

Index

a

α-acetyl β-ketoesters 271
 (1*S*,3*R*)-3-acetoxy-1-cyclohexanol 187
 (*R*)-2-acetoxy-1-indanone 251
 ((*2R*)-5-acetoxy-1,3-oxathiolan-2-yl)
 methyl benzoate 254
 ((*2S*)-5-acetoxy-1,3-oxathiolan-2-yl)
 methyl benzoate 254
 acetylated β-nitroalkanols 253
 acetylated (*S*)-cyanohydrins 137, 138
 (-)-acetylated cyclopentenone 255
 4-acetylbenzaldehyde 3, 4
 (aza-)Achmatowicz reaction 289–290
 acid-catalyzed hydration-dehydration
 mechanism 168
 acid-catalyzed racemization 159
 acidic H-beta zeolite-catalyzed alcohol
 racemization 168
 acridines 352
 Active Pharmaceutical Ingredients (APIs) 363
 acyclic chiral 1,3-aminoalcohols 250
 acyl donor effects
 on dynamic kinetic resolution of
 phenethyl alcohol 162
 acyl donors 23–26, 29, 31, 91, 160,
 162–168, 170, 172, 176, 177–180,
 184, 187–189, 191
 acyloxyphenyl ketones 249, 250
 ADH-catalyzed DYRK 196
 adipic acid synthesis 76, 77
 Aerangis lactone 57

aerobic oxidation, of 2-phenyl-1-propanol 108
 Alcalase-catalyzed peptide synthesis 31
 Al-catalyzed alcohol racemization 167
 alcohol dehydrogenases (ADHs) 5, 7, 8,
 33, 37, 94, 97–99, 103, 105, 107,
 111, 115
 alcohol oxidases (AOx) 115
 aldimines 96
 aldolases 59–63, 126–128
 alkyl aryl carbinols 179, 180
 α-alkyl-β-keto amides 203
 α-allenols 291
 allylated gallic acid 262
 (*R*)-6-allyl-5,6-dihydro-pyran-2-one 22
 (*S*)-6-allyl-5,6-dihydro-pyran-2-one 22
 allylic alcohols
 chemoenzymatic dynamic kinetic
 transformation of 170, 171
 dynamic kinetic resolution (DKR) of 170
 Ru(IV)-catalyzed redox isomerization
 of 105
 vanadium-catalyzed racemization of 170
 alpha-ketoglutarate (αKG)-dependent
 hydroxylases 53
 Amano Lipase PS-C1 190
 amidotriazole peptides 139, 140
 amine dehydrogenase-catalyzed reductive
 amination 132
 amino acid racemases 160

- 2-amino-2-cyano-3-phenylpropanoic acid 284
 α -aminoketones 199
 β -aminoketones 250
 aminolysis 259
 (*S*)-3-aminomethyl-5-methylhexanoic acid 39
 aminomethylpyridine (ampy) ruthenium complex 166
 α -aminonitriles 284
 2-amino-1-phenylpentan-3-ol 200, 201
 ammonolysis 259
 2-and 3-substituted cyclopentanones 262
 9-and 14-substituted parthenolide derivatives 51, 52
 aromatic 2-azido alcohols 110
 aromatic compounds
 Au-TiO₂-mediated light-driven halogenation of 337
 FMN-mediated light-driven halogenation 337
 ArRmut11-M117F/G279A 45, 125
 artemisinic acid 75, 76
 artemisinin-based combination treatments (ACTs) 75
 artemisinin derivatives 75
 1-arylacetones 35
 3-arylalkanones 198, 199
 aryl alkenes 340, 341
 α -arylallyl alcohols 179, 180
 arylated dihydrocoumarins 67, 68
 3-arylated 3,4-dihydrocoumarins 67
 (*Z*)- β -aryl- β -cyanoacrylates 114
 (*R*)-1-arylethanols 103
 β -aryl- γ -amino acids 114
 aryl halides
 palladium-catalyzed Heck reaction of 101
 arylketones 103
 arylmalonate decarboxylase (AMDase) 136
 3-aryl-4-pentenoic acids 193
 1-aryl-2-propanols 35
 (*S*)-arylpropanols 198
 aryl propargyl alcohols 173, 175
 Asinger-type multi-component reaction 134
 3 α -(*S*)-piperazino[1,2- α]indolyl strictosidine 72
 AspRedAm-NOX system 233, 234
 α -substituted α -acetoxytetralones 332
 α -substituted β -keto acid derivatives 195
 α -substituted carboxylic acids 350, 351
 asymmetric aldol reaction 59, 95
 Atazanavir 200
 Au-TiO₂-mediated light-driven halogenation of aromatic compounds 337
 Au-TiO₂-mediated light-driven hydroxylation, of hydrocarbons 339
 aza-Friedel-Crafts (aza-FC) reaction 281
 aza-Michael addition 92
 of benzylamine 92, 301
 AZD1480 synthesis 42, 43
 1,2-azido alcohols 286
 2-azido-1-arylethanols 12
 (*S*)-2-azido-1-arylethanols 34
cis-2-azido-1-indanols 27
 (*R,S*)-2-azido-1-indanols 27
- b**
- (*R*)-Baclofen synthesis 33
 Baeyer-Villiger monooxygenase (BVMO) 56–63, 203, 317, 322
 Baeyer-Villiger oxidation (BVO) 262, 263, 294
 of cyclopentanone 264
 of substituted ketones 264
 Baeyer-Villiger oxidation of levoglucosanone (LGO) 265
 base-catalyzed racemization of ketones 158
B. cepacia lipase (BCL) 253
 benzaldehyde lyase (BAL) 63, 343
 benzazepine 47
 (1-allyloxy)allylbenzene 292
 1,4-benzodioxane-2-carboxylic acid derivatives 32

- 1-benzylisoquinolines 227
N-benzyl-2-methyl-3-oxobutanamide 202
 berberine bridge enzyme (BBE) 120, 227
 (*S*)-berbines 227, 228
 beta-silicalite-1 core-shell microcomposites 168
 D-biarylalanines 68, 69
 (*R*)-bicalutamide 66
 bifunctional amidoiridium complexes 167
 biocatalysis 19, 177, 336
 biocatalytic aza-Michael transformation 278
 biocatalytic epoxidation 284
 biocatalytic reactions 19, 57, 85, 105, 129, 134, 246, 247, 316, 317, 342
 biocatalytic reduction, of β -ketosulfides 38
 bio-compatible chemical reactions 364
 bioelectrocatalysis 364, 365
 bioelectrocatalytic N₂ fixation system 365
 biohydrid catalyst (BHC) 135
 bioreduction/hydration cascade process 273
 bis(allyl)(acetate)Ru(IV) complex 105
 bis(allyl)-ruthenium(IV) complexes 105, 268
 Boceprevir 281
 Boc-protected D-biarylalanines 131
 Brivaracetam 200
 α -bromo- α -allyl- γ -lactone 331
 α -bromoacetophenones 9, 272, 287
 (*S*)- α -bromoamide 69
 α -bromoamides 331
 α -bromoarylketones 103
 4-bromocinnamic acid 68, 131
 γ -bromo- δ -lactone 290
 α -bromolactones 331
 5-(bromomethyl)dihydrofuran-2(3H)-one 288
 Buchwald–Hartwig alkoxylation 134
 Buchwald–Hartwig amination 133, 134
 (*R*)-bufuralol synthesis 181
Burkholderia cepacia lipase (BCL) 252
 4-(but-3-en-1-yloxy)benzoic acid 285
- C**
- cadmium sulfide quantum dots (CdS QDs) 327
 caffeic acid 293
 CALB-catalyzed aminolysis 93
 calcimimetic (+)-NPS R-568 190
 camphor monooxygenase (CAMO) 58
Candida antarctica lipase A (CAL-A) 192, 204
Candida antarctica lipase-B (CALB) 21, 23, 24, 87, 160, 248, 250, 262–264
 capsaicin 91, 116
 Captopril 69, 70
 carbo-[3+3] annulation 278
 carbon dots (CDs) 320, 321
 carbonyl reductases 33, 94
 α -acetyl β -ketoesters 271
 aldoximes 274
 dimethyl 2-benzoylsuccinate 271
 enantiopure diols 273
 enantiopure epoxides and diols 273
 enzymatic DKR reduction 271, 272
 enzymatic reduction and lactone formation 270
 (*R*)- β -hydroxyamides 274
 metal nanoparticles 268
 NAD(P)H 267
 organocatalytic aldol reaction 269
 Pd-catalyzed hydrogenation and enzymatic reduction 269
 Rh catalyst 267
 Ru-catalyzed isomerization and enzymatic reduction 268
 Stetter reaction 272
 carboxylic acid reductases 4
 cascade reactions benefits of 13 defined 13
 CASP tools 362
 catalysts for alcohol racemization 165
 celite-immobilized TvDAAO 219

