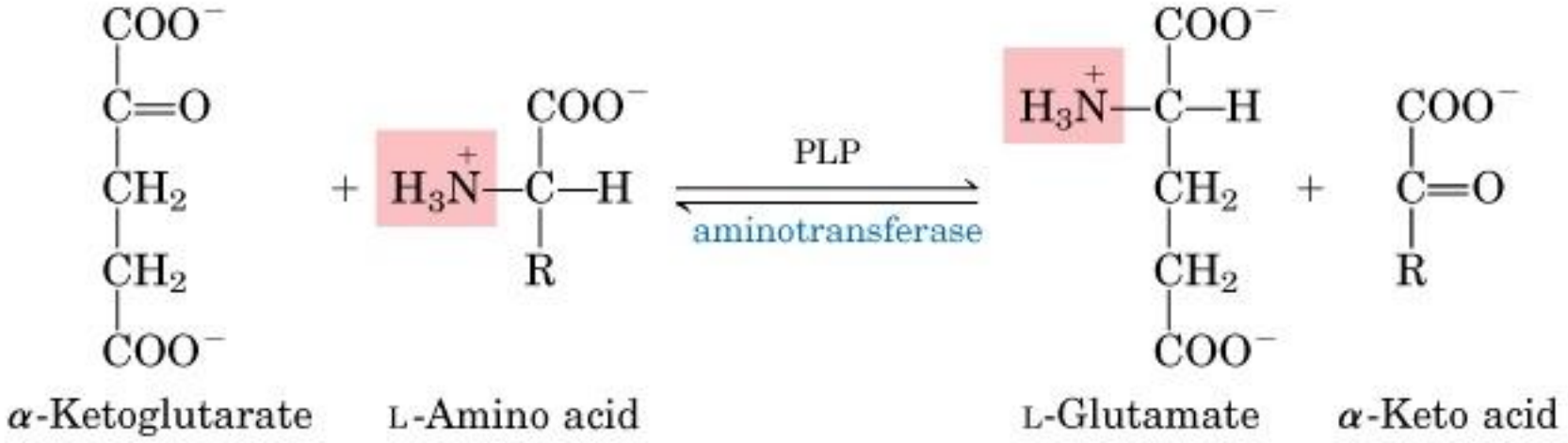
Amino Group Transfer - Aminotransferase

Enzymatic removal of α-amino groups (transaminase /aminotransferases - named for amino donor
i.e. Ala aminotranferase removes amino group from Ala)

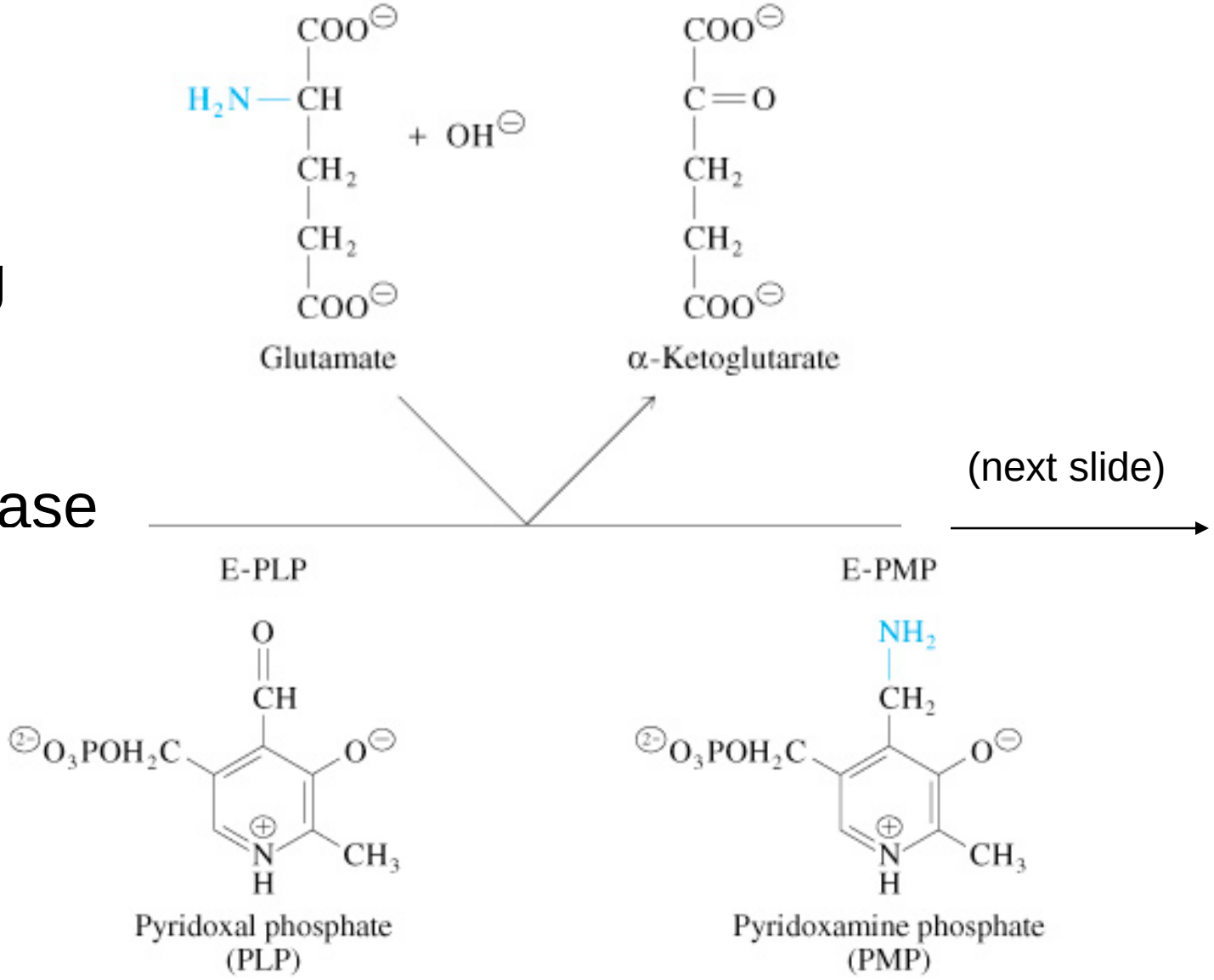


Amino Group Transferi - Aminotransferaz

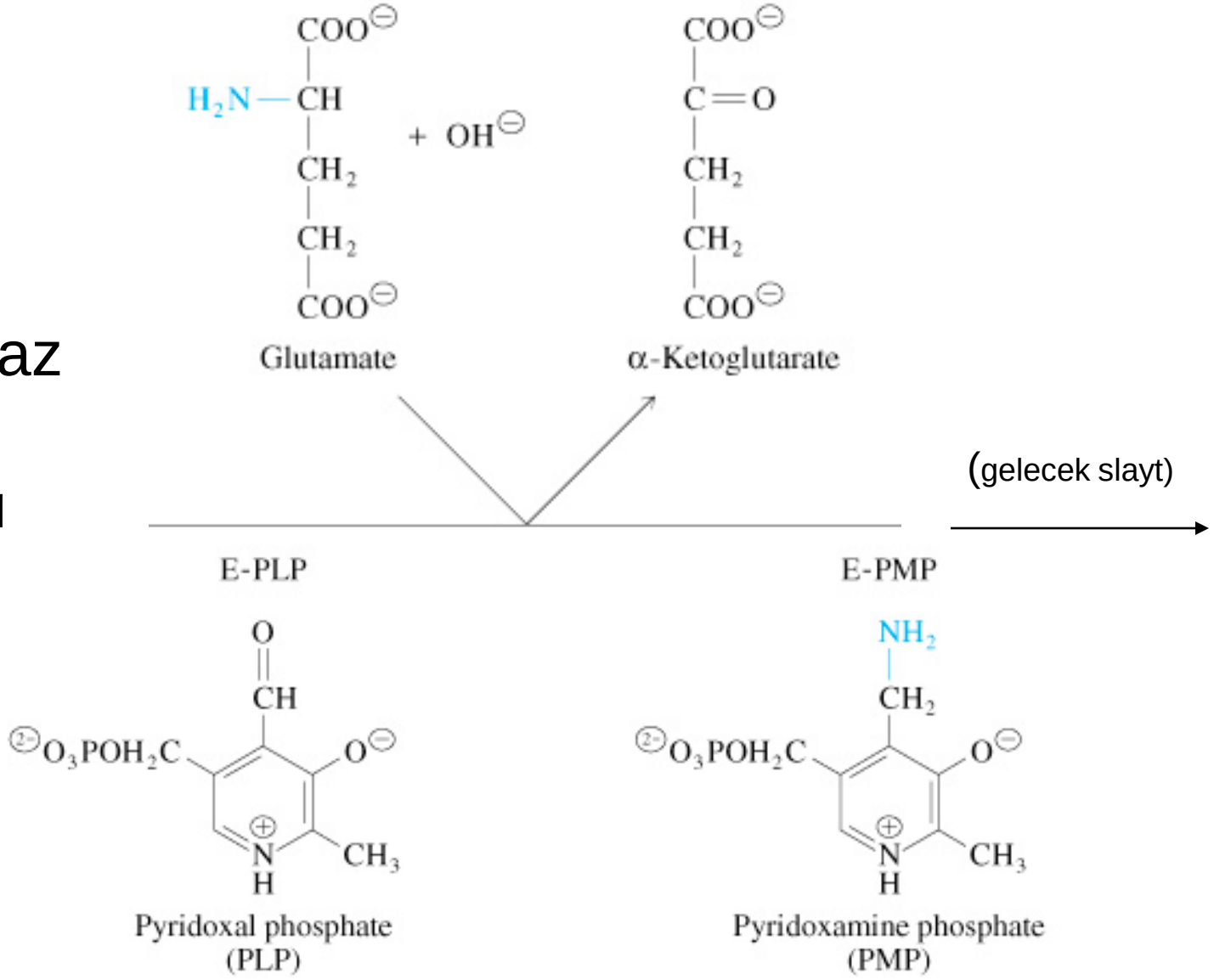
α-amino gruplarının enzimatik yolla uzaklaştırılması (taşınması) (transaminaz /aminotransferazlar – örneğin Ala aminotransferaz enzimi Alanin amino asitinden amino grubunu uzaklaştırır)



