

Appendix

List of enzymes according to the EC numbers

1. Oxidoreductases

1.1 Acting on the CH-OH group of donors

1.1.1 With NAD⁺ or NADP⁺ as acceptor

1.1.1.1 Alcohol dehydrogenase, alcohol:NAD⁺ oxidoreductase

1.1.1.27 L-Lactate dehydrogenase, (S)-lactate:NAD⁺ oxidoreductase

1.1.1.28 D-Lactate dehydrogenase, (R)-lactate:NAD⁺ oxidoreductase

1.1.1.29 Glycerate dehydrogenase, (R)-glycerate:NAD⁺ oxidoreductase

1.1.1.37 Malate dehydrogenase, (S)-malate:NAD⁺ oxidoreductase

1.1.1.38 Malate dehydrogenase (oxaloacetate-decarboxylating)
“malic enzyme,” (S)-malate:NAD⁺ oxidoreductase

1.1.1.41 Isocitrate dehydrogenase (NAD⁺), isocitrate:NAD⁺ oxidoreductase

1.1.1.42 Isocitrate dehydrogenase (NADP⁺), isocitrate:NADP⁺ oxidoreductase (decarboxylating)

1.1.1.44 6-phosphogluconate dehydrogenase, 6-phospho-D-gluconate:NADP⁺ 2-oxidoreductase

1.1.1.47 Glucose 1-dehydrogenase, β -D-glucose:NAD(P)⁺ 1-oxidoreductase

1.1.1.49 Glucose-6-phosphate 1-dehydrogenase, D-glucose-6-phosphate:NADP⁺ 1-oxidoreductase, *Zwischenferment*

1.1.2 With a cytochrome as acceptor

1.1.2.3 L-Lactate dehydrogenase(cytochrome), (S)-lactate:ferricytochrome-c 2-oxidoreductase

- 1.1.3 With oxygen as acceptor
 - 1.1.3.4 Glucose oxidase, β -D-glucose:oxygen 1-oxidoreductase
 - 1.1.3.5 Hexose oxidase, D-hexose:oxygen 1-oxidoreductase
 - 1.1.3.22 Xanthine oxidase, xanthine:oxygen oxidoreductase
- 1.1.4 With a disulfide as acceptor
- 1.1.5 With a quinone or similar compound as acceptor
- 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
 - 1.2.1.2 Formate dehydrogenase, formate:NAD⁺ oxidoreductase
 - 1.2.1.3 Aldehyde dehydrogenase (NAD⁺), aldehyde:NAD⁺ oxidoreductase
 - 1.2.1.12 Glyceraldehyde-3-phosphate dehydrogenase (phosphorylating), D-glyceraldehyde-3-phosphate:NAD⁺ oxidoreductase
 - 1.2.2 With a cytochrome as acceptor
 - 1.2.2.2 Pyruvate dehydrogenase (cytochrome), pyruvate:ferricytochrome-*b*₁ oxidoreductase
 - 1.2.3 With oxygen as acceptor
 - 1.2.3.3 Pyruvate oxidase, pyruvate:oxygen 2-oxidoreductase (phosphorylating)
 - 1.2.3.4 Oxalate oxidase, oxalate:oxygen oxidoreductase
 - 1.2.4 With a disulfide as acceptor
 - 1.2.4.1 Pyruvate dehydrogenase (lipoamide), pyruvate:lipoamide 2-oxidoreductase (decarboxylating and acceptor-acetyloyating)
 - 1.2.4.2 Oxoglutarate dehydrogenase (lipoamide), 2-oxoglutarate lipoamide 2-oxidoreductase (decarboxylating and acceptor-succinylating)
 - 1.2.4.4 3-Methyl-2-oxobutanoate dehydrogenase(lipoamide), branched chain α -keto acid dehydrogenase, 3-methyl-2-oxobutanoate:lipoamide 2-oxidoreductase (decarboxylating and acceptor-2-methylpropionylating)
 - 1.2.7 With an iron–sulfur protein as acceptor
 - 1.2.7.1 Pyruvate synthase, pyruvate:ferredoxin 2-oxidoreductase (CoA-acetyloyating)
 - 1.2.99 With other acceptors
 - 1.2.99.2 Carbon monoxide dehydrogenase, carbon monoxide:(acceptor) oxidoreductase
- 1.3 Acting on the CH–CH group of donors
 - 1.3.1 With NAD⁺ or NADP⁺ as acceptor