- chemical transformation
 multi-enzyme cascade integration with
 74–77
- chemoenzymatic α -oxyamination of
 aldehydes 291
- chemo-enzymatic cascade 1, 10, 11, 13,
 14, 118, 246, 247–293
- chemo-enzymatic cascade
 transformations
 one-pot-one-step mode 12–14
 one-pot-two-step mode 11–12
 schematic illustration 10, 11
 separate-pot two-step mode 10–11
- chemo-enzymatic construction, of
 carbocyclic scaffolds 58
- chemo-enzymatic deracemization 218
- chemo-enzymatic dynamic kinetic
 resolution 155–205
- chemo-enzymatic fluorination
 of cyclopentenone derivatives 49
 of methylester of ibuprofen 49
- chemo-enzymatic halocyclization 289
- chemo-enzymatic process, of optically
 active β -cyano esters 40, 41
- chemo-enzymatic selective
 functionalization of
 monosaccharides 51
- chemo-enzymatic substitution, of
 methoxy group for fluorine 51
- chemo-enzymatic synthesis
 of (*R*)- α -acetoxy-2-naphthylacetonitrile
 21
- of adipic acid 77
- of Aerangis lactone 57
- of (*S*)-6-allyl-5,6-dihydro-pyran-2-one
 23
- of 9-and 14-substituted parthenolide
 derivatives 51, 52
- of arylated dihydrocoumarins 67, 68
- of 1-aryl-3-methylisochromans 36
- of aryltetralin lignans 56
- of AZD1480 42, 43
- (*R*)-Baclofen 34
- (*R*)-baclofen 34
- of benzyl
 7-methyloxepane-2-carboxylate
 38
- of (*R*)-bicalutamide 66
- of bicyclic lactones 59
- of 2-butyl-1-octanol 42
- of Captopril 70
- of chiral α -substituted amides 70
- of (*S*)-and (*R*)-chromanemethanol 65,
 66
- of Cinacalcet 45
- of compounds with
 4-hydroxy-1-tetralone skeleton
 50
- of (*S*)- α -cyano-3-phenoxybenzyl alcohol
 21
- of D-biarylalanines 69
- of D-5-bromotryptophan 222
- of (*S*)-deflectin-1a 72
- of (*R*)-(–)-denopamine 35
- of D-fagomine and N-alkylated
 derivatives 60
- diastereomers of
 β -methyl- β -phenylalanine
 analogues 222
- of (*S*)-duloxetine 39
- of (*R*)-Eliprodil 65
- of equisetin 67, 68
- of ethyl (*R*)-4-cyano-3-hydroxybutyrate
 32
- of ethyl (*R*)-2-hydroxy-4-phenylbutyrate
 37
- of florfenicol 70, 71
- of (*R*)-flurbiprofen methyl ester 40
- of (*R*)-6-formyl-1,4-benzodioxane-2-
 carboxylic acid 32
- of functionalized heterocyclic
 compounds 61
- of 1*H*-Azepino-[3,4,5-cd]indolyl-stricto-
 sidine lactam 72, 73
- of 1*H*-azepino-indole alkaloids 73
- of homoiminocyclitols 61, 62
- of Imagabalin 43
- of L-biarylalanines 68, 69
- of linalool oxide 65

- of lunatoic acid A 72
- of manzacidin c and L-proline analogs
 - 54
- of (*R*)-Marmin 67
- of (1*S*, 2*R*)-1-(methoxycarbonyl) cyclohex-4-ene-2-carboxylic acid 86
- of (*R*)-and (*S*)-5-methyl-6,7-dihydro-5*H*-dibenzo[c,e]azepine 46, 47
- of 5-methyl-1-substituted 1,4-diazepane 48
- of 2-methyl-1,2,3,4-tetrahydroquinoline 13
- of MK6096 44
- of MK-7246 44, 45
- of (*R*)-Nifenadol 64
- of optically active amines 27
- of optically active aryl β -hydroxyl-sulfoxides 38
- of optically active β -substituted- γ -amino acids 28
- of optically active 1-fluoro-2-amino-indane 28
- of optically pure β -hydroxy triazoles 35
- of optically pure linalool oxide 65
- of optically pure 6-substituted 5,6-dihydropyran-2-one derivatives 23
- of 5-or 6-C-aryl carbohydrates 63
- of peptides 31
- of phenyl-substituted 1-benzyl-1,2,3,4,5,6,7,8-octahydroisoquinolines 46
- of PMP-protected α -amino- γ -butyrolactone 98
- of (-)-podophyllotoxin 56
- of poly- ϵ -caprolactone 74
- of polyhydroxylated pipercolic acids 60, 61
- of (*S*)-pregabalin 33, 34, 42
- of pyrrolidine iminocyclitols 62
- of (*R*)-Ramatroban 26
- of (*S*)-rivastigmine 42
- of (*R*)-and (*S*)-Rugulactone 22
- of (*R*)-(-)-salmeterol 35
- of soluble epoxide inhibitor 33, 34
- of substituted pyrrolidines 54, 55
- of Suvorexant 44, 48
- of syn-cembranoid-diols 53
- of tambroxide 55
- of (*R*)-(-)-Taniguchi lactone 58, 59
- of telaprevir 30
- of α -tertiary amine derivatives 47
- of thiamphenicol 70, 71
- of thiosugar scaffolds 63
- of thrombin inhibitor 36
- of β -thymidine 10, 11
- of 1,2,3-triazole-derived diols 12
- of (*S*)-and (*R*)-trichoflectin 71
- of yimatasvir 29
- chemo-selectivity, of enzyme catalysis 3, 4
- chiral amines 347, 350
 - aldehyde/ketone mediated racemization 158
- chiral β -amino alcohols 181
- chiral chromanemethanol 65
- chiral 1,4-diazepanes 43
- chiral 1-(2-hydroxycycloalkyl)imidazoles 23
- chiral lactones 37, 57, 58
- chiral mandelic acid 24
- chiral secondary fatty alcohols 316
- chiral sulfoxides, deracemization of 239
- chiral vicinal 1,2-diols 109
- α -chloroacetohenone 272
- α -chloroamides 333, 334
- chlorohydrins 181, 236
- chloroperoxidase from *Caldariomyces fumago* (CfCPO) 289
- chloroperoxidase-initiated Achmatowicz reaction 290
- (*R,S*)-(1-(3-chlorophenyl)-1,3-butandiol 300
- 3-(3'-chlorophenyl)-3-hydroxypropanenitrile 273
- 3-(3'-chlorophenyl)-3-oxopropanenitrile 273
- (2*R*,3*R*)-2-(4-chlorophenyl)-5-oxotetrahydrofuran-3-carboxylate 271

