Course 2851 Principles of Metabolism
Metabolism and endocrinology programme, Karolinska Institutet

Lecture 11

Enzyme classes

Roland Nilsson, Ph.D

Department of Medicine, Solna
Center for Molecular Medicine
Karolinska Institutet

Principles of metabolism: coping with complexity

Many enzyme, reactions and pathways, but:

Only a few *classes* of enzymes and metabolites

Six classes of enzymes

1. Oxidoreductase
2. Transferase
3. Hydrolase
4. Lyase
5. Isomerase
6. Ligase

Enzyme Commission (EC) system

Published by the IUBMB
www.chem.qmul.ac.uk/iubmb/enzyme/

```
1. -. -.-  Oxidoreductases.
1. 1. -.-   Acting on the CH-OH group of donors.
1. 1. 1.-    With NAD(+) or NADP(+) as acceptor.
1. 1. 2.-    With a cytochrome as acceptor.
1. 1. 3.-    With oxygen as acceptor.
1. 1. 4.-    With a disulfide as acceptor.
1. 1. 5.-    With a quinone or similar compound as acceptor.
1. 1. 9.-    With a copper protein as acceptor.
1. 1.98.-    With other, known, acceptors.
1. 1.99.-    With other acceptors.
1. 2. -.-  Acting on the aldehyde or oxo group of donors.
1. 2. 1.-    With NAD(+) or NADP(+) as acceptor.
1. 2. 2.-    With a cytochrome as acceptor.
1. 2. 3.-    With oxygen as acceptor.
1. 2. 4.-    With a disulfide as acceptor.
1. 2. 5.-    With a quinone or similar compound as acceptor.
1. 2. 7.-    With an iron-sulfur protein as acceptor.
```

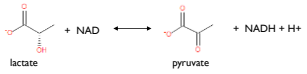
...

Class
Subclass
Subsubclass
Enzyme

Oxidoreductases transfer electrons

1. Oxidoreductase
2. Transferase
3. Hydrolase
4. Lyase
5. Isomerase
6. Ligase

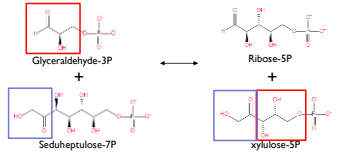
1.1 Acting on the CH-OH group of donors
1.1.1 With NAD(+) or NADP(+) as acceptor
1.1.1.27 Lactate dehydrogenase



Transferases exchange parts of molecules

1. Oxidoreductase
2. Transferase
3. Hydrolase
4. Lyase
5. Isomerase
6. Ligase

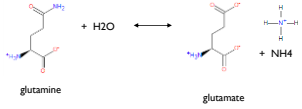
2.2 Transferring aldehyde or ketonic groups
2.2.1 Transketolases and transaldolases
2.2.1.1 Transketolase



Hydrolases cleave molecules using water

1. Oxidoreductase
2. Transferase
3. Hydrolase
4. Lyase
5. Isomerase
6. Ligase

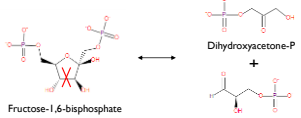
3.5 Acting on carbon-nitrogen bonds, other than peptide bonds
3.5.1 In linear amides
3.5.1.2 Glutaminase



Lyases cleave molecules *without* using water

1. Oxidoreductase
2. Transferase
3. Hydrolase
4. **Lyase**
5. Isomerase
6. Ligase

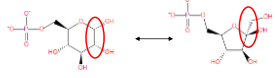
4.1 Carbon-carbon lysaes
4.1.2 Aldehyde-lyases
4.1.2.13 Fructose-bisphosphate aldolase



Isomerases convert between isomers

1. Oxidoreductase
2. Transferase
3. Hydrolase
4. Lyase
5. **Isomerase**
6. Ligase

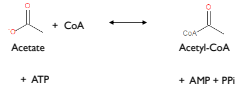
5.3 Intramolecular oxidoreductases
5.3.1 Interconverting aldoses and ketoses
5.3.1.9 glucose-6-phosphate isomerase



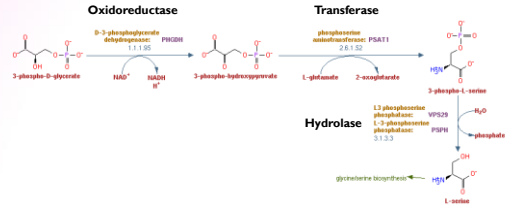
Ligases join molecules

1. Oxidoreductase
2. Transferase
3. Hydrolase
4. Lyase
5. Isomerase
6. **Ligase**

6.2 Forming carbon-sulfur bonds
6.2.1 Acid--thiol ligases
6.2.1.1 Acetate-CoA ligase



Enzyme classes in metabolic pathways



- Some enzymes perform "sequences" of "simple" reactions from the EC system.