- 1.3.1.6 Fumarate reductase (NADH), succinate:NAD⁺ oxidoreductase
- 1.3.1.8 Acyl-CoA dehydrogenase (NADP⁺), acyl-CoA: NADP⁺ 2-oxidoreducatse
- 1.3.2 With a cytochrome as acceptor
- 1.3.3 With oxygen as acceptor
- 1.3.5 With a quinone or related compound as acceptor
 - 1.3.5.1 Succinate dehydrogenase (ubiquinone), succinate:ubiquinone oxidoreductase
- 1.3.7 With an iron–sulfur protein as acceptor
- 1.3.99 With other acceptors
 - 1.3.99.3 Acyl-CoA dehydrogenase, acyl-CoA:acceptor 2,3-oxidoreductase
- 1.4 Acting on the CH–NH₂ group of donors
 - 1.4.1 With NAD⁺ or NADP⁺ as acceptor
 - 1.4.1.1 Alanine dehydrogenase, L-alanine:NAD⁺ oxidoreductase (deaminating)
 - 1.4.1.2 Glutamate dehydrogenase, L-glutamate:NAD⁺ oxidoreductase (deaminating)
 - 1.4.1.14 Glutamate synthase (NADH), L-glutamate:NAD⁺ oxidoreductase (transaminating)
 - 1.4.2 With a cytochrome as acceptor
 - 1.4.3 With oxygen as acceptor
 - 1.4.3.2 L-Amino acid oxidase, L-amino acid:oxygen oxidoreductase (deaminating)
 - 1.4.3.4 Amine oxidase (flavin-containing), amine:oxygen oxidoreductase (deaminating) (flavin-containing)
 - 1.4.3.6 Amine oxidase (copper-containing), amine:oxygen oxidoreductase (deaminating) (copper-containing)
 - 1.4.4 With a disulfide as acceptor
 - 1.4.4.2 Glycine dehydrogenase, glycine:lipoylprotein oxidoreductase (decarboxylating and acceptor-amino-methylating)
 - 1.4.7 With an iron–sulfur protein as acceptor
 - 1.4.99 With other acceptors
- 1.5 Acting on the CH–NH group of donors
 - 1.5.1 With NAD⁺ or NADP⁺ as acceptor
 - 1.5.1.3 Dihydrofolate reductase, 5,6,7,8-tetrahydrofolate: NADP⁺ oxidoreductase
 - 1.5.3 With oxygen as acceptor
 - 1.5.3.13 Polyamine oxidase, N1-acetylspermidine:oxygen oxidoreductase
 - 1.5.4 With a disulfide as acceptor
 - 1.5.5 With a quinone or similar compound as acceptor
 - 1.5.99 With other acceptors

- 1.6 Acting on NADH or NADPH
 - 1.6.1 With NAD⁺ or NADP⁺ as acceptor
 - 1.6.2 With a heme protein as acceptor
 - 1.6.2.2 Cytochrome-*b*₅ reductase, NADH:ferricytochrome-*b*₅ oxidoreductase
 - 1.6.4 With a disulfide as acceptor
 - 1.6.4.2 Glutathion reductase (NADPH), NADPH:oxidized-glutathion oxidoreductase
 - 1.6.4.5 Thioredoxin reductase (NADPH), NADPH:oxidized-thioredoxin oxidoreductase
 - 1.6.5 With a quinone or similar compound as acceptor
 - 1.6.5.3 NADH dehydrogenase (ubiquinone), NADH:ubiquinone oxidoreductase
 - 1.6.6 With a nitrogenous group as acceptor
 - 1.6.6.1 Nitrate reductase (NADH), NADH:nitrate oxidoreductase
 - 1.6.8 With a flavin as acceptor
 - 1.6.99 With other acceptors
 - 1.6.99.3 NADH dehydrogenase, NADH:(acceptor) oxidoreductase
- 1.7 Acting on other nitrogenous compounds as donors
 - 1.7.2 With a cytochrome as acceptor
 - 1.7.3 With oxygen as acceptor
 - 1.7.7 With an iron–sulfur protein as acceptor
 - 1.7.5 With a quinone or similar compound as acceptor
 - 1.7.99 With other acceptors
 - 1.7.99.3 Nitrite reductase, nitric oxide:(acceptor) oxidoreductase
 - 1.7.99.4 Nitrate reductase, nitrite:(acceptor) oxidoreductase
- 1.8 Acting on a sulfur group of donors
 - 1.8.1 With NAD⁺ or NADP⁺ as acceptor
 - 1.8.1.4 Dihydrolipoamide dehydrogenase, diaphorase, dihydrolipoamide:NAD⁺ oxidoreductase
 - 1.8.1.7 Glutathione disulfide reductase, glutathione:NADP⁺ oxidoreductase
 - 1.8.1.9 Thioredoxin disulfide reductase, thioredoxin:NADP⁺ oxidoreductase
 - 1.8.2 With a cytochrome as acceptor
 - 1.8.2.1 Sulfite reductase, sulfite:ferricytochrome-*c* oxidoreductase
 - 1.8.3 With oxygen as acceptor
 - 1.8.3.3 Glutathione oxidase, glutathione:oxygen oxidoreductase
 - 1.8.4 With a disulfide as acceptor