- Cinacalcet 45, 123
cis,cis-muconic acid 76
 Codexis KRED P1-B05 199
 computer-aided synthesis planning (CASP) 361
 (R) -configurated amides 91, 92
 continuous stirred tank reactor (CSTR) 302
 copper-catalyzed alkyne-azide cycloaddition 93, 94
 copper-catalyzed Huisgen azide-alkyne cycloaddition (CuAAC) 139
 copper(I)-catalyzed Huisgen cycloaddition 110
 Corey lactones 51
 cortisone 5, 19
 coumarins 67
 $(-)$ -crinane synthesis 172, 174
 (\pm) -crispine A 226
 crizotinib 169
 Crotalus atrox 284
 Cu/bipyridine catalyst 88
 (Z) - α -cyano- α,β -unsaturated esters 340, 342
 (S) - α -cyano-3-phenoxybenzyl alcohol (S -CPBA) 20, 21
 cyanobacteria 329
 (S) -1-cyano-2-(naphthalen-1-yloxy)ethyl acetate 257
 cyclic β -enaminones 277, 278
 cyclic deracemization 217, 220, 221, 234, 348
 cyclobutane pyrimidine dimers (CPD photolyase) 314
 cis -1,3-cyclohexanediol 187
 $cis/trans$ -1,3-cyclohexanediol 187
 cyclohexanone monooxygenase (CHMO) 57, 364
 cyclohexanones 23, 91, 262, 263, 325, 346
 cyclohexene 294–296
 4-(cyclohex-1-en-1-yl)but-3-en-2-ol lipase/oxovanadium co-catalyzed DKR of 171, 172, 174
 one-pot chemoenzymatic DKR 173
 cyclohexylamine oxidase (CHAO) 12, 229, 230
 cyclopentadienyl benzoyl ruthenium(II) complex 165, 166
 $(1S, 2R)$ -1,2-cyclopentanedimethanol monoacetate 29
 cyclopentanones 115, 134, 264
 cytochrome P450 48, 49, 53, 136, 284 monooxygenases 48
- d**
- D-amino acid dehydrogenase (DAADH) 68, 131
 D-amino acid oxidase 222
 D-amino acid oxidase from porcine kidney (pkDAO) 284
 Darunavir 200, 202
 (S) - δ -decalactone 137
 decarboxylases 135, 136
 deep eutectic solvents (DESs) 99, 118, 259, 268
 (S) -deflectin-1a 71, 72
 dehydrodecarboxylation, of carboxylic acids 352
 deracemization 217, 218
 of acyclic DL- α -amino acids 219
 of alcohols 237
 of amino acid and amines 218
 of α -amino acids 220
 of $(2RS,3RS)$ -2-amino-3-methylhexanoic acid 220
 of 2-amino-3-(6-*o*-tolylpyridin-3-yl) propanoic acid 220
 of 1-aminotetraline 230
 of 2-aryl azepanes 225
 of 1-benzyl-3,4,5,6,7,8-hexahydroisoquinoline derivatives 232
 of 1-benzylisoquinolines 227
 of 1,1'-[(1,1'-biphenyl)-3,3'-diyl] diethanol 239
 of $(2RS,3RS)$ - β -methyl-phenylalanine 220
 of chlorohydrins 237
 of 4-Cl-benzhydrylamine (CBHA) 233
 of (\pm) -crispine A 226

- of C-1 substituted
 - tetrahydro- β -carbolines 229
- of 2,2-dichloro-1-phenylethanol 238
- of DL-piperazine-2-carboxylic acid 219
- and dynamic kinetic resolution 217
- (R)-Eleagnine and (R)-Leptaflorin 228
- hydroxy acids and alcohols 235–239
- of L-proline 218, 219
- of 1-(4-methoxybenzyl)-1,2,3,4,5,6,7,8-octahydroisoquinoline 231, 232
- of 1-(6-methoxynaphthalen-2-yl) ethanol 236
- of α -methylbenzylamine 224
- of 2-methyl-1,2,3,4-tetrahydroquinoline derivatives 231
- of 1-methyl-2,3,4,5-tetrahydro-1*H*-benzo[c]azepine 226
- of 1-methyltetrahydroisoquinoline 224
- of 2-methyl-1,2,3,4-tetrahydroquinoline 230
- modes 217, 218
- of *N*-methyl-2-phenylpyrrolidine 225
- of *N*-(prop-2-yn-1-yl)-2,3-dihydro-1*H*-inden-1-amine 231, 232
- of 2-phenyl-1-propanol 238
- of 2-phenylpyrrolidine 224
- of phenyl-substituted 2-(2-phenylethyl) THQ derivatives 230, 231
- of 1-phenyltetrahydroisoquinoline 227
- of (\pm)-2-propylpiperidine 225
- of racemic 4-chlorobenzhydrylamine 226
- of racemic cyclic amines 234
- of racemic harmicine 228, 229
- of racemic 1-methyltetrahydroisoquinoline 224
- of racemic 2-phenylpyrrolidine 224
- of racemic secondary alcohols 236
- of racemic valine ethyl ester 232
- of 2-substituted piperidines 233
- of 2-substituted-THQ derivatives 231
- of 1,2,3,4-tetrahydroisoquinoline-1-carboxylic acids 223
- of 1,2,3,4-tetrahydroisoquinoline-3-carboxylic acids 223
- Desulfovibrio vulgaris* Hildenborough (DvH) 322
- D-fructose 245, 246
- D-fructose-6-phosphate aldolase (FSA) 60
- D-galacturonic acid 76
- D-glucose 245, 246
- α,α -dialkyl cyclic ketones 57
- diallylated vanillic acid 262, 263
- 1,2-diarylethanols 178
- diaryl ketones 8, 100
 - transition metal-catalyzed hydrogenation of 7
- diarylmethanols 7, 100, 101, 177–179
- 4-diazabicyclo[2.2.2]octane (DABCO) 255
- 2,4-diazido-2,4,6-trideoxymannose 74
- dibenzo[c,e]azepine 46
- dibenzyl carbonate 192
- dibromonated thymol 287
- 3,4-dichlorobenzaldehyde 257
- 2,2-dichloro-1-phenylethanol 107, 108, 238
- (S)-dictyoprolene 89
- Diels–Alderase-catalyzed reaction 67
- Diels–Alder reaction of sorbicillinol 144
- 3,4-dienoate 290, 291
- dienols, dynamic kinetic transformation of 171
- diesters 5, 6
- diethylaminosulfur trifluoride (DAST) 26
- 2,5-dihydrofurans 292
- 4,9-dihydro-1*H*-carbazol-3(2*H*)-one 26
- 3,4-dihydroisoquinolin-1(2*H*)-one 279
- dihydro levoglucosenone (2*H*-LGO) 265
- dihydroxyacetone phosphate (DHAP)
 - dependent enzymes 60
- dihydroxyacid dehydratases (DHAD) 301
- 1,4-dihydroxybenzenes 292, 293

- 4,4'-dihydroxy-*trans*-stilbene 135
(E)-1-(2,4-dimethoxyphenyl)-2-nitro-
 propene 253
 3,4-dimethoxyphenyl-substituted thiolane
 254
(S)-3-(dimethylamino)-1-(2-thienyl)-1-
 propanol 39
 6,6-dimethyl-3-azabicyclo[3.1.0]hexane
 280
 dimethyl 2-benzoysuccinate 270, 271
 dimethyl 2-(4-chlorobenzoyl)succinate
 271
 2,6-dimethylheptan-4-ol 248
(R)-3,3-dimethyl-2-hydroxybutyric acid
 36
 1,3-diol 95–97, 301
 1,4-diol 57, 185, 187
 1,5-diol 185, 186
(S)-2-[diphenyl(trimethylsilyl-oxy)
 methyl]pyrrolidine 292
 direct asymmetric hydration, of
 non-activated alkenes 104
 direct electron transfer, of redox enzymes
 318, 319
(±)-2,2-disubstituted epoxides 125, 126
 2,2-disubstituted indol-3-ones 343, 344
 3,5-disubstituted morpholine 185, 186
 2,6-disubstituted piperidine 185, 186,
 277
 2,5-disubstituted pyrrolidines 184–186
 1,4-disubstituted 1,2,3-triazole 90
 1,4-dithiane-2,5-diol 253, 254
 δ -lactones 111
 D-mannitol 245, 246
 domino reaction 13
 domino thia-Michael–Henry reaction
 253
(S)-duloxetine synthesis 38, 39
 δ -valerolactones 263
 dynamic asymmetric reduction, of
 prochiral ketoxime 189
 dynamic kinetic asymmetric
 transformation (DYKAT) system
 185–187
 dynamic kinetic resolution (DKR) 156
 of allylic acetate 157
 of allylic alcohols 170, 171
 with immobilized oxovanadium
 catalyst 171
 of α -aryllallyl alcohols 179, 180
 of 3-aryl-4-pentenoic acids 193
 basic requirements for 158
 of β -azido alcohols 181, 182
 of benzylic alcohols 167
 of benzylic amines 190
 of chiral alcohols 160, 162
 of chiral amines 193, 347
 of cyanohydrins 194
 and deracemization 217
 of 1,2-diarylethanols 179
 of 1-(2,6-dichloro-3-fluorophenyl)
 ethanol 169
 of dienols 171
 of dimethyl (1,3-dihydro-2*H*-isoindol-
 1-yl)phosphonate 204
 of ethyl 1,2,3,4-tetrahydro- β -carboline-
 1-carboxylate 204
 of hexane-2,5-diamine 348, 349
 of 2,5-hexanediol 184, 185
 of α -hydroxy esters 182, 183
 of β -hydroxy esters 182
 of hydroxyl carboxylic acid esters 182
 of 4-hydroxy-2-methylcyclopent-2-en-1-
 one O-trityloxime 175
 of 3-hydroxy-3-(4-nitrophenyl)
 propanoic acid 194
 of mandelonitrile analogues 194, 195
 Noyori's dynamic asymmetric
 hydrogenation of ketones 157
 and one-pot chemoenzymatic
 hydrogenation 89
 of 2,4-pentanediol 184, 185
 of phenethyl alcohol 161
 of 1-phenylethanol 165
 of *N*-phenyl-2-bromopropionamide
 194
 of phenyl-(*p*-trimethylsilylphenyl)
 methanol 179
 of primary amines 192

