

Index

a

- achiral metal catalysts 8
 actinophyllic acid 309, 310
 (-)-actinophyllic acid hydrochloride 310
 acylammonium salts 221, 225
 α -acylation 288, 289
 acyl-CoA cholesterol acyltransferase (ACAT) inhibitor 303
N-acyl hemiaminals 54
N-acyliminium cyclization reaction 134
 acyl-palladium 242, 269, 270
 aldehydes 132, 151, 191, 319
 catalytic asymmetric α -oxidation 63–64
 enantioselective direct alkylation 52
 xanthenes 284
 aldol and Mannich reactions 39
 alkene isomerization 125, 142, 144–151
 alkene metathesis 141–144
 alkynylpyridine 291
 alkyl sulfonyl chlorides 190, 191, 193
 alkyne hydrosilylation 137–138
 2-alkynylbenzaldehydes 132, 134
 alkynyl bromides 31, 32
 alkynyl glycols 136, 137
 2-alkynyl indoles 139
 1-(2-alkynylphenyl)carbonyls 118
 alkynyl silver 94
 alkynyl-metal mediated transformations 253–254
 allenolate equivalent 211
 allyl acetates 25–26, 40, 77, 246, 306
 allylamine isomerization 147
 α -allylation of aldehydes 8, 10, 40, 41, 44, 95, 97, 98, 99, 101
 allylating reagents 99
 allylbenzene 157
 allylboronate 148, 151, 158, 319
 allylborons 155
N-allylcarbamates 146, 150
 allyl electrophiles 260, 261
 allylic alkylation
 metal hydride-initiated 48, 51
 oxidative addition-initiated 39–48
 π -allyliridium intermediate 44, 251
 π -allyl metal intermediates 245, 247
 π -allylmetallic complexes 48
 π -allyl-metal-mediated transformation 95–107, 245–253, 258–263
 allyl methylsulfonates 258, 260, 261
N-allyl-*N*-benzylacrylamide 142
 π -allylpalladium 5, 9, 10, 24, 25, 45, 99, 100, 104, 107, 115–117, 156
 π -allylpalladium chloride 115, 116
N-allyl tryptamine 144, 146
 amine catalysis 2, 39, 52, 54, 58, 62, 82, 221, 279, 282, 285, 287, 288, 305–310
 amine catalyst 10, 40–42, 44, 49, 50, 53, 56, 68, 75–77, 81, 82, 85–87, 183, 184, 196, 258, 277, 279–285, 287
 Amine-Mediated Ammonium Enolates 184–198
 2-aminobenzaldehydes 127
 2-aminobenzamides 132, 134
 β -amino- α -hydroxyl acid 110