- 1.8.4.2 Protein disulfide reductase (glutathione), glutathione:protein disulfide oxidoreductase
- 1.8.5 With a quinone or similar compound as acceptor
- 1.8.7 With an iron–sulfur protein as acceptor
- 1.8.99 With other acceptors
- 1.9 Acting on a heme group of donors
 - 1.9.3 With oxygen as acceptor
 - 1.9.6 With a nitrogenous group as acceptor
 - 1.9.99 With other acceptors
- 1.10 Acting on diphenols and related substances as donors
 - 1.10.1 With NAD⁺ or NADP⁺ as acceptor
 - 1.10.2 With a heme protein as acceptor
 - 1.10.3 With oxygen as acceptor
 - 1.10.3.2 Laccase, benzenediol:oxygen oxidoreductase
 - 1.10.3.3 L-Ascorbate oxidase, L-ascorbate:oxygen oxidoreductase
 - 1.10.99 With other acceptors
- 1.11 Acting on a peroxide as acceptor
 - 1.11.1.1 NADH peroxidase, NADH:hydrogen peroxide oxidoreductase
 - 1.11.1.6 Catalase, hydrogen peroxide:hydrogen peroxide oxidoreductase
 - 1.11.1.7 Peroxidase, donor:hydrogen peroxide oxidoreductase
 - 1.11.1.9 Glutathione peroxidase, glutathione:hydrogen peroxide oxidoreductase
- 1.12 Acting on hydrogen as donor
 - 1.12.1 With NAD⁺ or NADP⁺ as acceptor
 - 1.12.2 With a cytochrome as acceptor
 - 1.12.99 With other acceptors
- 1.13 Acting on single donors with incorporation of molecular oxygen (oxygenases)
 - 1.13.11 With incorporation of two atoms of oxygen
 - 1.13.11.1 Catechol 1,2-dioxygenase, catechol:oxygen 1,2-oxidoreductase
 - 1.13.11.12 Lipoxygenase, linoleate:oxygen 13-oxidoreductase
 - 1.13.12 With incorporation of one atom of oxygen (interal monooxygenases or internal mixed function oxygenases)
 - 1.13.12.4 Lactate 2-monooxygenase, (S)-lactate:oxygen 2-oxidoreductase
 - 1.13.99 Miscellaneous
- 1.14 Acting on paired donors with incorporation of molecular oxygen
 - 1.14.11 With 2-oxoglutarate as one donor, and incorporation of one atom each of oxygen into both donors

- 1.14.12 With NADH or NADPH as one donor, and incorporation of two atoms of oxygen into one donor
- 1.14.12.1 Anthranilate 1,2-dioxygenase (deaminating, decarboxylating) anthranilate, NAD(P)H:oxygen oxidoreductase (1,2-hydroxylating, deaminating, decarboxylating)
- 1.14.13 With NADH or NADPH as one donor, and incorporation of one atom of oxygen
- 1.14.13.17 Cholesterol 7α -monooxygenase, cholesterol, NADPH:oxygen oxidoreductase (7α -hydroxylating)
- 1.14.14 With reduced flavin or flavoprotein as one donor, and incorporation of one atom of oxygen
- 1.14.14.1 Unspecific monooxygenase, microsomal P-450, substrate, reduced-flavoprotein:oxygen oxidoreductase (RH-hydroxylating or -epoxidizing)
- 1.14.15 With a reduced iron–sulfur protein as one donor, and incorporation of one atom of oxygen
- 1.14.15.4 Steroid 11β -monooxygenase, steriod, reduced-adrenal-ferredoxin:oxygen oxidoreductase (11β -hydroxylating)
- 1.14.16 With reduced pteridine as one donor, and incorporation of one atom of oxygen
- 1.14.16.4 Tryptophan 5-monooxygenase, L-tryptophan, tetrahydro-biopterin:oxygen oxidoreductase (5-hydroxylating)
- 1.14.17 With ascorbate as one donor, and incorporation of one atom of oxygen
- 1.14.17.1 Dopamine 11β -monooxygenase, 3,4-dihydroxy-phenethylamine, ascorbate:oxygen oxidoreductase (β -hydroxylating)
- 1.14.99 Miscellaneous
- 1.14.99.5 Stearoyl-CoA desaturase, stearoyl-CoA, hydrogenase-donor:oxygen oxidoreductase
- 1.15 Acting on superoxide radicals as acceptor
- 1.15.1.1 Superoxide dismutase, superoxide:superoxide oxidoreductase
- 1.16 Oxidizing metal ions
- 1.16.1 With NAD^+ or NADP^+ as acceptor
- 1.16.1.1 Mercury(II) reductase, Hg:NADP^+ oxidoreductase
- 1.16.3 With oxygen as acceptor
- 1.16.3.1 Ferroxidase, Fe(II):oxygen oxidoreductase
- 1.17 Acting on CH_2 groups
- 1.17.1 With NAD^+ or NADP^+ as acceptor
- 1.17.3 With oxygen as acceptor