- principle for 157
 of racemic alcohols 160, 161
 of racemic amines 348
 of racemic β -haloalcohols 187, 188
 of racemic β -hydroxynitrile 182
 of racemic δ -hydroxy esters 183
 of racemic γ -hydroxy amides 183
 of β -racemic primary alcohols 181
 racemic 1-substituted cyclohex-2-enols 173
 of secondary alcohols
 at room temperature 164
 using isopropenyl acetate 163, 164
 using *p*-chlorophenyl acetate 163
 of 3-substituted cyclohex-2-enols 175
 transamination of α -alkyl- β -keto
 amides 203
 transamination of ethyl
 2-oxocyclopentanecarboxylate 202
 dynamic reductive kinetic resolution (DYRKR)
 of α -acetyl- γ -butyrolactone 195, 196
 of 3-amino-4-phenylbutan-2-one 199
 2-amino-1-phenylpentan-3-ol 201
 of aromatic and aliphatic
 α -aminoketones 200
 of 3-arylalkanones 198, 199
 of arylpropanals 198
 of β -keto acid derivatives 195
 of β -keto esters 195, 196
 of ethyl 2-methyl-3-oxobutanoate 195
 of isopropyl 2-benzyl-3-oxobutanoate 195, 196
 of 2-oxocyclopentanecarbonitrile 196, 197
 tert-butyl (1-oxo-1-phenylhex-5-yn-2-yl) carbamate 199
- e**
 ϵ -caprolactone 347
E. coli 295
E. coli strain 294
 eleagnine 228
- electrochemical cofactor regeneration 318, 364
 electrochemical method 292, 364
 electrochemoenzymatic deracemization,
 of leucine 223
 electrochemoenzymatic stereoinversion of
 L-lactic acid 235
 (*R*)-Eliprodil synthesis 65
 enantio-complementary ketoreductases 101
 enantiopure β -hydroxy azides 129
 enantiopure imidazole derivatives 23, 24
 ene-reductases (ERs) 4, 39, 113, 332, 339
 enoate reductases 275–276
 enol acetates 248, 249
 enzymatic aminolysis 93
 enzymatic amino transfer reaction 42
 enzymatic desymmetrization, of
 meso-1,2-cyclopentanedimethanol 30
 enzymatic dynamic kinetic reduction
 of 2-benzenesulfonylcycloalkanones 197
 of dimethyl (1-chloro-2-oxopropyl) phosphonate 197
 enzymatic hydrolysis 87
 enzymatic ketone reduction 38, 101, 106, 110, 111, 199, 267, 298
 enzymatic kinetic resolution 24, 155–156, 160, 167, 188
 enzyme catalysis 1
 advantages of 3–10
 chemo-selectivity 3–4
 mild reaction conditions 8–10
 regioselectivity 4–7
 stereoselectivity 7–8
 epoxide hydrolase-catalyzed hydrolysis 125
 epoxide hydrolases (EHs) 64–67, 124, 125
 (+)-epoxysorbicillinol 144, 145
 equisetin synthesis 67, 68
 esterification 20, 24, 32, 86, 156, 167, 176, 259
 ethyl 3-aminobutyrate 279

- ethyl benzene 339
 flavin-based organic photocatalyst
 mediated light-driven
 hydroxylation 340
 $\text{g-C}_3\text{N}_4$ -mediated light-driven
 hydroxylation 339
 ethyl 3-(benzylamino)butanoate 301,
 302
 ethyl (S)-3-(benzylamino)butanoate 92,
 302
 ethyl (*R*)-4-cyano-3-hydroxybutyrate 3,
 31
 ethyl 3,3-dimethyl-2-oxobutanoate 36
 ethyl 2,5-dimethyl-4-phenyl-1*H*-
 pyrrole-3-carboxylate 279
 ethylenediaminetetraacetic acid (EDTA)
 276
 ethyl (*R*)-2-hydroxy-4-phenylbutyrate 37
 ethyl 2-oxocyclopentanecarboxylate 202
 ethyl secodione 8, 9
 $(13R, 17S)$ -ethyl secol 8
Exigobacterium sibiricum (EsLeuD-DM)
 299
- f**
- FAD-dependent monooxygenases 143–144
 flavin adenine dinucleotide (FAD) 315
 dependent halogenases 132
 molecule 314
 flavin-dependent enzymes 56
 flavin-dependent monooxygenases (FDMO) 70
 flavin-dependent tryptophan
 halogenase-catalyzed chlorination
 reaction 324
 flavin-dependent tryptophan halogenases 299
 flavin hydroquinone (FMNhq) 333
 flavin mononucleotide 275
 flavin mononucleotide-mediated
 light-driven halogenation, of
 aromatic compounds 336, 337
 flavoenzymes 322
 florfenicol synthesis 70, 71
- 1-fluoro-2-amino-indane 27
 (R) -flurbiprofen methyl ester 39
 fumarate 322
 fumarate reductase (FccA) 320, 321
 α -functionalized carboxylic acids 316
- g**
- GABA analogues 39
 gabapentin 138
 galactose oxidases 142
Geotrichum candidum-catalyzed kinetic
 resolution, of racemic secondary
 alcohols 235
 geraniol-derived oxiranes 64
Gluconobacter oxydans 274
 glucose dehydrogenase (GDH) system
 285
 gold-catalyzed C–C bond-formation 283
 gold(I)oendash Ga_4L_6 supramolecular
 cluster 257
 graphitic carbon nitride ($\text{g-C}_3\text{N}_4$) 339
 graphitic carbon nitride
 ($\text{g-C}_3\text{N}_4$)-mediated light-driven
 hydroxylation of ethyl benzene
 339
 green chemistry 10, 362
 griselimycin synthesis 54
 Grubbs catalyst 86, 283
 encapsulation 363
 Grubbs–Hoveyda catalyst 136
 Grubbs second-generation catalyst 297
 Guerbet alcohols 40
- h**
- β -halo alcohol 286
 haloalcohol dehalogenase (HheC) 68,
 187, 188
 halogenase-catalyzed regioselective
 bromination 299
 halogenase-reductase-dehydrogenase
 crosslinked enzyme aggregates
 (HRD-CLEAs) 300
 halogenases 132–134
 halogenated L-tryptophan derivatives
 221