- β-amino ketone 69
 2-aminophenones 127
 ammonium salts 221–225
 angiogenesis inhibitor 310, 311
 (−)-aromadendranediol 15, 305, 306
 Arundic acid 306, 307
N-arylaminomethanes 296, 297
 α-arylation 55, 56, 58, 59, 102, 104
 1,1-arylborylation of alkenes 30
 aryl diazoacetates 86
N-aryl imines 107–108
 2-arylindoles 284
 3-aryloxindoles 104, 105
N-aryl-tetrahydroisoquinolines (THIQ) 115, 267, 283, 288, 289, 296
 asymmetric addition to alkynes 59–61, 62
 asymmetric α-alkenylation 55, 56
 asymmetric allylation reaction 24, 151, 152, 160
 asymmetric annulation reactions 201–211
 asymmetric [2+2] cycloaddition reactions 186–192
 cinchona alkaloid/In(OTf)₃ catalyzed 186, 187
 cinchona alkaloid/lithium-catalyzed 187, 189
 of imines and alkyl sulfonyl chlorides 190, 193
 asymmetric [3+2] cycloaddition 77–80
 asymmetric [3+3] reactions 225–229
 asymmetric [4+2] reactions 192–196
 asymmetric Baylis–Hillman reactions 184–186
 asymmetric carbonyl allylation/ hydroformylation 160
 Asymmetric Cascade Reactions 229–231
 asymmetric catalysis 1, 2, 16, 20, 22–29, 33, 92, 179, 180, 188, 205, 225, 245, 277, 290
 asymmetric cyclopropanation 1, 77, 79
 asymmetric Diels–Alder reaction 136
 asymmetric electrophilic fluorination reaction 29
 asymmetric Friedel–Crafts alkylation 14
 asymmetric Friedel–Crafts-type reaction 141
 asymmetric hetero-Diels–Alder reactions 192, 195
 cinchona alkaloid/Lewis acid catalyzed 196, 198
 cinchona alkaloid/LiClO₄ catalyzed 196, 198
 cinchona alkaloid/palladium acid catalyzed 196, 197
 asymmetric hydrogenation 2, 8, 15, 107–110, 151, 152, 154–156
 asymmetric kinetic resolutions 215–216, 231–235
 asymmetric metal/phase-transfer catalyst 20, 22
 anionic combination 29–33, 34
 cationic combination 22–29
 asymmetric Michael addition 15, 81–83, 229, 231
 asymmetric organocatalysis 2, 3, 6, 7, 11, 16, 179, 235, 243, 301, 320
 asymmetric oxidative cascade reaction 83
 asymmetric β-protonation reactions 211–215
 asymmetric vinylogous umpolung reaction 27–28
 atroposelective annulation reaction 227, 230
 aza–Baylis–Hillman-type reaction 288
 aza–carbene ene-type reaction 165, 167
 aza–ene type reaction 165, 318
 aza–Morita–Baylis–Hillman reaction 267
 aza–Petasis–Ferrier rearrangement reaction 146, 149
 aza–pinacol cyclization 290, 291
 azolium enolates 216
 and dienolates 216–217
- b**
- Baeyer–Villiger oxidation 314, 318
 Baylis–Hillman reaction 183–186
 benzotetramisole 258, 314, 316
 benzothiazolines 151

- benzoxazines 109, 111, 113, 143, 154
 benzoxazinones 152, 154, 155, 192
 1,4-benzoxazinones 192
O-benzoyl quinidine (BQD) 196
 benzoylquinine (BQ) 5, 186, 187
N-benzoyl-vinyl benzoxazinanones 252
 benzoyloxy isochromene 167
 benzyl alcohols 51, 110, 134
 π -benzyl-metal mediated transformations 263–265
 benzyltriethylammonium chloride 20
 BINAM-derived phosphoric acids (BDPA) 33
 bis(1,2-diphenylphosphino)ethane (DPPE) 22, 25, 77
 bis(phenylsulfonyl)methane (BSM) 221, 223
 bisabolane sesquiterpenes 305
N-Boc-protected 2-pyrrolidinone 309
 α -branched aldehydes 12, 41, 42, 49, 68
 4-(bromomethyl)pyridine 310
 Brønsted acid 10, 48
 catalysis 2, 91, 93, 125, 132, 173, 292, 296
 chiral Brønsted acid relay catalysis 14, 125–127, 136, 138, 144, 146, 152, 163, 167–169, 172
 BrCCl_3 284
 Breslow intermediate 180, 216, 219, 228, 229, 246, 248, 278, 288
 Buchwald–Hartwig cross-coupling reaction 316
 Burgess’ reagent 314
 1,3-butadienes 30–32
 butenolide 211, 305, 315
 3-butynoic acids 14, 132
- C**
 (–)-Calycanthidine 311, 312
 carbene formation
 and asymmetric protonation 160–165
 multiple cascade reaction 165–167, 168
 carbocyclization cascade 81–83
 carbon nucleophiles 28, 77, 139–140
 carbonyl compounds 40, 48, 55–59, 61–63, 70, 75, 76, 110, 160, 165, 184, 196–198, 227, 279, 292
 1,3-carbonyl compounds 227
 Carreira ligand 45
 cascade catalysis 6
 cascade cross-metathesis 14, 141, 143, 144, 305
 catalytic asymmetric cross dehydrogenative coupling 64–68
 catalytic asymmetric propargylic substitution reaction 61–63
 catalytic asymmetric substitution 51–54
 catalytic organometallic reactions 75
 cationic iridium(I) complexes 146
 C–C double bond functionalization 144, 146
 C–H bond functionalization 170
 (–)-Chimonanthine 311, 312
 chiral amine catalysts 42, 75, 277, 279, 280
 chiral Brønsted acid relay catalysis 14, 125–127, 136, 138, 144, 146, 152, 163, 167–169, 172
 chiral Cu-pybox complexes 255
 chiral N-heterocyclic compounds 14
 chiral organocatalysts 8, 9, 152, 277, 278, 297
 chiral pentacarboxycyclopentadiene (PCCP) 116
 chiral phosphinite ligand 69
 chiral phosphoramidite 9, 45, 100, 104, 107, 251
 cinnamaldehyde 186, 205, 215, 225, 231, 248
 cinnamyl *tert*-butylcarbonates 258, 259
 C,N-cyclic azomethine 95, 97
 C–N double bond
 asymmetric hydrogenation of 107–110
 co-organocatalyst 3, 69
 cobalt carbonyl 20
 cooperative catalysis 7
 allylation of aldehydes 10