- 1.17.4 With a disulfide as acceptor
- 1.17.99 With other acceptors
- 1.18 Acting on reduced ferredoxin as donor
 - 1.18.1 With NAD⁺ or NADP⁺ as acceptor
 - 1.18.1.2 Ferredoxin-NADP⁺ reductase, ferredoxin-NADP⁺ oxidoreductase
 - 1.18.6 With dinitrogen as acceptor
 - 1.18.6.1 Nitrogenase, reduced ferredoxin:dinitrogen oxidoreductase (ATP-hydrolyzing)
 - 1.18.99 With H⁺ as acceptor
 - 1.18.99.1 Hydrogenase, ferredoxin:H⁺ oxidoreductase
- 1.19 Acting on reduced flavodoxin as donor
 - 1.19.6 With dinitrogen as acceptor
 - 1.19.6.1 Nitrogenase (flavodoxin), reduced flavodoxin: dinitrogen oxidoreductase (ATP-hydrolyzing)
- 1.97 Other oxidoreductases
 - 1.97.1.3 Sulfur reductase, (donor):sulfur oxidoreductase

2. Transferases

- 2.1 Transferring one-carbon groups
 - 2.1.1 Methyltransferases
 - 2.1.1.23 Protein-arginine N-methyltransferase, protein methylase I, S-adenosyl-L-methionine:protein-L-arginine N-methyltransferase
 - 2.1.1.29 t-RNA (cytosine-5)-methyltransferase, S-adenosyl-L-methionine:tRNA (cytosine-5)-methyltransferase
 - 2.1.2 Hydroxymethyl-, formyl-, and related transferases
 - 2.1.2.1 Glycine hydroxymethyltransferase, 5,10-methylene-tetrahydro-folate:glycine hydroxymethyltransferase
 - 2.1.3 Carboxyl- and carbamoyltransferases
 - 2.1.3.2 Aspartate carbamoyltransferase, carbamoyl-phosphate:L-aspartate carbamoyltransferase
 - 2.1.4 Aminotransferases
 - 2.1.4.1 Glycine aminotransferase, L-arginine:glycine amidotransferase
- 2.2 Transferring aldehyde and ketone residues
 - 2.2.1.1 Transketolase, sedoheptulose-7-phosphate:D-glyceraldehyde-3-phosphate glycoaldehydetransferase
 - 2.2.1.2 Transaldolase, sedoheptulose-7-phosphate:D-glyceraldehyde-3-phosphate glycerotransferase
- 2.3 Acyltransferases
 - 2.3.1 Acyltransferases
 - 2.3.1.8 Phosphate acetyltransferase (phosphotransacetylase), acetyl-CoA:orthophosphate acetyltransferase

- 2.3.1.12 Dihydrolipoamide S -acetyltransferase, acetyl-CoA: dihydrolipoamide S -acetyltransferase
- 2.3.1.61 Dihydrolipoamide S -succinyltransferase, succinyl-CoA:dihydrolipoamide S -succinyltransferase
- 2.3.1.85 Fatty acid synthase, acyl-CoA:malonyl-CoA C-acyltransferase (decarboxylating, oxoacyl- and enoyl-reducing and thioester-hydrolyzing)
- 2.3.1.85 Fatty acyl-CoA synthase (yeast fatty acid synthase), acyl-CoA:malonyl-CoA C-acyltransferase (decarboxylating, oxoacyl- and enoyl-reducing)
- 2.3.2 Aminoacyltransferases
 - 2.3.2.6 Leucyltransferase, L-leucyl-tRNA:protein leucyl transferase
- 2.4 Glycosyltransferases
 - 2.4.1 Hexosyltransferases
 - 2.4.1.1 Phosphorylase, 1,4- α -D-glucan:orthophosphate α -D-glucosyltransferase
 - 2.4.1.11 Glycogen(starch) synthase, UDPglucose:glycogen 4- α -D-glucosyltransferase
 - 2.4.1.18 1,4- α -Glucan branching enzyme, 1,4- α -D-glucan:1,4- α -D-glucan 6- α -D-(1,4- α -D-glucano)-transferase
 - 2.4.2 Pentosyltransferases
 - 2.4.2.1 Purine nucleoside phosphorylase, pyrimidine nucleoside:orthophosphate α -D-ribosyltransferase
 - 2.4.2.2 Pyrimidine nucleoside phosphorylase, pyrimidine nucleoside:orthophosphate α -D-ribosyltransferase
 - 2.4.99 Transferring other glycosyl groups
- 2.5 Transferring alkyl or aryl groups, other than methyl groups
 - 2.5.1.6 Methionine adenosyltransferase, ATP:L-methionine S-adenosyl-transferase
- 2.6 Transferring nitrogenous groups
 - 2.6.1 Transaminases
 - 2.6.1.2 Alanine transaminase, L-alanine:2-oxoglutarate aminotransferase
 - 2.6.3 Oximinotransferases
 - 2.6.99 Transferring other nitrogenous groups
- 2.7 Transferring phosphorus-containing groups
 - 2.7.1 Phosphotransferases with an alcohol group as acceptor
 - 2.7.1.1 Hexokinase, ATP:D-hexose 6-phosphotransferase
 - 2.7.1.2 Glucokinase, ATP:D-glucose 6-phosphotransferase
 - 2.7.1.11 6-Phosphofructokinase, ATP:D-fructose-6-phosphate 1-phosphotransferase
 - 2.7.1.37 Protein kinase, ATP:protein phosphotransferase
 - 2.7.1.38 Phosphorylase kinase, ATP:D-phosphorylase-6 phosphotransferase

