Enzyme nomenclature

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Enzyme nomenclature

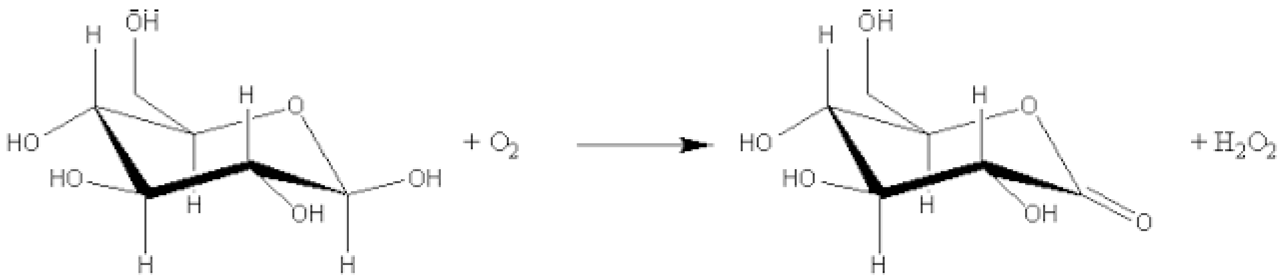
- The International Union of Biochemistry (IUB, 1961) adopted a scheme for systematic functional classification and nomenclature of enzymes.
- **The recommendations of IUB are as follows:**
  - (i) All known enzymes have been grouped into six major classes on the basis of reaction type they catalyze,
  - (ii) Each class further sub-divided into subclasses and sub-subclasses,
  - (iii) Each enzyme is assigned two names i.e., recommended (trivial) name and systematic name,
  - (iv) Each enzyme is identified by a unique four digit classification number.
- The enzyme commission (**EC**) numbers divide enzymes into six main groups according to the type of reaction catalysed:

Table 5.2. IUB classification of enzymes

Major Class (Type of reaction catalyzed)	Common exmaples	Kind of reaction	Specific Example
1. ***Oxidoreductases*** (*Transfer of electrons*)	Oxidases Reductases Dehydrogenase	$A^{+3} + B^{+2} \longrightarrow A^{+2} + B^{+3}$	Alcohol + NAD ↓ *Alcohol dehydrogenase* Aldehyde + $NADH_2$
2. ***Transferases*** (*Transfer of functional groups*)	Transaminase Transketolase Transaldolase	$A-X + B \rightarrow A + B-X$	Glucose + ATP ↓ *Glukokinase or hexokinase* Glucose-6-Phosphate + ADP
3. ***Hydrolases*** (*Hydrolysis Reactions*)	Amylases Lipases Proteases Nucleases	$A–B+H_2O \rightarrow A–OH + B–H$	Sucrose ↓ *Sucrase* Glucose + Fructose
4. **Lyases or *Desmolases*** (*Group elimination to form double bonds without hydrolysis*)	Aldolase Decarboxylase Fumarase Citrate synthase	$\underset{X}{\overset{\vert}{A}} - \underset{Y}{\overset{\vert}{B}} \rightarrow A = B + X - Y$	Histidine ↓ *Histidine decarboxylase* Histidine + CO_2
5. ***Isomerases*** (*Transfer of Groups within a molecule*)	Isomerase Mutase Epimerase	$\underset{Y}{\overset{\vert}{A}} - \underset{X}{\overset{\vert}{B}} \rightarrow \underset{X}{\overset{\vert}{A}} - \underset{Y}{\overset{\vert}{B}}$	Glucose – 6-Phosphate ↓ *Isomerase* Fructose-6-Phosphate
6. ***Ligases or Synthetases*** (*Bond formation couples with ATP hydrolysis*)	Synthetases Carboxylases	$A + B + ATP \rightarrow$ $A - B + ADP + Pi$	Pyruvate + CO_2 + ATP ↓ *Pyruvate carboxylase* Oxaloacetate + ADP + Pi