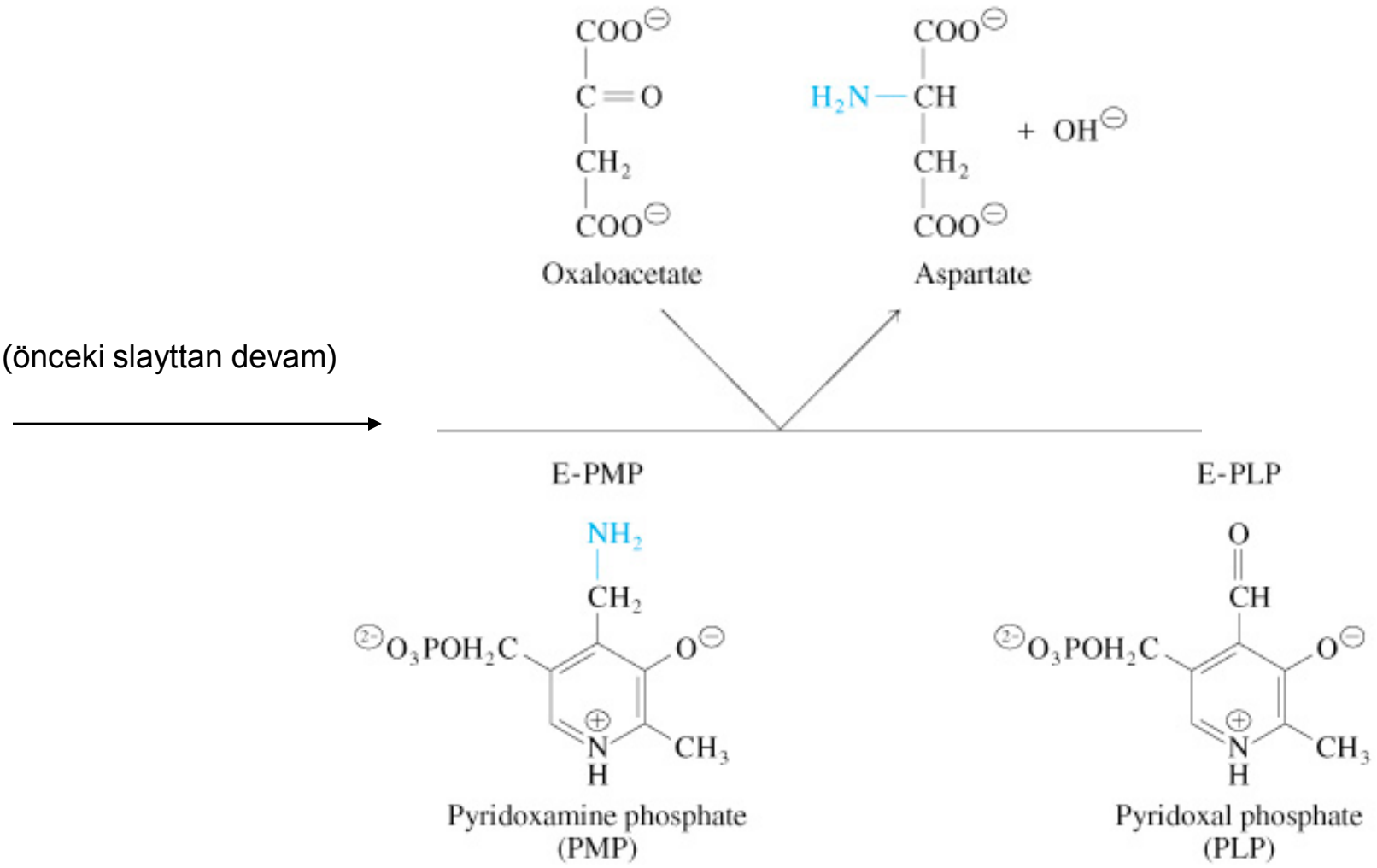
- Ping-pong kinetics of aspartate transaminase



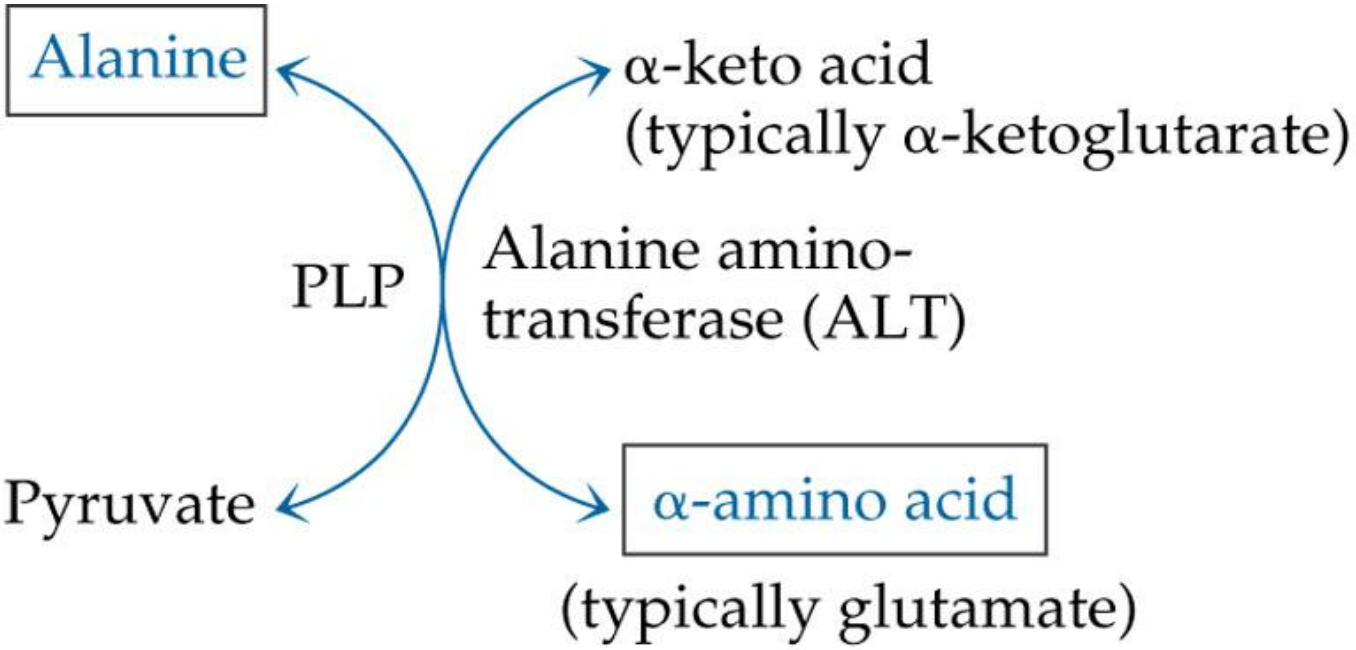
- Aspartat transaminaz enziminin Ping-pong kinetikleri

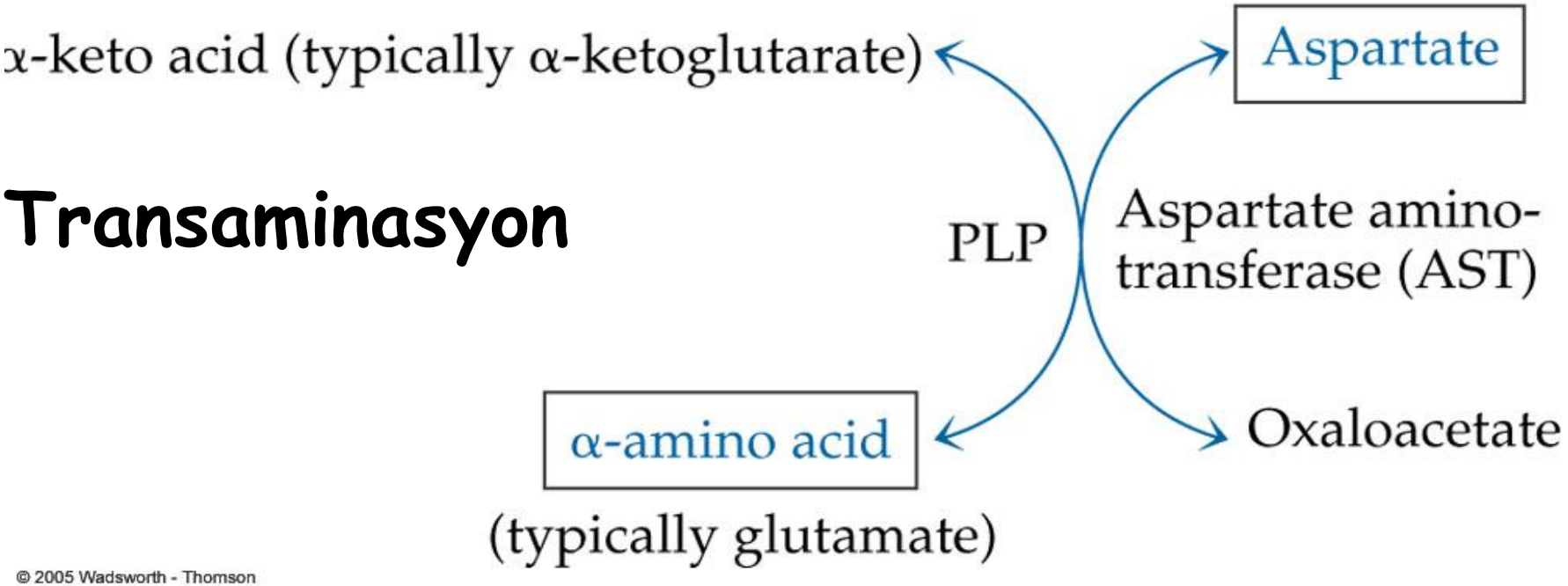


(önceki slayttan devam)