- 2.7.1.40 Pyruvate kinase, ATP:pyruvate 2-O-phosphotransferase
- 2.7.2 Phosphotransferases with a carboxyl group as acceptor
 - 2.7.2.1 Acetate kinase, ATP:acetate phosphotransferase
- 2.7.3 Phosphotransferases with a nitrogenous group as acceptor
 - 2.7.3.2 Creatine kinase, ATP:creatine N-phosphotransferase
- 2.7.4 Phosphotransferases with a phosphate group as acceptor
 - 2.7.4.3 Adenylate kinase (myokinase), ATP:AMP phosphotransferase
 - 2.7.4.6 Nucleoside diphosphate kinase, ATP:nucleoside diphosphate phosphotransferase
- 2.7.6 Diphosphotransferases
 - 2.7.6.1 Ribose phosphate pyrophosphokinase, ATP:D-ribose-5-phosphate pyrophosphotransferase
- 2.7.7 Nucleotyldyltransferases
 - 2.7.7.2 FMN adenyltransferase, ATP:FMN adenyltransferase
 - 2.7.7.48 RNA-directed RNA polymerase, nucleoside triphosphate:RNA nucleotidyltransferase (RNA-directed)
 - 2.7.7.49 RNA-directed DNA polymerase, deoxynucleoside triphosphate:DNA deoxynucleotidyltransferase (RNA-directed)
- 2.7.8 Transferases for other substituted phosphate groups
- 2.7.9 Phosphotransferases with paired acceptors
- 2.8 Transferring sulfur-containing groups
 - 2.8.1 Sulfurtransferases
 - 2.8.2 Sulfotransferases
 - 2.8.3 CoA transferases
 - 2.8.3.3 Malonate CoA transferase, acetyl-CoA:malonate CoA transferase

3. Hydrolases

3.1 Acting on ester bonds

- 3.1.1 Carboxylic ester hydrolases
 - 3.1.1.3 Triacylglycerol lipase (lipase), triacylglycerol acylhydrolase
 - 3.1.1.4 Phospholipase A₂, phosphatidylcholine 2-acylhydrolase
 - 3.1.1.7 Acetylcholine esterase, acetylcholine acetylhydrolase
 - 3.1.1.8 Choline esterase, acetylcholine acetylhydrolase
- 3.1.2 Thioester hydrolases
 - 3.1.2.2 Palmitoyl-CoA hydrolase
- 3.1.3 Phosphoric monoester hydrolases
 - 3.1.3.1 Alkaline phosphatase, orthophosphoric-monoester phosphohydrolase (alkaline optimum)