Oxidoreductases

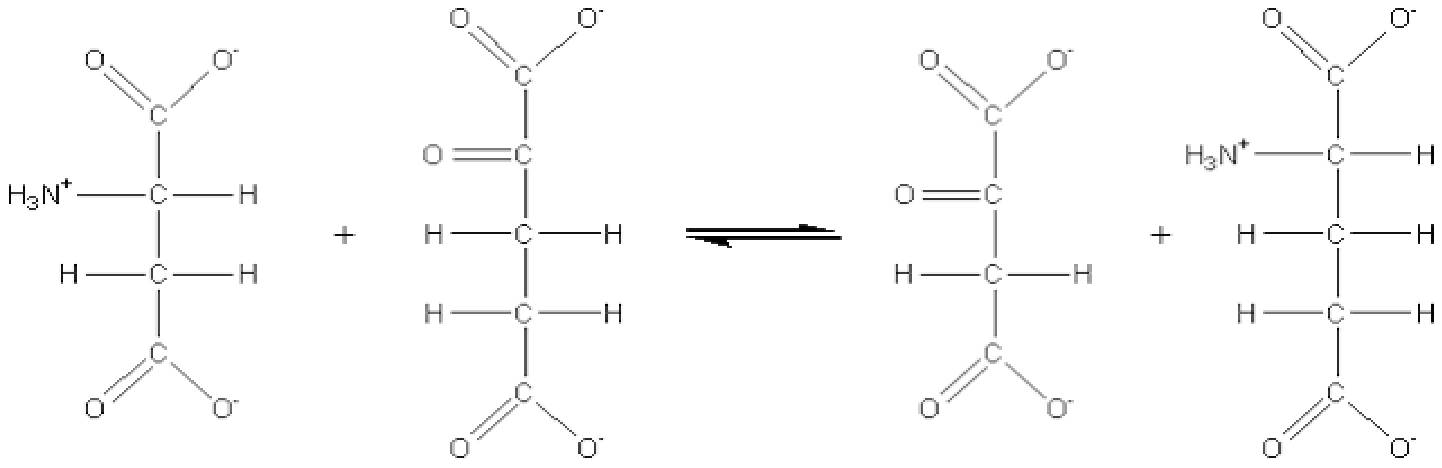
- (1) **Oxidoreductases** which involve redox reactions in which hydrogen or oxygen atoms or electrons are transferred between molecules. This extensive class includes the dehydrogenases (hydride transfer), oxidases (electron transfer to molecular oxygen), oxygenases (oxygen transfer from molecular oxygen) and peroxidases (electron transfer to peroxide). For example: glucose oxidase (EC 1.1.3.4, systematic name, b-D-glucose:oxygen 1-oxidoreductase).



β-D-glucose + oxygen ⟶ D-glucono-1,5-lactone + hydrogen peroxide

Transferases

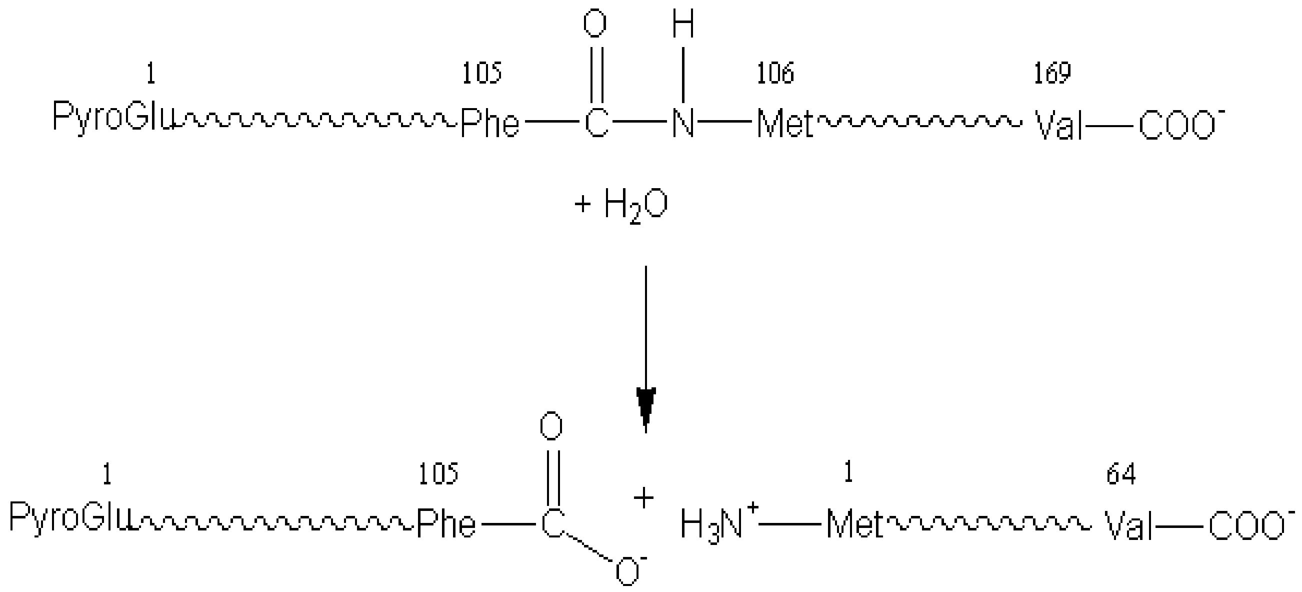
- (2) **Transferases** which catalyse the transfer of an atom or group of atoms (e.g. acyl-, alkyl- and glycosyl-), between two molecules, but excluding such transfers as are classified in the other groups (e.g. oxidoreductases and hydrolases). For example: aspartate aminotransferase (EC 2.6.1.1, systematic name, L-aspartate:2-oxoglutarate aminotransferase; also called glutamic-oxaloacetic transaminase or simply GOT).