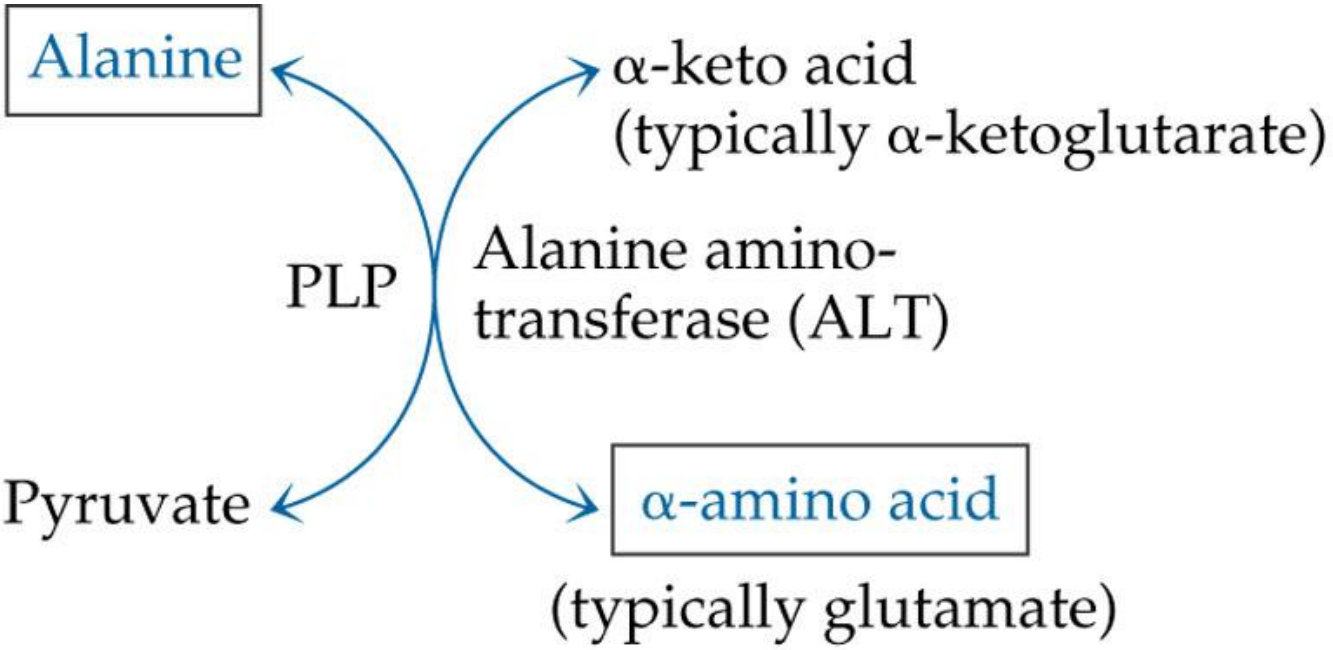


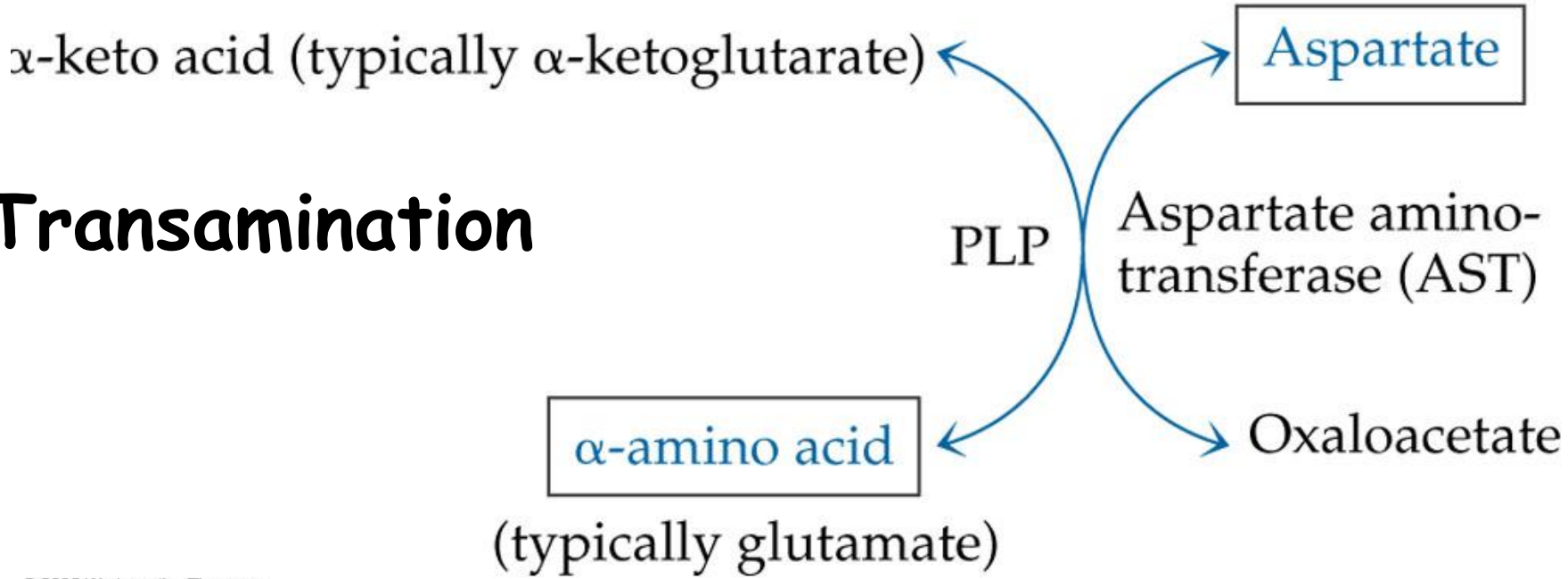
Transaminasyon

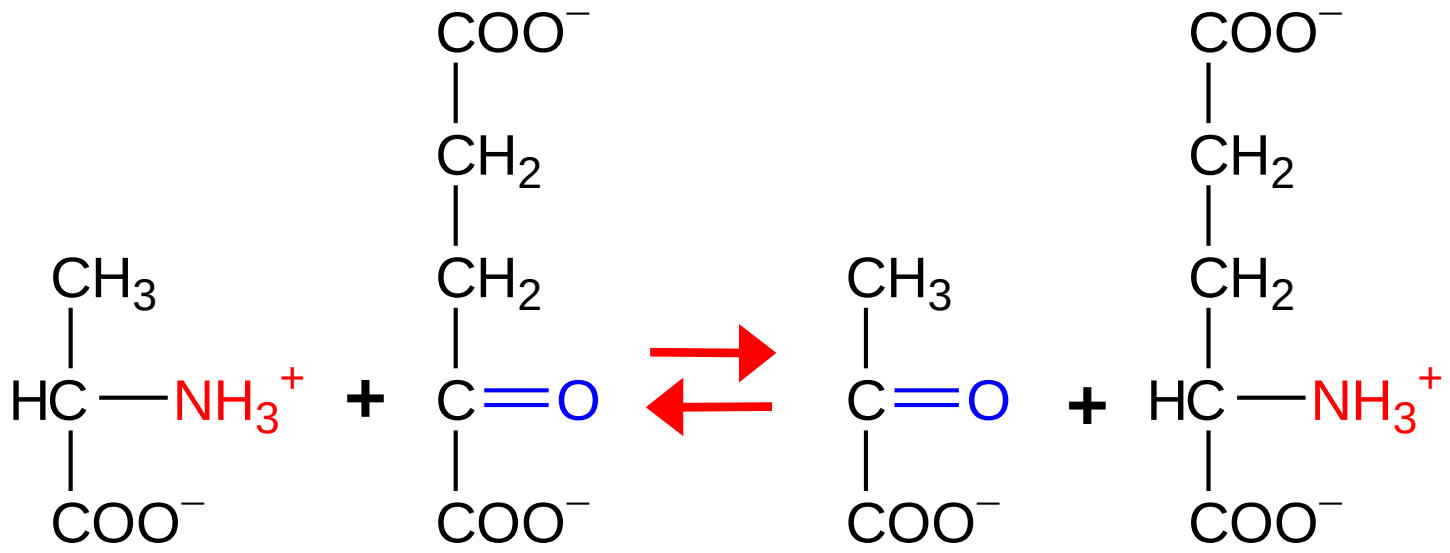




Transamination



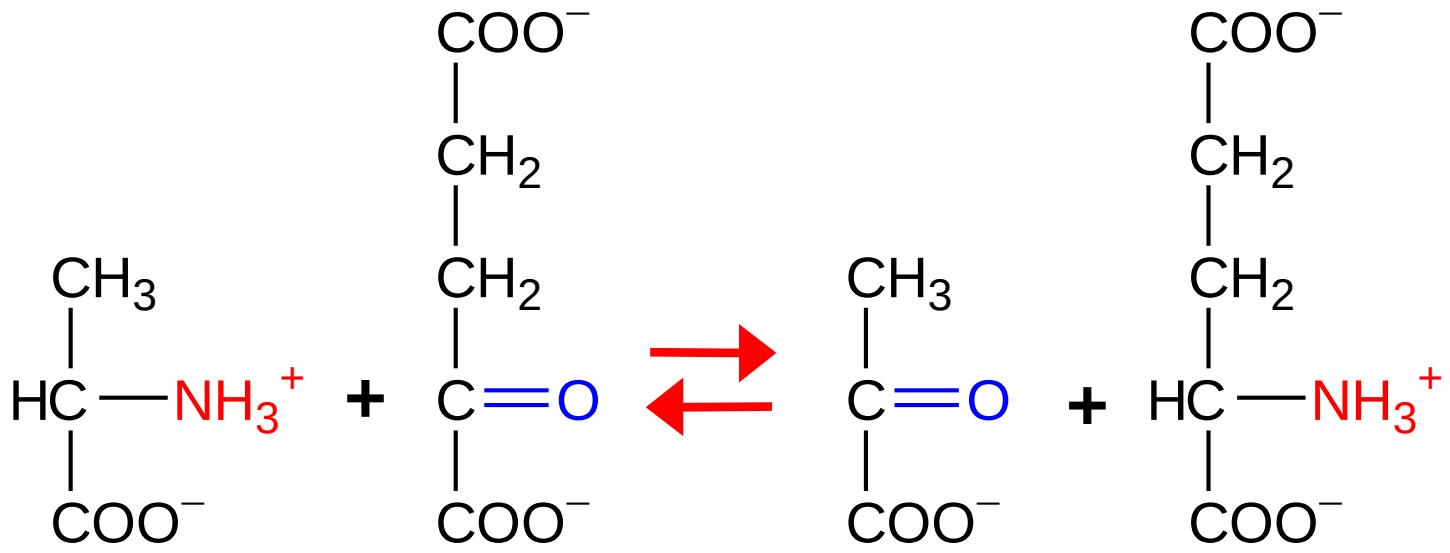




Aminotransferase (Transaminase)

The **3-C** α-keto acid **pyruvate** is produced from **alanine, cysteine, glycine, serine, & threonine**.

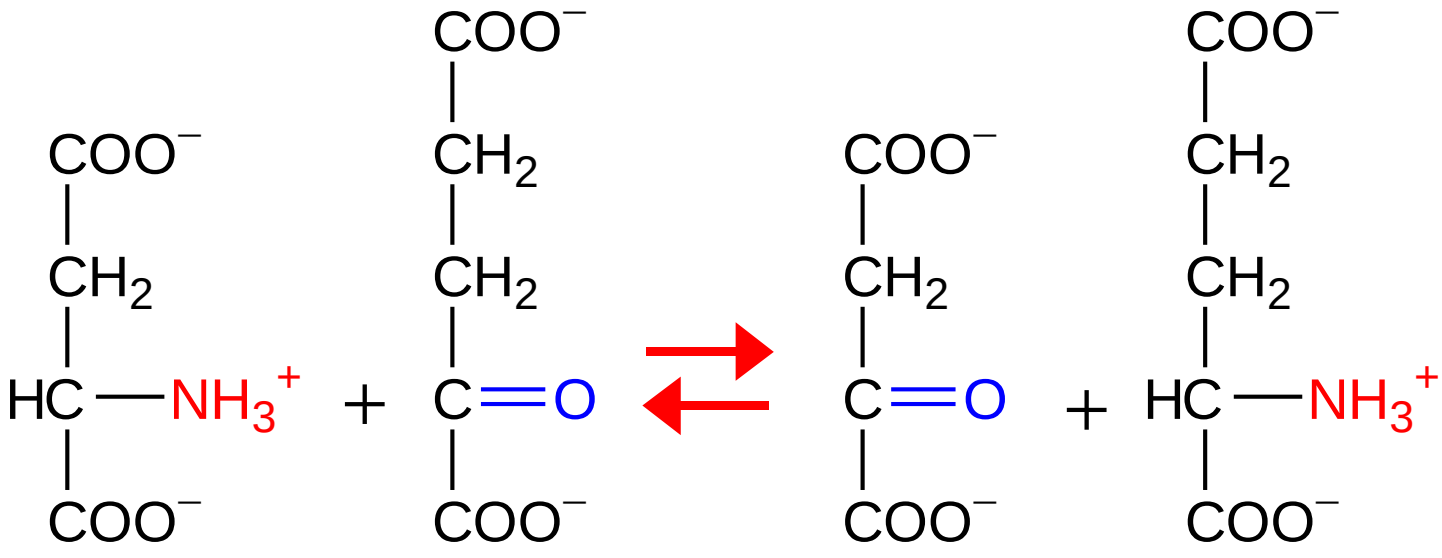
Alanine deamination via Transaminase directly yields pyruvate.



Aminotransferase (Transaminase)

3-C'lu α-keto asiti olan ***pirüvat alanin, sistein, glisin, serin*** ve ***treonin*** amino asitlerinden üretilir.

Transaminazlar yardımıyla gerçekleşen **Alanin** deaminasyonu doğrudan pirüvik asit üretir.