- halohydrin dehalogenase 128, 286–287
 α -haloketones 287
 halolactones 288, 331
 halonium ions 290
 HAPMO-catalyzed DKR of benzyl ketones 203
 harmicine 228
1H-azepino-indole alkaloids 73
 6-HDNO E350L/E352D enzyme 233
N-heterocyclic azepane 47
 α -heterofunctionalized furans 289
 heterogeneous alcohol racemization catalysts 167
 2,5-hexanediol, enzyme catalysed acylations 184
 1-hexanol 40
(*E*)-4-(hex-3-en-1-yloxy)benzoic acid 285
 homoallylic sec-alcohols 142
 homogeneous alcohol racemization catalysts 167
 homoinositol cyclitols 61, 62
 horse liver alcohol dehydrogenase (HLADH) 105, 267
 Hoveyda–Grubbs ruthenium(II) catalyst 294
 Hoveyda–Grubbs second generation ruthenium carbene catalysts 284, 285
 hydrogen atom transfer (HAT) protocol 348
 hydrolases 259
 4-hydroxyacetophenone monooxygenase (HAPMO) 203
 α -hydroxyarylketones 103
 hydroxybromination reaction 288
 2-hydroxy-1-indanone 251
 α -hydroxy ketones, enzymatic reduction of 109
 ω -hydroxyl α -diazo esters 37
 4-hydroxy-2-methylcyclopent-2-en-1-one 175
 5-(hydroxymethyl)dihydrofuran-2(3H)-one 288
- (*S*)- γ -hydroxymethyl- α,β -butenolide (HBO) 264
 hydroxynitrile lyase (HNL) 70, 137–138
 β -hydroxy nitriles 9
 β -hydroxy nitriles, nitrilase-catalyzed hydrolysis of 10
 3-hydroxy-3-(4-nitrophenyl)propanoic acid 193, 194
(*R*)-6-hydroxy-1,2,3,4-tetrahydroisoquinoline-1-carboxylic acid 204
(*1S,4R*)-8-hydroxy-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl propionate 27
(*R*)- β -hydroxytriazoles 287
hypobromite 287
hypochlorite 287
hypohalites (XO^-) 288
hypohalogenites (XO^-) 289
- i*
 imagabalin 43
cis-3-(*1H*-imidazol-1-yl)cyclohexanol 23, 24
 imine reductases (IREDS) 4, 46–48, 134, 329, 330
 imines, photocatalytic reduction of 349
 1,2-indanedione 89, 251
 indirect electron transfer, of redox enzymes 318, 319
 indoles 350, 351
(*S*)-2-indolinecarboxylic acid 131
 intramolecular aza-Michael reaction (IMAMR) 277
 intramolecular nitroaldol reaction 252, 253
 intramolecular oxa-Michael reaction (IMOMR) 112, 277
 inverse electron-demand Diels–Alder (IEDDA) reactions 141
 ionic-surfactant-coating enzyme 178
 Ireland–Claisen rearrangement 172, 173
 iridium-catalyzed oxidation, of chlorhydrins 236
 iron-catalyzed redox reactions 250

- iron hydride complex 167
 iron(III) phthalocyanine catalyst (FePcCl)
 294
 isopropyl 2-benzyl-3-oxobutanoate 195
- j**
 JAK2 kinase inhibitor synthesis 42
- k**
 KAuCl_4 -catalyzed cycloisomerization, of
 4-pentynoic acid 107
 2-keto-3-deoxy sugar acids (KDs)
 300–301
 α -ketoglutarate-dependent (α -KG)
 non-heme iron oxygenases 140
 ketoisophorone 275, 323, 324, 328
 ketoreductase-catalyzed reduction
 of tetrahydrofuran-3-one 8
 of tetrahydrothiophene-3-one 8
 ketoreductases (KREDs) 5, 33
 catalyze 273
 Knoevenagel condensation 71
 of salicylaldehydes 67
 Knoevenagel–Doebner condensation
 130
 Knorr pyrrole synthesis 278, 279
- l**
 $\text{L-}\alpha\text{-amino acids}$ 109
 laccases 67, 138, 290
 laccase/TEMPO system 292
Lactobacillus brevis (LBADH) 99, 195,
 270
Lactobacillus kefir (LKADH) 95, 273,
 277
 γ -lactones 111
 lactone synthesis 347
 $\text{L-amino acid deaminase}$ 223
 $\text{L-amino acid oxidase}$ 220, 284
 L-aryllalanines 130
 L-biaryllalanines 68, 69
 L-cloperastine 179
 leptaflorin 228
 leucine 5-hydroxylase 54
 Leuckart reaction 90
- Lewis acid-catalyzed transformation 138
 Liebeskind–Srogl (L–S) coupling 297,
 298
 light-activated catalyst 313
 light-activated co-factor regeneration
 325
 light-activated redox enzymes
 with co-factor regeneration 325–330
 without co-factor regeneration
 317–325
 light-dependent NADPH
 protochlorophyllide oxidoreductase
 (LPOR) catalyzed reduction of
 protochlorophyllide 314
 light-driven CHMO-catalyzed
 Baeyer–Villiger oxidation, of cyclic
 ketones 325
 light-driven cofactor regeneration
 dimer formation during 329, 330
 of pyruvate 329
 light-driven double-bond
 reductase-catalyzed
 enantioselective deacetoxylation
 of α -substituted α -acetoxytetralones
 332
 light-driven ene reductase-catalyzed
 enantioselective reduction, of
 ketones 332
 light-driven enzymatic enantioselective
 Baeyer–Villiger oxidation, of cyclic
 ketones 323
 light-driven enzymes 313, 334
 light-driven ketoreductase-catalyzed
 enantioselective radical
 dehalogenation
 α -bromoamides 332
 α -bromolactones 331, 332
 light-driven NAD(P)H regeneration
 L-glutamate synthesis 326
 for redox enzymes 326
 light-driven NADH regeneration, for
 carbon dioxide reduction 328
 linear deracemiztion 217
 lipase (Novozym 435) 302
 lipase CALB-catalyzed aminolysis 93, 94

- lipase-catalyzed aminolysis, of esters 92
 lipase-catalyzed esterification of alcohols
 161
 lipase-catalyzed hydrolysis
 of esters 27
 of triglycerides 353
 lipase-catalyzed kinetic resolution
 of chiral alcohols 177
 of *cis*-3-(1*H*-Imidazol-1-yl)cyclohexanol
 24
 of β -cyanodiester 40
 of methyl mandelate 25
 of propargylic alcohols 25
 of proxyphylline 22
 of *trans*-2-(1*H*-imidazol-1-yl)
 cyclohexanol 24
 lipase-catalyzed Mannich reaction 343,
 344
 lipase-catalyzed regioselective acylation,
 of hydroxyl groups 5, 6
 lipase-catalyzed selective hydrolysis, of
 diesters 6
 lipase-catalyzed transesterification 20,
 161, 162, 164, 183, 252
 lipase-mediated BVO of levoglucosenone
 (LGO) 264
 lipase/oxovanadium co-catalyzed DKR
 of racemic aryl propargyl alcohols
 174, 175
 of racemic 4-(cyclohex-1-en-1-yl)but-3-
 en-2-ol 171, 172
 lipases 20, 26
 acetophenone into (*R*)-1-phenylethyl
 acetate 252
 (*R*)-2-acetoxy-1-indanone 251
 acetylated β -nitroalkanols 253
 acylation of chiral alcohols and diols
 251
 acylation of ketones 248, 249
 alcohol or amine formation 247
 of allylated gallic acid 262
 allylated gallic and vanillic acids
 262
 anilines 266
 antipodes of (5-acetoxy-1,3-oxathiolan-
 2-yl)methyl benzoate 255
 Baeyer–Villiger oxidation of substituted
 cyclobutanones 264
 calcimimetic (+)-NPS R-568 256
 N-alkylimines 266
 β -aminoketones 250
 benzylamines and
 α -methylbenzylamines 266
 BVO-ROP of substituted
 cyclohexanones 265
 carbonyl reductases 267–275
 of diallylated vanillic acid 263
 domino thia-Michael–Henry reaction
 254
 enol acetates to chiral acetates 248,
 249
 epoxidation of unsaturated fatty acids
 260
 hydrolases 259
 intramolecular acyl transfer of
 acyloxyphenyl ketones 250
 intramolecular nitroaldol reaction
 252, 253
 ketone reduction and alcohol
 racemization 248
 lipase/H₂O₂ system 260, 261
 nitroaldol (Henry) reaction 253
 oxathiazinanones 255
 1,3-oxathiolan-5-one 255
 Passerini reaction 258
 perhydrolysis and chemical
 epoxidation 260
 (*S*)-propanolol 257
 of salicyl alcohols 266
 and esterases 85–94
 in organic synthesis 20
 organocatalytic aldehyde–aldehyde C–C
 bond coupling reactions 259
 L-lactic acid 235
 L-Leucine 221
 L-4-nitrophenylalanine 223
 L-proline synthesis 218
 lunatoic acid A synthesis 71, 72