- 3.1.3.2 Acid phosphatase, orthophosphoric-monoester phosphohydrolase (acid optimum)
- 3.1.4 Phosphoric diester hydrolases
 - 3.1.4.1 Phosphodiesterase I, oligonucleate 5'-nucleotido-hydrolase
 - 3.1.4.3 Phospholipase C, phosphatidylcholine cholinophosphohydrolase
- 3.1.5 Triphosphoric monoester hydrolases
- 3.1.6 Sulfuric ester hydrolases
 - 3.1.6.1 Arylsulfatase, aryl sulfate sulfohydrolase
- 3.1.7 Diphosphoric monoester hydrolases
- 3.1.8 Phosphoric triester hydrolases
- 3.1.11 Exodeoxyribonucleases producing 5'-phosphomonoesters
 - 3.1.11.1 Exodeoxyribonuclease I
- 3.1.13 Exoribonucleases producing 5'-phosphomonoesters
 - 3.1.11.1 Exoribonuclease II
- 3.1.14 Exoribonucleases producing other than 5'-phosphomonoesters
- 3.1.15 Exonucleases active with either ribo- or deoxyribonucleic acids and producing 5'-phosphomonoesters
- 3.1.16 Exonucleases active with either ribo- or deoxyribonucleic acids and producing other than 5'-phosphomonoesters
- 3.1.21 Endodeoxyribonucleases producing 5'-phosphomonoesters
 - 3.1.21.1 Deoxyribonuclease I
- 3.1.22 Endodeoxyribonucleases producing other than 5'-phosphomonoesters
 - 3.1.22.1 Deoxyribonuclease II
- 3.1.25 Site-specific endodeoxyribonucleases specific for altered bases
- 3.1.26 Endoribonucleases producing 5'-phosphomonoesters
- 3.1.27 Endoribonucleases producing other than 5'-phosphomonoesters
- 3.1.30 Endonucleases active with either ribo- or deoxyribonucleic acids and producing 5'-phosphomonoesters
- 3.1.31 Endonucleases active with either ribo- or deoxyribonucleic acids and producing other than 5'-phosphomonoesters
- 3.2 Glycosidases
 - 3.2.1 Hydrolyzing O-glycosyl compounds
 - 3.2.1.1 α -Amylase, 1,4- α -D-glucan glucanohydrolase
 - 3.2.1.2 β -Amylase, 1,4- α -D-glucan maltohydrolase
 - 3.2.1.4 Cellulase, 1,4-(1,3;1,4)- β -D-glucan 4-glucanohydrolase
 - 3.2.1.17 Lysozyme, peptidoglycan N-acetylmuramoylhydrolase
 - 3.2.1.20 α -Glucosidase, α -D-glucoside glucohydrolase
 - 3.2.1.23 β -Galactosidase, β -D-galactoside galactohydrolase

- 3.2.1.26 β -D-Fructofuranoside fructohydrolase, β -fructofuranosidase, invertase, invertin, saccharase, sucrase
- 3.2.1.108 Lactase, lactose galactohydrolase
- 3.2.2 Hydrolyzing N-glycosyl compounds
 - 3.2.2.1 Purine nucleosidase, N-D-ribosylpurine ribohydrolase
- 3.2.3 Hydrolyzing S-glycosyl compounds
 - 3.2.3.1 Thioglucosidase, thioglucoside glucohydrolase
- 3.3 Acting on ether bonds
 - 3.3.1 Thioether hydrolases
 - 3.3.2 Ether hydrolases
 - 3.3.2.3 Epoxide hydrolase
- 3.4 Acting on peptide bonds (peptidases)
 - 3.4.11 Aminopeptidases
 - 3.4.11.1 Leucyl aminopeptidase
 - 3.4.13 Dipeptidases
 - 3.4.13.6 Cys-Gly dipeptidase
 - 3.4.14 Dipeptidyl peptidases and tripeptidyl peptidases
 - 3.4.15 Peptidyl dipeptidases
 - 3.4.16 Serine-type carboxypeptidases
 - 3.4.16.1 Serine-type carboxypeptidase
 - 3.4.17 Metallocarboxypeptidases
 - 3.4.17.1 Carboxypeptidase A
 - 3.4.18 Cysteine-type carboxypeptidases
 - 3.4.18.1 Cysteine-type carboxypeptidase
 - 3.4.19 Omegapeptidases
 - 3.4.19.1 Acylaminoacyl peptidase
 - 3.4.21 Serine endopeptidases
 - 3.4.21.1 Chymotrypsin
 - 3.4.21.4 Trypsin
 - 3.4.21.5 Thrombin
 - 3.4.21.62 Subtilisin
 - 3.4.22 Cysteine endopeptidases
 - 3.4.22.1 Cathepsin B
 - 3.4.22.2 Papain
 - 3.4.22.17 Calpain
 - 3.4.23 Aspartic endopeptidases
 - 3.4.23.1 Pepsin A
 - 3.4.22.15 Renin
 - 3.4.24 Metalloendopeptidases
 - 3.4.24.3 Microbial collagenase
 - 3.4.24.27 Thermolysin
 - 3.4.99 Endopeptidases of unknown catalytic mechanism
 - 3.4.99.46 Multicatalytic endopeptidase complex (proteasome)