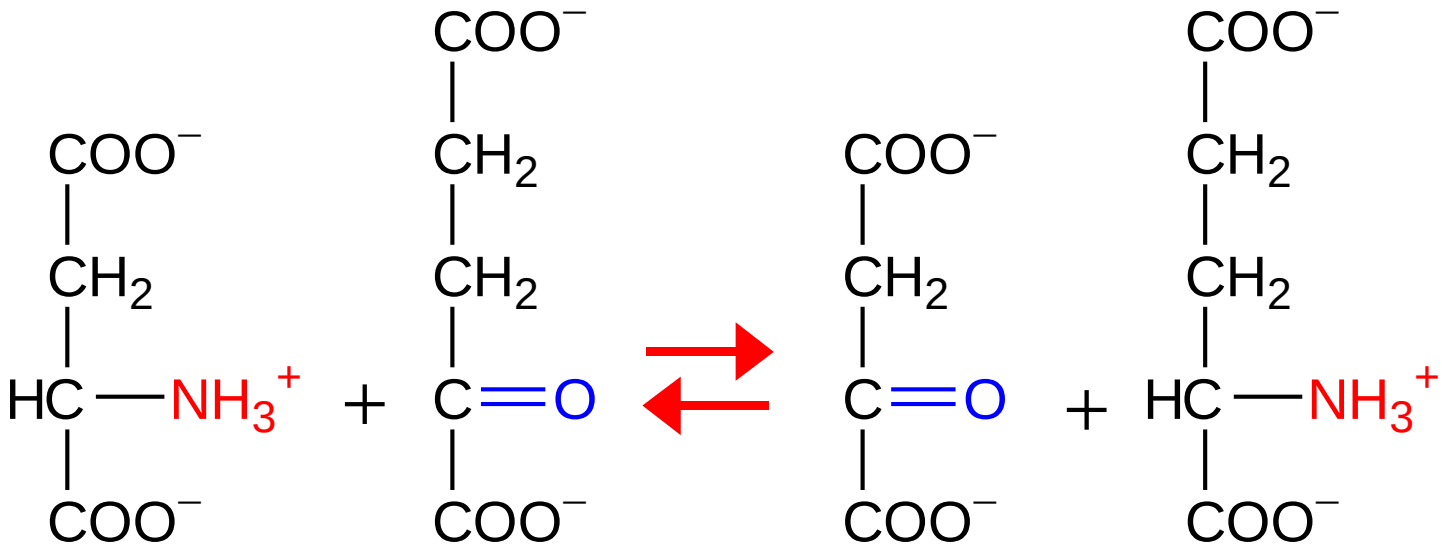


Aminotransferase (Transaminase)

The **4-C** Krebs Cycle intermediate **oxaloacetate** is produced from **aspartate & asparagine**.

Aspartate transamination yields **oxaloacetate**.

Aspartate is also converted to **fumarate** in Urea Cycle.
Fumarate is converted to oxaloacetate in Krebs cycle.



Aminotransferase (Transaminase)

Krebs döngüsünün 4-C'lu ara basamak ürünü olan **oksalasetat** *aspartat* ve *asparagin*'den üretilir.

Aspartat transaminasyonu **oksaloacetat** bileşiğini üretir.

Aspartat aynı zamanda üre döngüsünde **fumarat** bileşiğine dönüşür. **Fumarat** krebs döngüsünde **oksalasetat** bileşiğine dönüşür.