m

mandelate racemase 159
 mandelonitrile analogues 194, 195
 Mannich reaction 343
 MAO-N-mediated aromatization 283
 MAO-N mutant enzymes 225
 Markovnikov's rule 288
 (*R*)-Marmin 66, 67
 Meerwein-Ponndorf-Verley-Oppenauer (MPVO) reaction 167
 mercaptoketones 341, 342
 meso-1,2-cyclopentanediethanol 29, 30
meso-diaminopimelate dehydrogenase 5, 6
 (*S*)- α -mesyloxyamide 69
 metal-catalyzed Leuckart reactions 90
 metal-catalyzed metathesis reaction, of double olefin compounds 86
 metal-catalyzed racemization of secondary alcohols hydridic pathways for 163
 metallic palladium nanoparticles 176
 3'-methoxyacetophenone 256
 (*1S,2R*)-1-(methoxycarbonyl)cyclohex-4-ene-2-carboxylic acid 86
 (*R*)- α -methylbenzylamine 284
 3-(*1S,3S*)-methylcyclohexanol 269
 methylcyclohexene 343
 2-methylcyclohexenone 276, 323, 324, 344
 2-methyl-2-cyclohexen-1-one 328, 329
 methyl (*R*)-(−)-mandelate 25
 methyl 4-oxo-4-arylbutanoate 270
 methyl 4-oxo-4-phenylbutanoate 111
 4-methyl-5-oxo-5-phenylpentanoic acid 4
 5-methyl-1-substituted 1,4-diazepane 48
 methyl-terminated organosilanes (MH-Me-L) 264
 2-methyl-1,2,3,4-tetrahydroquinoline 12 chemo-enzymatic deracemization of 13
 1-((*2R, 6R*)-6-methyltetrahydro-2H-pyran-2yl)propan-2-one 277

methyl/trifluoromethyl diketone 5
 methyl viologen mediated light-driven enzymatic reduction, of ketoisophorone 328
 microbial transglutaminase (MTG) 139
 MK-7246 synthesis 44, 45
 molecular-weight cut-off (MWCO) cellulose membrane 299
 monoamine oxidases (MAO) 279–284
 monobromonated 287
 morphinone reductase (MorB) 334
 morpholine-based buffers 325
 3-(*N*-morpholino)propanesulfonic acid (MOPS) 325
 mutant P450BM3 enzymes 49, 50
 mutant RasADH-catalyzed reduction of diarylketones 7, 8

n

N-acetylneurameric acid lyase (NAL) 127
 NADPH-dependent reductive aminase 233
 2-naphthaldehyde 257
 natural electron transfer, of redox enzymes 318, 319
 NCS-catalyzed Pictet-Spengler reaction 122, 123
 negatively charged carboxylate-terminated carbon dots 321
 Ni-catalyzed Suzuki–Miyaura coupling and enzymatic ketone reduction 101
 nicotinamide cofactors, regeneration of 326
 nicotinamide-dependent ketoreductase 330
 (*R*)-Nifenalol 64
 nitrilase-based chemo-enzymatic approach 40
 nitrilase-catalyzed chemo-specific hydrolysis, of ethyl (*R*)-4-cyano-3-hydroxybutyrate 3

- nitrilase-catalyzed desymmetric hydrolysis, of prochiral 3-substituted glutaronitriles 7 nitrilase-catalyzed hydrolysis of β -hydroxy nitriles 10 nitrilase-catalyzed reactions 31 nitrilase-catalyzed resolution, of *rac*-3-oxocyclohexane-1-carbonitrile 33 nitrilase-catalyzed the regiospecific hydrolysis 6 nitrilases 31, 138 nitroaldol (Henry) reaction 252 3-nitrobenzaldehyde 253 (*R*)-*N*-methyl-1-benzyl-1,2,3,4-tetrahydroisoquinolines 227 none one-pot chemoenzymatic transformation 85 nonivamide 91, 92, 116, 117 non-selective oxidation of alcohols 108 norlaudanosoline 119 19-nor-steroids 1 Novozym-435 25, 160, 162, 165, 262, 302 Noyori's dynamic asymmetric hydrogenation of ketones 157
- O**
- (*R*)-*O*-Acetylcyanohydrins 87 (*R,Z*)-octadec-9-en-7-ol 316 Odanacatib 100 Old Yellow Enzyme 1 (OYE1) mutants 114 old yellow enzymes (OYEs) 276, 322, 323 oleic acid to cycloheptene 295 oleic acid to cyclohexene 296 oleic acid to cyclopentene 295 olive oil to cycloheptene 296 olive oil to cyclohexene 296 olive oil to cyclopentene 296 one-pot cascades of photocatalytic oxidation and enzymatic functionalization 345, 346 lactone synthesis 346, 347 one-pot chemoenzymatic cascade transformations 362, 363 one-pot chemoenzymatic conversion of benzyl alcohol 92 of L- α -amino acids 109 one-pot chemoenzymatic deracemization of 2,2-dichloro-1-phenylethanol 108 of (\pm)-2,2-disubstituted epoxides 126 of (\pm)-2-methylglycidyl benzyl ether 126 of 2-phenyl-1-propanol 108 of racemic *para*-nitrostyrene oxide 126 of secondary alcohols 107, 108 one-pot chemoenzymatic oxidation and allylation cascade 143 one-pot chemoenzymatic synthesis of acetylated (*S*)-cyanohydrins 138 of (*R*)-*O*-acetylcyanohydrins from aldehydes 87 of *O*-acetylcyanohydrins 88 of amidotriazole peptides 140 of (*R*)-and (*S*)-1-aryl-1,2-ethanediols 104 of (*R*)-and (*S*)-orphenadrine 102 of L-aryllalanines 130 of (*R*)-1-arylethanols 103 of (*R*)- β -aryl- γ -lactams 114 of Boc-protected C5, C6, or C7 aryl-substituted derivatives 133 of Boc-protected D-biarylalanines 132 of Boc-protected L-biarylalanines 131 of (1*S*,3*S*,4*R*)-1-(2-bromophenyl)-1,2,3,4-tetrahydroisoquinoline-4,6-diol 121 of chiral 2-aryl succinic acid derivatives 113, 114 of chiral biaryl alcohol intermediate of Odanacatib 100 of chiral 1,3-diols 95, 96 of chiral 1,2,3-triazole-derived diols 111 of (*R*)-configured amides 91, 92 of (*S*)- δ -decalactone 137

- one-pot chemoenzymatic synthesis
(*contd.*)
- of diastereomers of chiral amino alcohols 115
 - of diastereomers of 1,3-diols 96, 97
 - of (*S*)-dictyoprolene 89
 - of 6,7-dihydrobenzofuran-4-(5*H*)-ones 139
 - of 1,4-disubstituted 1,2,3-triazole 90
 - of enantiomers of β -hydroxytriazoles 130
 - of (+)-epoxysorbicillinol 145
 - of gabapentin 138
 - of γ -and δ -lactones 111, 112
 - of highly functionalized indole derivatives 139
 - of (*S*)-2-indolinecarboxylic acid 131
 - of natural product urea sorbicillinoid 144
 - of (*R*)-(-)-rhododendrol 102
 - of sorbicatechol A 145
 - of (*S*)-tembamide 110
 - of 1,2,3-triazole derivatives 90
 - of (*S*)-1,5-undecadien-3-ol 89
 - of vanillyl nonivamide 117
 - of (-)-xyloketal D 142
- one-pot chemoenzymatic synthesis of γ -hydroxy amides 107
- one-pot chemoenzymatic
- trans*-dihydroxylation of olefins 125
- one-pot chemoenzymatic transformation
- of aromatic terminal alkynes 107
 - of benzylic C–H bond 141
- one-pot concurrent cascades
- of photocatalytic oxidation and enzymatic functionalization 344
- one-pot concurrent chemo-enzymatic reactions 155
- biocatalytic reaction 247
- cascades via compartmentalization 297–302
- chemical and biocatalytic reactions 246
- chemical reaction, living organisms
- metabolism 293–296
- cytochrome P450s 284
- of D-fructose 245
- D-glucose 245
- enoate reductases 275–276
- halohydrin dehalogenase 286–287
- laccases 290–293
- lipases 247–266
- monoamine oxidases (MAO) 279–284
- transaminases 277–279
- vanadium haloperoxidases 287–290
- one-pot concurrent
- photochemo-enzymatic asymmetric synthesis
 - of chiral amines 234
- one-pot multienzyme cascade reaction 74, 75
- one-pot multi-enzyme (OPME) sialylation systems 75
- one-pot-one-step mode
- chemo-enzymatic cascade transformations 12
- one-pot sequential biocatalytic azidolysis
- of epoxides and click reaction 128, 129
- one-pot sequential chemoenzymatic synthesis
- of chiral 2-substituted 3-hydroxycarboxylic esters 128
 - of Cinacalcet 123
 - of 9,10-dihydroxy-(*S*)-THPBs 120
 - of 10,11-dihydroxy-(*S*)-THPBs 120
- one-pot sequential enzymatic benzylic C–H hydroxylation 141
- one-pot sequential enzymatic
- decarboxylation
 - and BHC-catalyzed metathesis 136
 - and chemical reduction 136
 - and Ru-catalyzed metathesis 135
- one-pot sequential enzymatic halogenation
- and Buchwald–Hartwig alkoxylation 134