L-aspartate + 2-oxoglutarate $\rightleftharpoons$ oxaloacetate + L-glutamate

Hydrolases

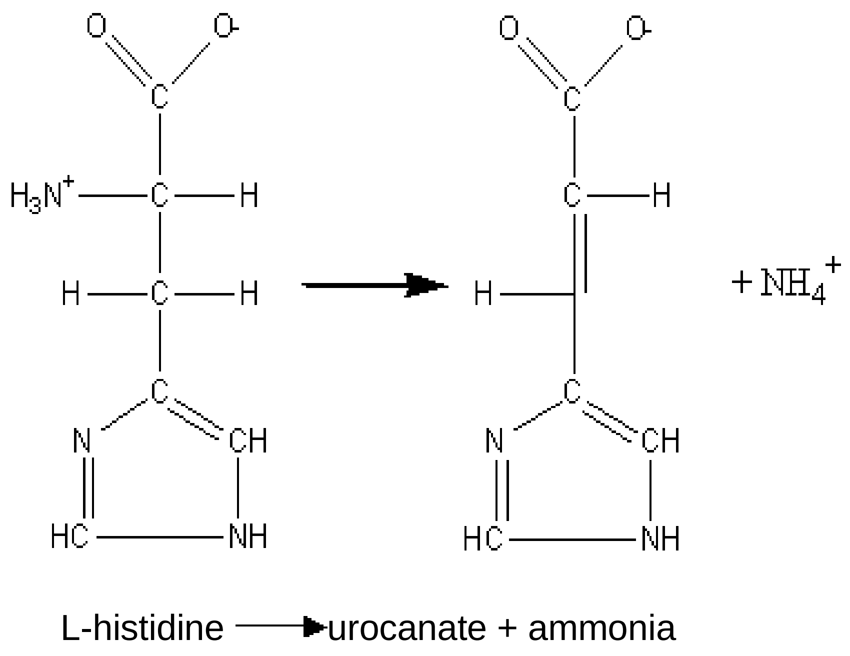
- (3) **Hydrolases** which involve hydrolytic reactions and their reversal. This is presently the most commonly encountered class of enzymes within the field of enzyme technology and includes the esterases, glycosidases, lipases and proteases. For example: chymosin (EC 3.4.23.4, no systematic name declared; also called rennin).