- 3.5 Acting on carbon–nitrogen bonds, other than peptide bonds
- 3.5.1 In linear amide
 - 3.5.1.1 Asparaginase, L-asparagine amidohydrolase
 - 3.5.1.4 Amidase, acylase; acylamine amidohydrolase
 - 3.5.1.5 Urease, urea amidohydrolase
 - 3.5.1.35 D-Glutaminase, D-glutamine amidohydrolase
 - 3.5.2 In cyclic amides
 - 3.5.2.3 Dihydroorotate, carbamoylaspartic dehydrase
 - 3.5.3 In linear amidines
 - 3.5.3.1 Arginase, L-arginine amidinohydrolase
 - 3.5.4 In cyclic amidines
 - 3.5.4.1 Cytosine desaminase, cytosine aminohydrolase
 - 3.5.5 In nitriles
 - 3.5.5.1 Nitrilase, nitrile aminohydrolase
 - 3.5.99 In other compounds
 - 3.5.99.1 Riboflavinase, riboflavin hydrolase
- 3.6 Acting on acid anhydrides
- 3.6.1 In phosphorus-containing anhydrides
 - 3.6.1.5 Apyrase, ATP diphosphohydrolase
 - 3.6.2 In sulfonyl-containing anhydrides
 - 3.6.2.1 Adenylsulfatase, adenylylsulfate sulfohydrolase
- 3.7 Acting on carbon–carbon bonds
- 3.7.1 In ketonic substances
 - 3.7.1.1 Oxalacetase, oxalacetate acetylhydrolase
- 3.8 Acting on halide bonds
- 3.8.1 In C-halide compounds
 - 3.8.1.1 Alkylhalidase, alkyl halide halidohydrolase
- 3.9 Acting on phosphorus–nitrogen bonds
- 3.9.1.1 Phosphoamidase, phosphamide hydrolase
- 3.10 Acting on sulfur–nitrogen bonds
- 3.10.1.2 Cyclamate sulfohydrolase, cyclohexylsulfamate sulfohydrolase
- 3.11 Acting on carbon–phosphorus bonds
- 3.11.1.1 Phosphonoacetaldehyde hydrolase, 2-oxoethylphosphonate phosphonohydrolase
- 3.12 Acting on sulfur–sulfur bonds
- 3.12.1.1 Trithionate hydrolase, trithionate thiosulfohydrolase
4. Lyases
- 4.1 Carbon–carbon lyases
- 4.1.1 Carboxy-lyases
 - 4.1.1.1 Pyruvate decarboxylase, 2-oxo-acid carboxy-lyase
 - 4.1.1.17 Ornithine decarboxylase, L-ornithine carboxy-lyase
 - 4.1.2 Aldehyde lyases

- 4.1.2.5 Threonine aldolase, L-threonine acetaldehyde-lyase
- 4.1.2.9 Phosphoketolase, D-xylulose-5-phosphate D-glyceraldehyde-3-phosphate-lyase (phosphate-acetylating)
- 4.1.3 Oxo-acid lyases
- 4.1.3.1 Isocitrate lyase, isocitrate glyoxylate-lyase
- 4.1.3.2 Malate synthase, L-malate glyoxylate-lyase
- 4.1.3.7 Citrate (S) synthase (condensing enzyme), citrate oxaloacetate-lyase
- 4.1.3.27 Anthranilate synthase, chorismate pyruvate-lyase (amino-accepting)
- 4.1.99 Other carbon–carbon-lyases
- 4.1.99.1 Tryptophanase, L-tryptophan indole-lyase
- 4.2 Carbon–oxygen lyases
- 4.2.1 Hydrolyases
- 4.2.1.1 Carbonate dehydratase, carbonic anhydrase, carbonate hydrolyase
- 4.2.1.2 Fumarate hydratase, fumarase, (S)-malate hydrolyase
- 4.2.1.3 Aconitate hydratase, aconitase, citrate(isocitrate) hydrolyase
- 4.2.1.20 Tryptophan synthase, L-serine hydrolyase (adding indole glycerol phosphate)
- 4.2.2 Acting on polysaccharides
- 4.2.2.1 Hyaluronate lyase, hyaluronidase, hyaluronate lyase
- 4.2.99 Other carbon–oxygen lyases
- 4.2.99.2 Threonine synthase, O-phospho-L-homoserine phospho-lyase (adding water)
- 4.3 Carbon–nitrogen lyases
- 4.3.1 Ammonia-lyases
- 4.3.1.1 Aspartate ammonia-lyase, aspartase, L-aspartate ammonia-lyase
- 4.3.2 Amidine-lyases
- 4.3.2.1 Argininosuccinate lyase, argininosuccinase, N-(L-argininosuccinate) arginine-lyase
- 4.3.3 Amide lyases
- 4.3.99 Other carbon–nitrogen lyases
- 4.3.99.1 Cyanate lyase, cyanate C–N lyase
- 4.4 Carbon–sulfur lyases
- 4.4.1.2 Homocysteine desulhydrase, L-homocysteine hydrogen-lyase (deaminating)
- 4.5 Carbon–halide lyases
- 4.5.1.1 DTT-dehydrochlorinase, 1,1,1-dichloro-2,2-bis (4-chlorophenyl) ethane chloride-lyase
- 4.6 Phosphorus–oxygen lyases
- 4.6.1.1 Adenylate cyclase, ASTP-pyrophosphate-lyase