- and Buchwald–Hartwig amination 134
 and Suzuki–Miyaura cross-coupling reaction 133
 one-pot sequential lipase-catalyzed amidation 90
 one-pot sequential organocatalytic and enzymatic aldol reactions 127
 one-pot sequential ring-closing metathesis 87
 one-pot sequential ruthenium-catalyzed metathesis 86
 one-pot synthesis, of $(-)(R,R)$ -*cis*-6-methyltetrahydropyran-2-yl)acetic acid 113
 optically active (R) -amido carbamates 26
 optically active mandelic acid derivatives 24
 optically active pemoline 25
 optically active 1,2,3,4-tetrahydroisoquinoline carboxylic acids 221
 optically active triazole-containing β -adrenergic receptor blocker analogues 34
 optically pure 6-substituted 5,6-dihydro-pyran-2-one derivatives 23
 organocatalytic aldehyde-aldehyde C–C bond coupling reactions 259
 organocatalytic aldol reaction 95, 96, 269
 (S)-or (R)- γ -aryl- γ -butyrolactones 270
 oxidase-mediated redox cascade 290
 oxidoreductase (LPOR) 317
 photolyases 314
 photosystems 314
 oxindoles 334, 335
 2-oxoacid aldolases 127
 oxoammonium ion 291, 292
 2-oxocyclopentanecarbonitrile 197
 2-oxoglutarate/Fe(II)-dependent dioxygenases (2-ODD) 55
 oxovanadium-catalyzed Meyer–Schuster rearrangement 172–174
- p**
 packed-bed reactor (PBR) 302
 PAL-catalyzed synthesis of (*S*)-aryllalanines 130
 palladium-catalyzed cross-coupling reactions 98
 palladium-catalyzed Heck reaction, of aryl halides 101
 palladium-catalyzed stereoselective Tsuji–Trost reaction 64
 palladium(II) complexes 105
 palladium on charcoal (Pd/C) catalyst 188
 para-methoxyphenyl (PMP)-protected α -amino- γ -butyrolactone 97
 Passerini reaction 29, 258
 P450 BM3-catalyzed hydroxylation 53
 P450-catalyzed epoxidation 284, 285
 Pd-catalyzed alcohol oxidation 117
 Pd-catalyzed coupling reactions 37, 38
 Pd-catalyzed racemization
 of 1-phenylethylamine 189
 of (*S*)-1-phenylethylamine 188
 Pd-catalyzed Suzuki cross-coupling reaction 94
 of acetylphenylboronic acid 98
 Pd/Cu-catalyzed Wacker-oxidation 298
 1,2,3,4,6-pentamethyl- α -mannopyranoside 50
 P450 enzymes 319
 from *Bacillus megaterium* (P450 BM3) 284
 peptide enol ester preparation 31
 perhydrolysis 259, 260, 262, 263–265
 peroxidases 336
 peroxy acids 259
 peroxygenases 338–340
 phenylalanine ammonia lyase (PAL) 68, 129
 (*Z*)-2-phenylbut-2-enedioic acid dimethyl ester 340, 341
 phenylcapsaicin 91
 2-phenyl cyclic imine 47
 (*R*)-1-phenylethane-1,2-diol 272
 1-phenylethanol 91, 164–167

- 1-phenylethanol dehydrogenase (*S*)-PED 270
 5-phenyloxazoline derivative 51
 1-phenyl-1,4-pentanediol 185
 2-phenyl-1-propanol 238
 phenyl-substituted anilines 265
 phenyl-substituted 1-benzyl-1,2,3,4,5,6,7,
 8-octahydroisoquinolines 46
 phenyl-substituted 2-(2-phenylethyl)THQ
 derivatives 230, 231
 photoactivation
 of Baeyer–Villiger monooxygenase 323
 of fumarate reductase 320, 321
 of hydrogenase 321
 of P450 enzyme 319, 320
 of Rieske non-heme iron oxygenases 320
 photobiocatalytic regioselective
 chlorination, of tryptophan 325
 photocatalysis 335–353
 photocatalytic enzymatic reactions 364
 photochemical cofactor regeneration 318
 photochemical reaction 271, 313, 336, 364
 photoenzymatic cascade transformation
 of long-chain fatty acids 317, 318
 of oleic acid 317
 of (poly)unsaturated fatty acids 316
 photoenzymes 313
 description 313
 light-dependent
 NADPH:protochlorophyllide
 oxidoreductase (LPOR) 314
 photo-induced catalytic promiscuity 330
 photo-induced CvFAP catalyzed
 decarboxylation, of fatty acids 314, 315
 photo-induced ene reductase-catalyzed
 enantioselective hydrogenation
 of vinyl pyridines 333
 photo-induced ER-catalyzed asymmetric
 radical cyclization, of
 α -chloroamides 334
 photoinduced ER-catalyzed
 intermolecular radical coupling, of
 alkenes with α -halo carbonyl
 compounds 336
 photoinduced ER-catalyzed radical
 cyclization, oxindoles synthesis 335
 photo-induced oxidations 364
 photo-induced Ru-catalyzed racemization 176
 photolyases 314
 photoredox catalytic aminoalkylation
 of indoles 351
 of β -naphthol 352
 photosynthetic cofactor-regeneration
 for imine reductase-catalyzed reactions 330
 photosystems 314
 Pictet–Spenglerase/strictosidine synthase 72
 Pictet–Spengler reaction 229
 of dopamine 121
 of tryptamine 72
 pincer-type iron complexes 166
 pipecolic acid derivatives 60
 plant oils 353, 364
 platinum catalysts 191
 PLE-catalyzed hydrolysis 86
 plug-flow reactor (PFR) 302
 polydimethylsiloxane (PDMS) 298, 300
 membrane 298, 363
 poly- ϵ -caprolactone 74
 polymer-bound pyridinium tribromide
 (PBPTB) 103
 polysaccharides 50, 51
 porcine kidney D-amino acid oxidase
 (pkDAO) 219, 220, 233
 pregabalin 39, 40, 200
 (*S*)-pregabalin synthesis 32, 33
 Prileshajev reaction 260
 prochiral ketoxime 188, 189
 prochiral 3-substituted glutaronitriles 6, 7, 33
 proflavine 327

- proline-derivative-catalyzed aldol reaction 96
(S)-propanolol 182, 257
 propargylamine 93, 139
 propargylic alcohols 25
 proxyphylline 21, 22
Pseudomonas cepacia lipase (PCL) 160
Pseudomonas fluorescens lipase (PF) 183
Pseudomonas stutzeri lipase (PSL) 178
 pyridoxal-5-phosphate (PLP) 199
 pyrrolidine iminocyclitols 62
 pyruvate 329
- q**
 quinones 292
- r**
 racemases 159, 160
 racemic α -acetoxy-2-naphthylacetonitrile 20, 21
 racemic alcohols, one-pot transformation of 115
 racemic allenic acetates 258
 racemic β -haloalcohols 187
 racemic cyanohydrin acetate 20
 racemic 2,2-dichloro-1-phenylethanol 108
 racemic mandelic acid methyl esters 24
 β -racemic primary alcohols 180
 racemic proxyphylline 21
 racemization
 acid catalysed 159
 aldehyde/ketone mediated
 racemization 158
 of benzylic alcohols 168, 169
 of dimethyl (1,3-dihydro-2H-isoindol-1-yl)phosphonate 204
 of ketones 158
 of 1-phenylethanol 164, 165, 168
 of 2-phenylpropanol 180
 Schiff base-mediated 158
 of secondary alcohols 163
 via keto-enol or imine-enamine tautomerism 159
 via redox reactions 159, 160
- via reversible formation of carbocation 159
rac-2-hydroxy-1-indanone 88
 radical racemization procedure 192
Ralstonia sp. (RasADH) 270
 ramatroban 25, 26
 Raney metals 192
 rasagiline mesylate 190
 recombinant pig liver esterases (PLE) 86
 redox enzymes 240, 316–325
 regioselectivity, of enzyme catalysis 4, 7
 resin-supported peptide 139, 290
 RetroBioCat 362
 RetroPath 362
 retrosynthesis 13, 361, 362
 Rh-catalyzed asymmetric transfer hydrogenation 137
 Rhizomcor miehei 262
 rhodium-catalyzed racemization 193
 rhodium(II) complexes 113
 (R) -(-)-rhododendrol 102
 Rieske non-heme iron oxygenases (ROs) 320
 ring-closing metathesis (RCM) 23, 86, 87, 292
 ring-opening polymerization (ROP) 264
 rivastigmine 168, 169
 (S) -rivastigmine synthesis 42
 room temperature ionic liquids (ILs) 99
 Rose Bengal mediated photobiocatalytic enantioselective reduction, of 2-methylcyclohexenone 324
 Ru-catalyzed isomerization of allylic alcohols 116
 Ru(IV)-catalyzed redox isomerization, of allylic alcohols 105
 rugulactone 22
- s**
 SAS-mediated light-driven bromination, of thymol 338
 SAS-mediated light-driven hydroxybromination of 4-pentenoic acid 338
 of styrene 338