The Amino Group is Removed From All Amino Acids First

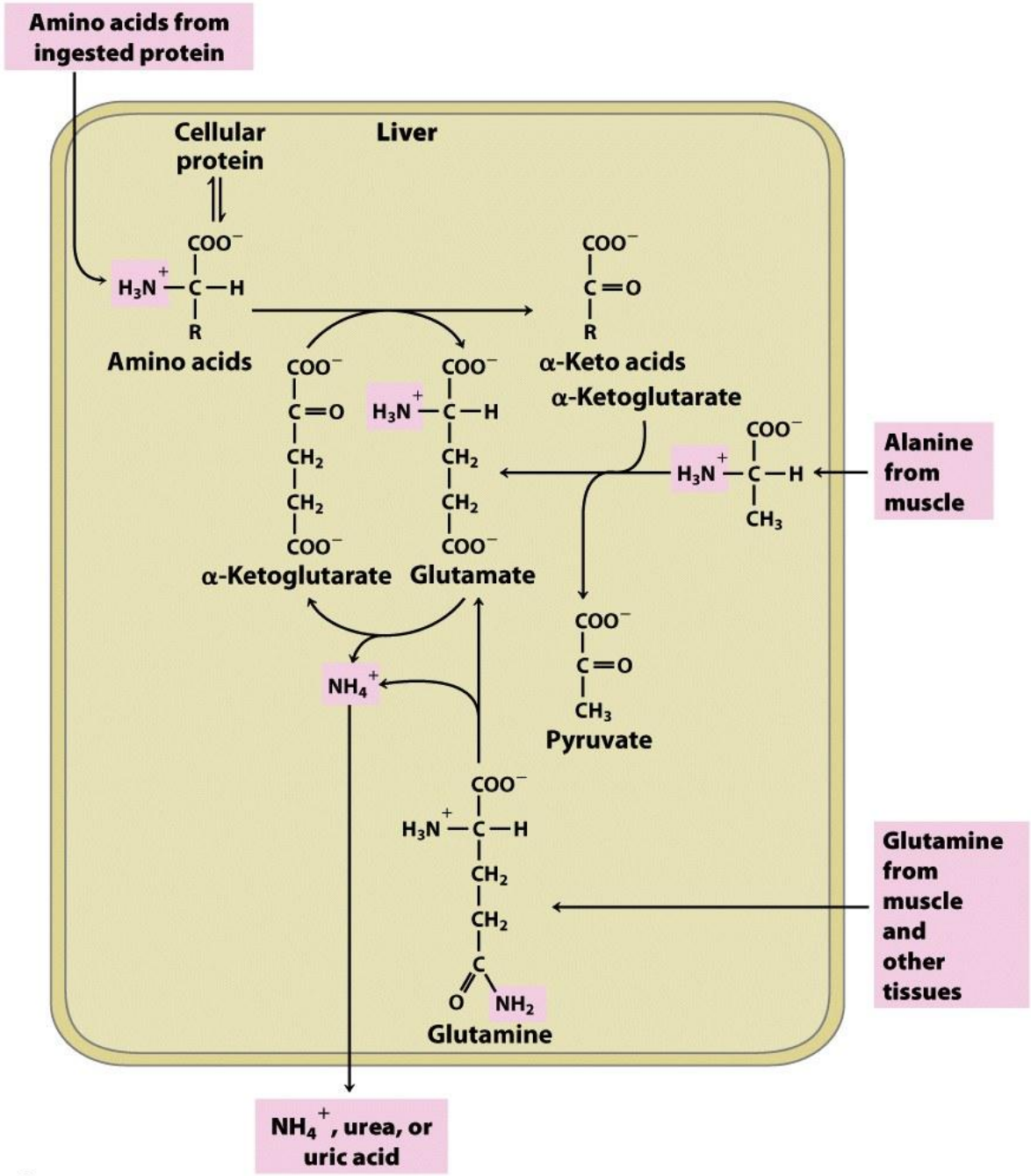


Figure 18-2a

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Önce tüm amino asitlerden amino grubu ayrılır (uzaklaştırılır)

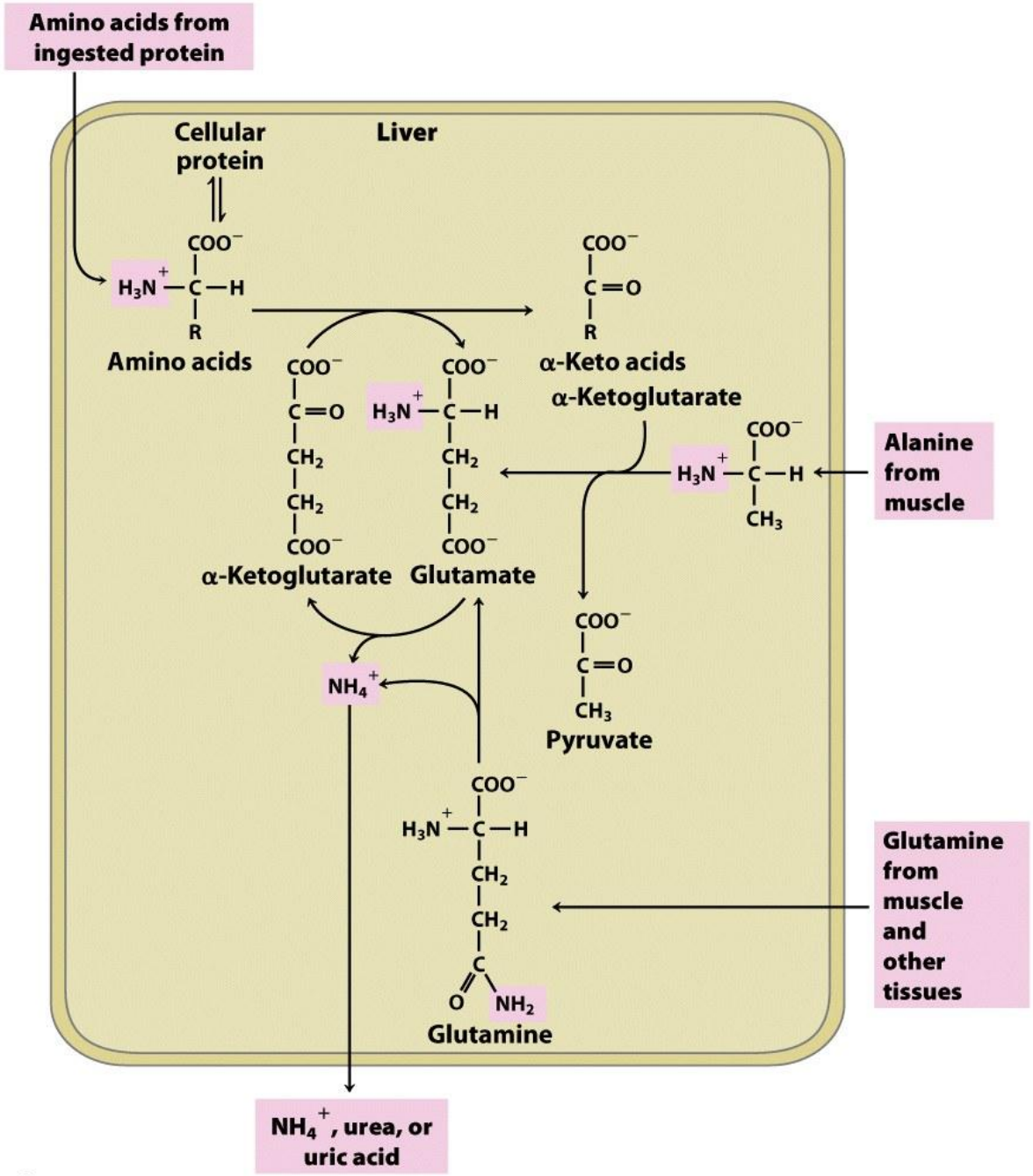

Figure 18-2a
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Oxidative Deamination

Oxidative deamination

- Removes the amino group as an ammonium ion from glutamate.
- Provides α-ketoglutarate for transamination.

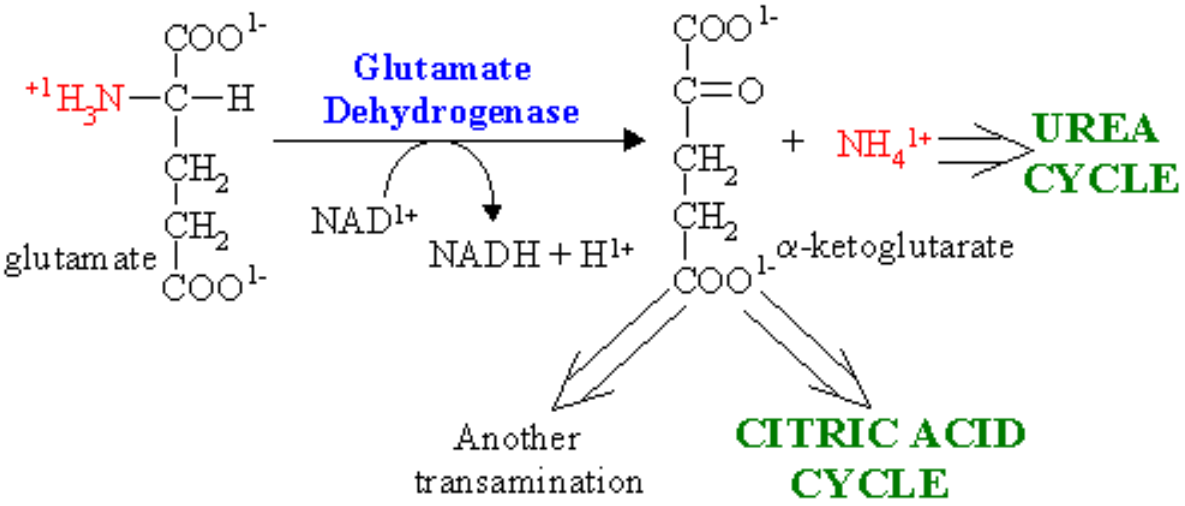
Oksidatif Deaminasyon

Oksidatif Deaminasyon

- Amino grubunu amonyum formunda glutamat bileşiğinden ayırır (uzaklaştırır).
- Transaminasyon için gerekli α-ketoglutarat bileşiğini temin eder.