κ-casein + water ⟶ *para*-κ-casein + caseino macropeptide

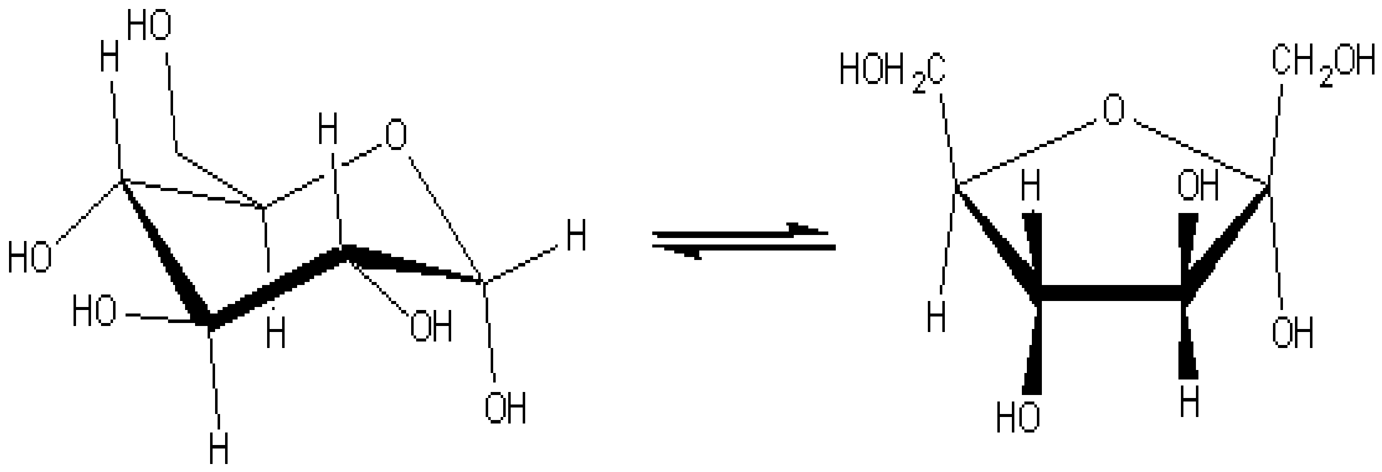
Lyases

- (4) **Lyases** which involve elimination reactions in which a group of atoms is removed from the substrate. This includes the aldolases, decarboxylases, dehydratases and some pectinases but does not include hydrolases. For example: histidine ammonia-lyase (EC 4.3.1.3, systematic name, L-histidine ammonia-lyase; also called histidase).



Isomerases

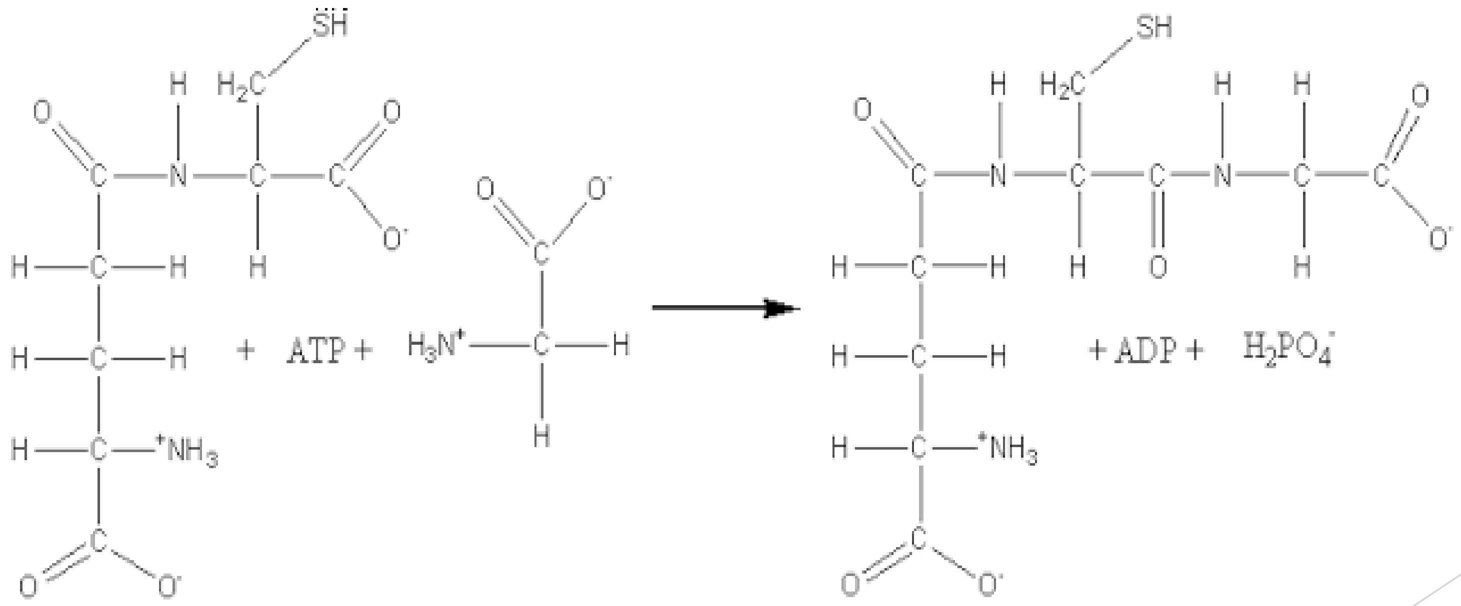
- (5) **Isomerases** which catalyse molecular isomerisations and includes the epimerases, racemases and intramolecular transferases. For example: xylose isomerase (EC 5.3.1.5, systematic name, D-xylose ketol-isomerase; commonly called glucose isomerase).



α-D-glucopyranose ⇌ α-D-fructofuranose

Ligases

- (6) **Ligases**, also known as synthetases, form a relatively small group of enzymes which involve the formation of a covalent bond joining two molecules together, coupled with the hydrolysis of a nucleoside triphosphate. For example: glutathione synthase (EC 6.3.2.3, systematic name, g-L-glutamyl-L-cysteine:glycine ligase (ADP-forming); also called glutathione synthetase).



ATP + γ-L-glutamyl-L-cysteine + glycine $\longrightarrow$ ADP + phosphate + glutathione