- cooperative catalysis (*contd.*)
 asymmetric allylic C–H
 functionalization by 10
 Lewis acid and base 8
 of chiral rhodium complex 9
 stereochemical control in 7
 copper acetylide 95
 copper-allenylidene complex 62, 265,
 267
 cross aldol reaction of ynals 61
 cross-dehydrogenative coupling (CDC)
 reaction 64–68, 283, 284
 crotonaldehyde 15, 305
 (+)-Cuparene 301, 302
 Cuparenone 302
 (-)-Curcumalactone 314
 (-)-Curcumanolide A 314
 Curcumene 305–307
 cyclic α,β-unsaturated aldehydes 46
 cyclobutanols 117
 cyclopentenes 201, 211
 cyclopentenyl methanone 241
 cyclotryptamine alkaloids 311, 316
- d**
 DABCO 183
 Dehydrocurcumene 305–307
 dehydrogenative coupling 64–68, 283,
 284
 demino catalysis 6
 density functional theory (DFT) 33, 42,
 109, 130, 162, 165, 207, 261
 deprotection sequence 319
 3-Deshydroxy-secu'amamine A 315
N,N-dialkylglycine esters 259, 260
 1,1-diarylalkenes 171
 α,α-diaryl β-amino esters 113
 1,1-diarylation of acrylates 31, 32
 diarylprolinol silyl ether 51, 62, 69
 diaryl substituted methylene 284
 diazo compound 110, 111, 116
 diazo-carbonyls 110, 111
 diazoesters 111, 113, 115, 162–166
 α-diazoesters 162–164
 α-diazoketones 162, 163, 302
 α-diazophenylacetates 113
 1,1-di(boryl)alk-3-enes 151
 dicarbonyl compounds 225, 282
 dienol silyl ether 27
 2,3-dihydrobenzofurans 143
 3,4-dihydro-1-furanium phosphate 132
 3,4-dihydro-2*H*-1,4-benzoxazines 143
 dihydropheanthridine (DHPD) 152,
 154
 dihydropyridone 269, 270, 316
 3,4-dihydroquinolin-2-one 267
 dihydroquinoxaline 15, 152
 diisopropylethylamine 196
 β-diketones 229
 dimethyl hydrogen phosphate 309
 diphenyl methanamine 98
 direct α-alkylation 279, 286
 direct aldol reaction of ynals 60
N,N-disubstituted anilines 113
 disulfonic acids 126, 172
 DMAP 179, 185, 267, 268
 2,5-DMBQ 102
N-dodecylmercaptan 303
 double bond isomerization 33, 144, 149
 double bond migration 13, 69, 144, 146,
 148, 151, 248
 dual amine/palladium catalysis 48–49
 dual photoredox/organo catalysis
 281–282
 dynamic kinetic asymmetric
 transformation (DyKAT)
 215–217
 dynamic kinetic resolution (DKR) 109,
 219, 221, 267, 268
- e**
 (S)-Eflucimibe 303, 304
 electron paramagnetic resonance (EPR)
 268
 electron-relay mechanism 282
 electrophilic π-allyl palladium 241
 enamides 132, 133, 146, 165, 167, 292