Oxidative Deamination

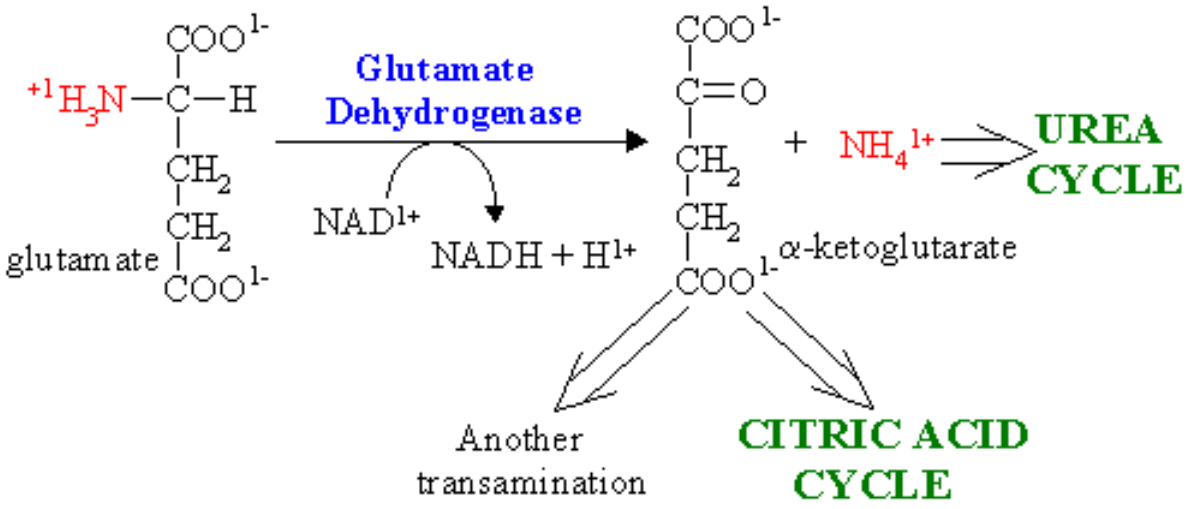
- Glutamate formed by transamination reactions is deaminated to α-ketoglutarate
- Glutamate dehydrogenase - NAD^+ or $NADP^+$ is coenzyme



- Other AA oxidases - (liver, kidney) low activity

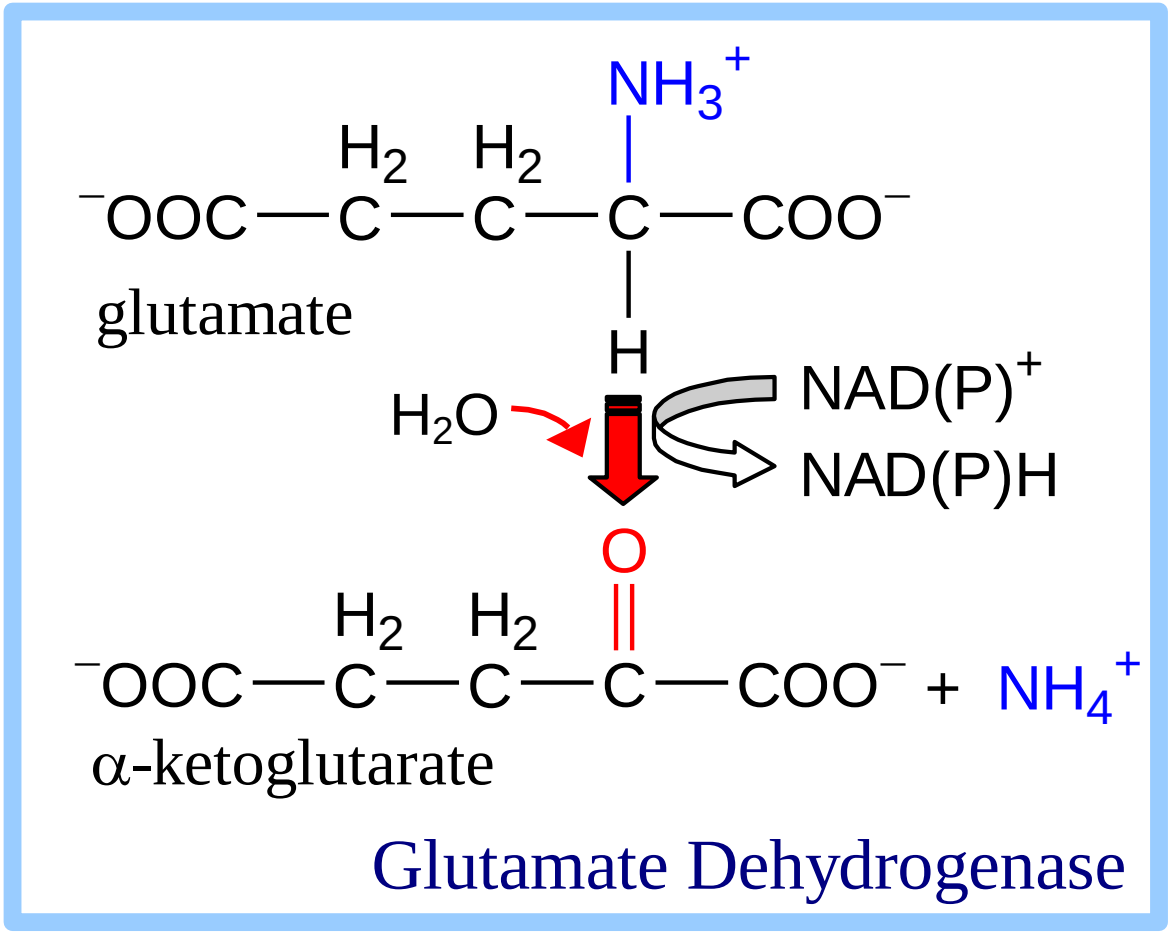
Oksidatif Deaminasyon

- Transaminasyon reaksiyonları tarafından oluşturulan glutamat bileşiği α-ketoglutarat oluşturmak üzere deamine edilir
- Glutamat dehydrogenaz - NAD^+ or $NADP^+$ bir koenzimdir



- Diğer AA oksidazları (karaciğer-böbrek) düşük aktiviteye sahiptir

Glutamate Dehydrogenase catalyzes a major reaction that effects **net removal of N** from the amino acid pool.

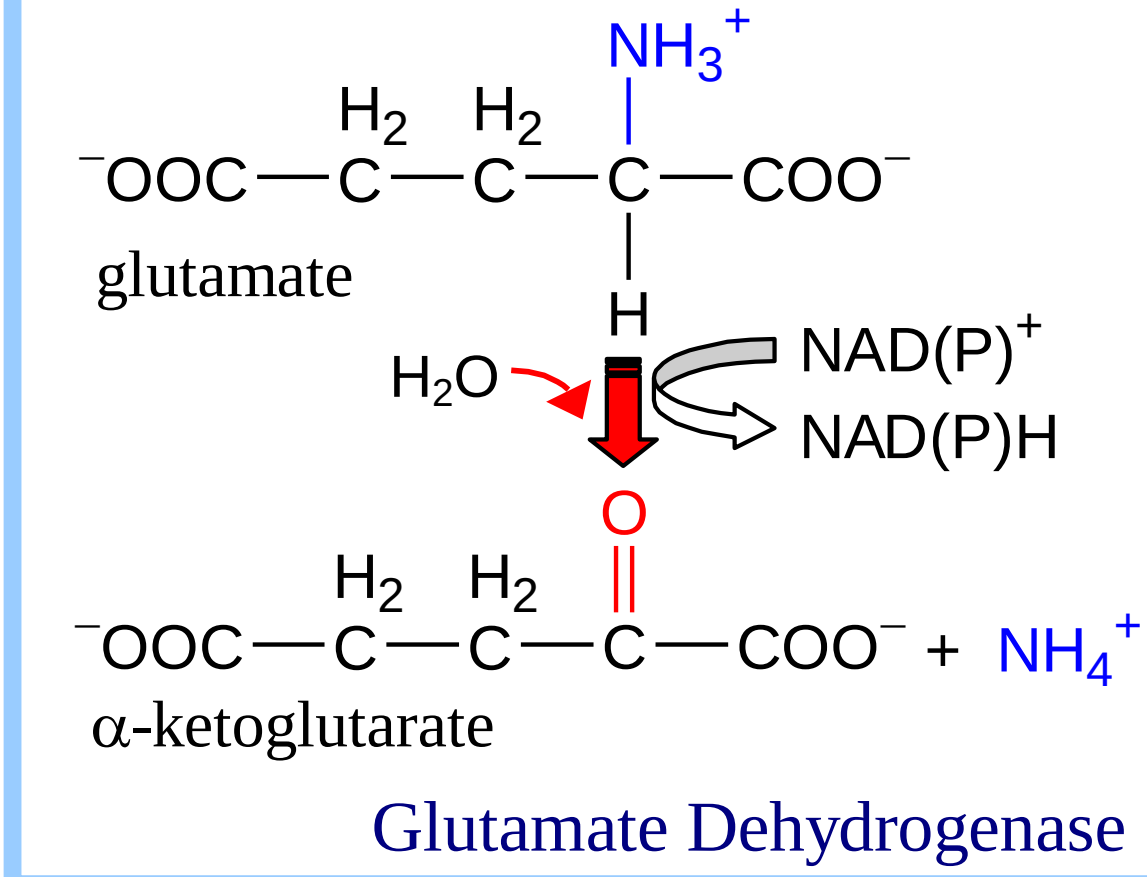


It is one of the few enzymes that can use **NAD^+ or $NADP^+$** as e^- acceptor.

Oxidation at the α-carbon is followed by hydrolysis, releasing NH_4^+.