- SAS-mediated light-driven hydroxylation, of hydrocarbons 340
- Schiff base-mediated racemization 158
- Schotten–Baumann conditions 44, 116
- sebacic acid 294, 295
- secondary alcohols 29, 88, 104, 107–109, 115, 160, 164, 165, 167, 168, 176
- (R)-selective 1-(4-hydroxyphenyl)-ethanol dehydrogenase (R)-HPED 270
- serine endopeptidase subtilisin A 29
- Shvo's catalyst 174, 175, 180–182, 192
- SmI₂-mediated cyclization process 58
- sodium anthraquinone sulfate (SAS) 337, 343
- (+)-Solenopsin A 186
- Sonogashira coupling reaction 90, 111
- SorbC 143, 144
- sorbicatemol A 145
- sorbicillactone A 143
- sorbicillinoid 144
- sorbicillinol 144
- Sphingobium yanoikuyae* (SyADH) 270
- statins 31
- stereoinversion 217
- of L-isoleucine to D-allo-isoleucine 221
 - of L-4-nitrophenylalanine 223
- stereoselectivity, of enzyme catalysis 7
- steroid active pharmaceutical ingredient 19
- steroids
- chemo-enzymatic and chemical demethylation of 2
- Stetter reaction 270–272
- (Z)-stilbene 285
- Strecker reaction 219
- styrenes
- asymmetric hydration of 104, 105
 - one-pot sequential Wacker oxidation of 132
- 3-substituted-3-cyano-2-(ethoxycarbonyl) propanoic acid ethyl esters 27
- 3-substituted 2,3-dihydrobenzofuran-2,5-diols 293
- 3,4-substituted meso-pyrrolidines 280
- 3-substituted pentane-1,5-diamines 26
- subtilisin-catalyzed kinetic resolution, of chiral alcohols 177
- Sulfolobus solfataricus* (SsDHAD) 301
- superabsorber-based co-immobilized alcohol dehydrogenase 96
- supercritical carbon dioxide (scCO₂) 176
- surfactant-treated subtilisin (STS) 178, 254
- Suvorexant 43, 44, 48
- Suzuki cross-coupling with enzymatic reduction 98
- Suzuki–Miyaura coupling 300
- of aryl amides 100
- Suzuki–Miyaura cross-coupling and TA-catalyzed amino transfer reactions 119, 120
- Suzuki–Miyaura cross-coupling reactions 99
- Synechocystis* sp. PCC 6803 329
- syn-(2R,3S) α-substituted β-hydroxyesters 195, 196

t

- TA-catalyzed amino transfer reaction 116–120
- tambroxide 54, 55
- tambromycin 54
- telaprevir 29, 30, 281, 282
- (S)-tembamide 110
- 6-*tert*-butoxy-2*H*-pyran-3(6*H*)-one 255
- tert*-butyl (1-oxo-1-phenylhex-5-yn-2-yl) carbamate 198
- (S)-5-(*tert*-butyldimethylsiloxy)heptanal 184
- tetrahydro-β-carboline (THBC) ring system 228
- tetrahydrofuran-3-one 8
- 1,2,3,4-tetrahydroisoquinoline (THIQ) 121, 204, 222, 223, 227, 279, 280
- tetrahydroisoquinoline (THIQ) moiety 120, 283
- tetrahydroprotoberberine alkaloids 119
- tetrahydropyridines (THPs) 279, 280
- (R)-tetrahydrothiophene-3-ol 7

- tetrahydrothiophene-3-one 8
 1,1,3,3-tetramethylguanidine (TMG) 253
 2,2,6,6-tetramethyl-1-piperidinyloxy (TEMPO) 266
 thermal decarboxylation, of 3-substituted-3-cyano-2-(ethoxy-carbonyl)propanoic acid 27
 thermostable alcohol dehydrogenase (TADH) 269
Thermus scotoductus 275
 thiamine diphosphate (ThDP)-dependent carboligase 63
 thiamphenicol synthesis 70, 71
 3-thiazolines 134
 thiosugar scaffolds 63
 thrombin inhibitor 36
 β -thymidine 10, 11
 TiO_2 -based photosensitizer mediated photobiocatalytic enantioselective reduction of ketoisphorone 323, 324
 TiO_2 doped with gold nanoparticles (Au-TiO_2) 337
 TiO_2 nanoparticles mediated photobiocatalytic reduction of CO_2 322
 of fumarate 321, 322
 α -tocopherols 65
 tocotrienols 65
 transaminase ATA-113 catalyzed 278
 transaminase from *Vibrio fluvialis* (VF-TA) 299
 transaminases (TA) 42, 123, 200, 277
 transamination 42, 43, 45, 46, 117, 118
 transesterification 20, 23, 98, 161–163, 259
 transglutaminases 139–140
trans-3-hexene 284
 transition-metal-based heterogeneous catalysts 168
 transition-metal-catalyzed hydrogenation 293
 (+)-*trans*-4-*tert*-butoxy-5-hydroxycyclopent-2-enone 255
 (−)-*trans*-4-*tert*-butoxy-5-hydroxycyclopent-2-enone 255
 (±)-*trans*-4-*tert*-butoxy-5-hydroxycyclopent-2-enone 255
 1,2,3-triazole-derived diols
 chemo-enzymatic synthesis one-pot two-step process 11–12
 separate-pot two-step process 12
 1,2,3-triazoles 89, 110, 128
 (R) -trichoflectin 71
 12-tridecanoic acid 284
 trifluoroacetic acid 47, 270
 (R) -2,2,2-trifluoro-1-(4'-(methylsulfonyl)-[1,1'-biphenyl]-4-yl)ethanol 100
 triglycerides 20, 353
 trimethylamine 255
 1,4-dithiane-2,5-diol 254
 TropB 143
 type II photosystems 314
 type I photosystems 314
- U**
- Ugi four-component reaction (U-4CR) 92–94
 Ugi three-component reaction 281, 282
 α,β -unsaturated ketones 57, 103
 urea–hydrogen peroxide (UHP) 262
- V**
- γ -valerolactone 106
 vanadium-catalyzed racemization, of allylic alcohols 170
 vanadium-dependent chloroperoxidase from *Curvularia inaequalis* (CiVCPO) 287
 vanadium haloperoxidases 287–290
 vanillin, reductive amination of 90, 91
 vanillylamine 91, 116
Vibrio fluvialis JS17 (Vf-TA) 42
 vinyl pyridines 332, 333
 visible light photocatalysis 364
 vitamin E-derived designer micelles 294
 V-MPS3 catalyst 171

W

- Wacker oxidation 298
of allylbenzenes 118
of styrenes 117, 118
Wacker-Tsuji oxidation of olefins 104
water + plastoquinone oxidoreductase
(PSII) 314
water soluble palladium catalyst 99
without co-factor regeneration
317
Wittig reaction 103, 113

X

- xanthene dyes 323, 324, 327
(-)xyloketal D 142

Y

- yimatasvir synthesis 27, 29

Z

- zeolite catalysts 168
 ZnI_2 253
Zn-porphyrin complexes 327