4.99 Other lyases

4.99.1.1 Ferrochelatase, protoheme ferro-lyase

5. Isomerases

5.1 Racemases and epimerases

5.1.1 Acting on amino acids and derivatives

5.1.1.1 Alanine racemase

5.1.2 Acting on hydroxy acids and derivatives

5.1.2.1 Lactate racemase

5.1.3 Acting on carbohydrates and derivatives

5.1.3.1 Ribulose-phosphate 3-epimerase, D-ribulose-5-phosphate 3-epimerase

5.1.99 Acting on other compounds

5.1.99.1 Methylmalonyl-CoA epimerase, 2-methyl-3-oxopropanoyl-CoA 2-epimerase

5.2 *cis-trans*-Isomerases5.2.1.3 Retinal isomerase, *all-trans*-retinal 11-*cis-trans*-isomerase

5.3 Intramolecular oxidoreductases

5.3.1 Interconverting aldoses and ketoses

5.3.1.1 Triosephosphate isomerase, D-glyceraldehyde-3-phosphate ketol isomerase

5.3.1.5 Xylose isomerase, D-xylose ketol isomerase

5.3.2 Interconverting keto- and enol groups

5.3.2.1 Phenylpyruvate tautomerase, phenylpyruvate keto-enol isomerase

5.3.3 Transposing C=C bonds

5.3.3.1 Steroid Δ -isomerase, 3-oxosteroid $\Delta 5$ - $\Delta 4$ -isomerase

5.3.4 Transposing S-S bonds

5.3.4.1 Protein disulfide isomerase

5.3.99 Other intramolecular oxidoreductases

5.3.99.7 Styrene oxide isomerase (epoxide-cleaving)

5.4 Intramolecular transferases (mutases)

5.4.1 Transferring acyl groups

5.4.1.1 Lysolecithin acylmutase

5.4.2 Phosphotransferases (phosphomutases)

5.4.2.2 Phosphoglucomutase, α -D-glucose 1,6-phosphomutase

5.4.3 Transferring amino groups

5.4.3.2 Lysine 2,3-aminomutase, L-lysine 2,3-aminomutase

5.4.99 Transferring other groups

5.4.99.5 Chorismate mutase, chorismate pyruvate mutase

5.5 Intramolecular lyases

5.5.1.1 Muconate cycloisomerase, 2,5-dihydro-5-oxofuran-2-acetate lyase (decarboxylating)

5.99 Other isomerases

5.99.1.2 DNA topoisomerase

6. Ligases

6.1 Forming carbon–oxygen bonds

6.1.1 Ligases forming aminoacyl-tRNA and related compounds

6.1.1.1 Tyrosine-tRNA ligase, tyrosyl-tRNA synthetase

6.2 Forming carbon–sulfur bonds

6.2.1 Acid-thiol ligases

6.2.1.1 Acetate-CoA ligase, acetate:CoA ligase
(AMP-forming)

6.3 Forming carbon–nitrogen bonds

6.3.1 Acid-ammonia (or amine) ligases (amide synthases)

6.3.1.2 Glutamate-ammonia ligase, glutamine synthetase,
L-glutamate:ammonia ligase (ADP-forming)

6.3.2 Acid-amino acid ligases (peptide synthases)

6.3.2.3 Glutathion synthase, γ -L-glutamyl-L-cysteine:glycine
ligase (ADP-forming)

6.3.3 Cyclo ligases

6.3.4 Other carbon–nitrogen ligases

6.3.4.1 GMP synthase, xanthosine-5'-phosphate:ammonia
ligase (AMP-forming)

6.3.5 Carbon–nitrogen ligases with glutamine as amido-N-donor

6.3.5.2 GMP synthase (glutamine-hydrolyzing)

6.4 Forming carbon–carbon bonds

6.4.1.1 Pyruvate carboxylase, pyruvate:carbon dioxide ligase
(ADP-forming)6.4.1.2 Acetyl-CoA carboxylase, acetyl-CoA:carbon dioxide
ligase (ADP-forming)

6.5 Forming phosphoric ester bonds

6.5.1.1 DNA ligase (ATP), poly(deoxyribonucleotide):poly
(deoxyribonucleotide) ligase (AMP-forming)