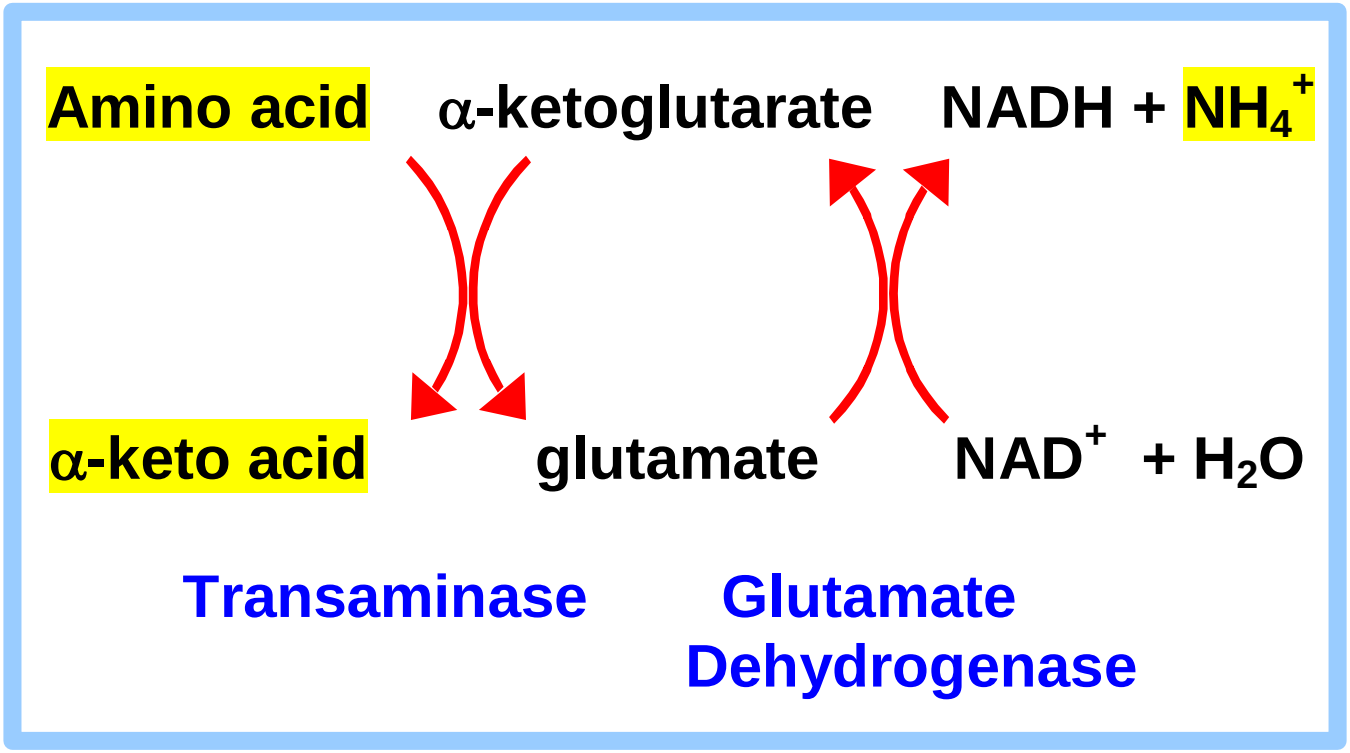
Glutamat Dehidrojenaz

Amino asit havuzundan N'un uzaklaştırılmasını etkileyen (sağlayan) önemli bir reaksiyonu katalize eder.



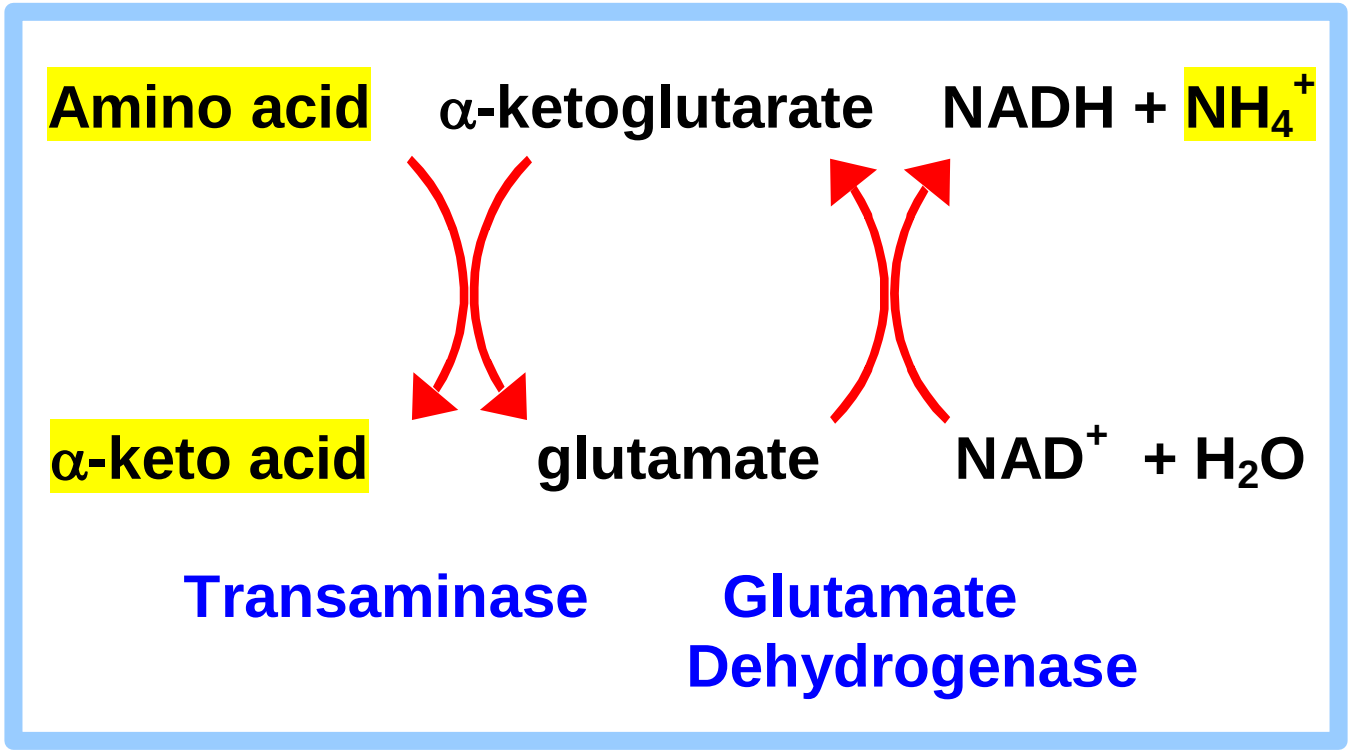
Bu enzim **NAD⁺ or NADP⁺** bileşiklerini e^- alıcısı olarak kullanabilen birkaç enzimden birisidir.

α-karbon'da gerçekleşen oksidasyonu hidroliz işlemi takip eder ve sonuçta NH_4^+ oluşur (açığa çıkar).



Summarized above:

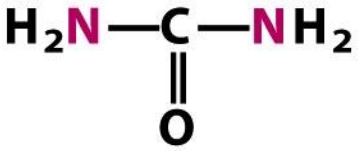
The role of transaminases in funneling amino N to glutamate, which is deaminated via Glutamate Dehydrogenase, producing NH_4^+.



Transaminazların amino N'nun glutamat dehidrojenaz enzimi vasıtası ile deaminasyona uğrayan glutamata aktarılması ve sonuçta NH_4^+ üretilmesi olayındaki rolü

Excretory Forms of Nitrogen

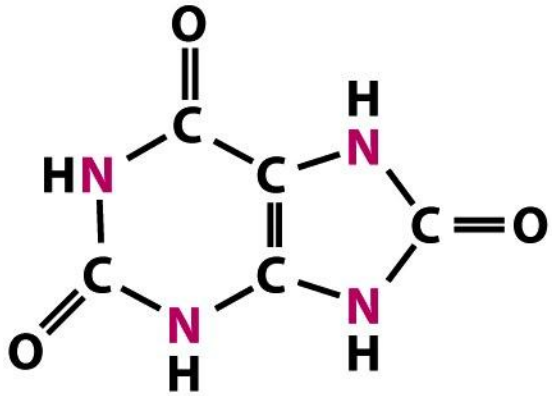
Ammonia (as ammonium ion)



Urea

Ammonotelic animals: most aquatic vertebrates, such as bony fishes and the larvae of amphibia

Ureotelic animals: many terrestrial vertebrates; also sharks



Uric acid

Uricotelic animals: birds, reptiles

Figure 18-2b
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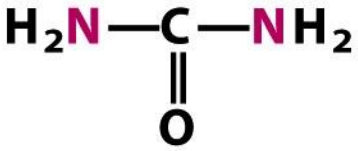
Azotun vücuttan atılma yolları

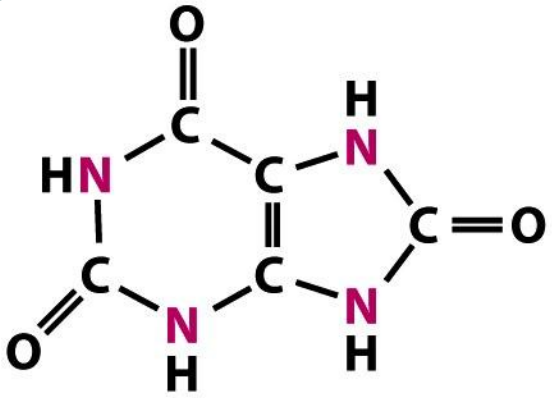
Amonyak (amonyum iyonu formunda)

Ammonotelik hayvanlar:
sucul omurgalılar, amfibilerin larvaları



Üre

Üreteolitik hayvanlar:
Kara omurgalılarının büyük bir kısmı ve köpek balıkları



Ürik asit

Ürikotelik hayvanlar:
Kuşlar, sürüngenler

Figure 18-2b
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Fate of Individual Amino Acids

- Seven to acetyl-CoA
  - Leu, Ile, Thr, Lys, Phe, Tyr, Trp
- Six to pyruvate
  - Ala, Cys, Gly, Ser, Thr, Trp
- Five to α-ketoglutarate
  - Arg, Glu, Gln, His, Pro
- Four to succinyl-CoA
  - Ile, Met, Thr, Val
- Two to fumarate
  - Phe, Tyr
- Two to oxaloacetate
  - Asp, Asn

Bireysel amino asitlerin metabolizmadaki akibetleri

- 7 tanesi asetil koA'ya
  - Leu, Ile, Thr, Lys, Phe, Tyr, Trp
- 6 tanesi pirüvat'a
  - Ala, Cys, Gly, Ser, Thr, Trp
- 5 tanesi α-ketoglutarat'a
  - Arg, Glu, Gln, His, Pro
- 4 tanesi süksinil KoA'ya
  - Ile, Met, Thr, Val
- 2 tanesi fumarat'a
  - Phe, Tyr
- 2 tanesi oksalasetat'a
  - Asp, Asn

dönüşür (metabolize olur)

Summary of Amino Acid Catabolism

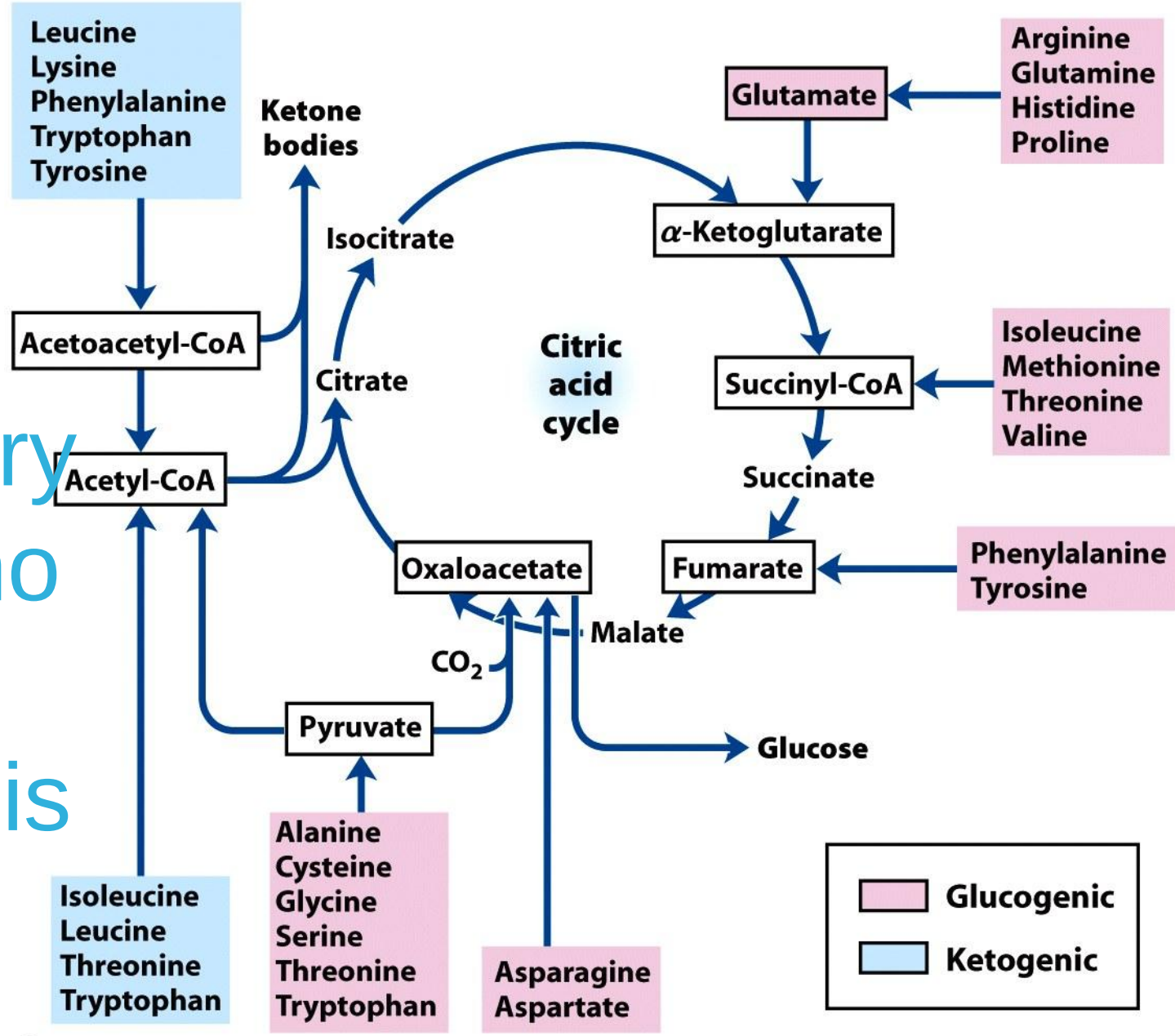

Figure 18-15
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Amino Asit katabolizmasının Özeti

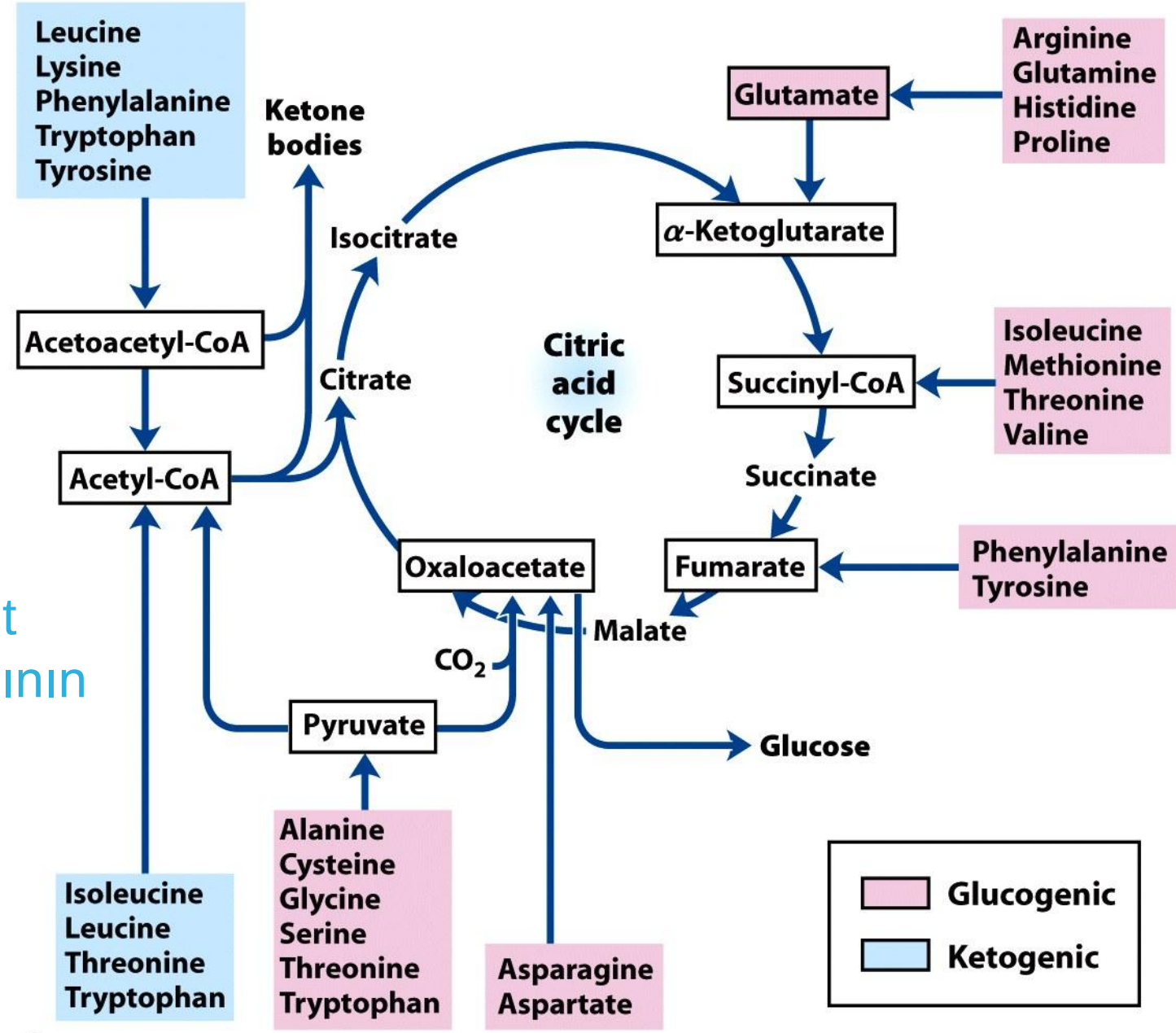

Figure 18-15
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Summary of amino acid catabolism. Amino acids are grouped according to their major degradative end product. Some amino acids are listed more than once because different parts of their carbon skeletons are degraded to different end products. The figure shows the most important catabolic pathways in vertebrates, but there are minor variations among vertebrate species. Threonine, for instance, is degraded via at least two different pathways, and the importance of a given pathway can vary with the organism and its metabolic conditions. The glucogenic and ketogenic amino acids are also delineated in the figure, by color shading. Notice that five of the amino acids are both glucogenic and ketogenic. The amino acids degraded to pyruvate are also potentially ketogenic. Only two amino acids, leucine and lysine, are exclusively ketogenic.

Amino asit katabolizmasının özeti. Amino asitler son parçalanma ürünlerine göre gruplandırılır. Bazı amino asitler, karbon iskeletlerinin farklı kısımları farklı son ürünlere parçalandığından, birden fazla yerde yer almaktadır. Bu şekil omurgalılarda en önemli katabolik yolları göstermekle birlikte omurgalı türleri arasında küçük çaplı farklılıklar olabilmektedir. Örneğin, treonin en az 2 farklı yolla parçalanmaktadır ve herhangi bir yolun önemi organizmaya ve bu organizmanın metabolik şartlarına göre değişir. Glukojenik ve ketojenik amino asitler şekilde farklı renklerle gölgeli halde gösterilmiştir. Görüldüğü gibi 5 amino asit hem glikojenik, hem de ketojeniktir. Pirüvata parçalanan amino asitler ketojeniktir. İki amino asit –lösin ve lisin- sadece ketojeniktir.