- enamine activation 45, 55, 60, 70, 75, 279
and metal catalysis 39
- enamine catalysis
active carbonyl compounds 39, 40
and metal cooperative catalysis
39, 40
- enantiodetermining step 33, 94
- enantioselective conjugate addition reaction 75–77
- enol intermediate 116, 162, 163, 165, 169, 248
- enone cycloallylation 241
- enones 84, 85, 169, 170, 205, 211, 281, 295, 296
- (*-*)-*epi*-Cytosazone 302, 303
- ethynyl benzoxazinonanes 256, 257, 265
- ethynylethylene carbonates 255, 257
- Eupomatiolone-6 316, 318
- 5-*exo*-dig cyclization 81, 132, 134
- f**
- FeCl₂ 63, 223
- Folicanthine 316, 317
- (*-*)-Folicanthine 316, 317
- Friedel–Crafts-like cyclization 309
- Friedel–Crafts reaction 15, 130, 144, 146, 147, 294, 295
- Friedländer condensation 167, 169
- furan-2(3H)-one 14, 132
- g**
- glycals 248
- gold-catalyzed decomposition 165
- gold-catalyzed intramolecular hydroalkoxylation 128, 130, 132, 136
- Grubbs catalyst 14, 309
- Grubbs II catalyst 14, 142–144, 305
- guanidine relay catalysis 165
- h**
- Hantzsch ester 151, 152, 154, 158, 167
- HAT from Hantzsch dihydropyridine (HEH) 290
- Heck reactions 33
- Heck-type insertion reaction 32, 55
- Heck–Matsuda reaction 33, 34
- hemiacetalization 158, 319
- hemiaminalization reaction 146, 148
- (*+*)-herboxidiene 161, 319
- (*+*)-herboxidiene/GEX1A 319
- N*-heterocyclic carbenes (NHCs) 179, 180, 198, 199, 201, 203, 216, 225, 235, 241, 242, 244, 245, 271, 288
- hetero-Diels–Alder (HDA) reactions 136, 138, 192, 195
- hexene-2-one 15, 305
- high-valent transition metals 2
- Hofmann rearrangement reaction 262
- HOMO 2, 179, 184, 198, 203, 277
- homobenzotetramisole 314
- Hoveyda–Grubbs II catalyst 142, 144
- 5,6-2H-pyridin-2-one 227
- hydroalkoxylation mediated relay catalysis 132–136, 137
- hydroalkoxylation/Povarov reaction 136
- hydroamination-initiated cascade reaction 127–132
- hydroamination/hydroarylation reaction 128, 130
- hydroaminomethylation of alkenes 159
- hydrogen atom transfer (HAT) 169, 281, 286, 290, 295, 297
- hydrogen transfer reagent 154
- hydrogen-bonding catalysts 91
- hydrogen-bonding interaction 2, 9, 65, 91, 95, 97, 99, 100, 116, 117, 119, 281, 290, 292, 293
- hydrogen-bonding organocatalysts 104
- 2-hydroxypyrimidines 154, 156
- 2-hydroxystyrenes 117, 118
- hydrosiloxylation mediated relay catalysis 136–138
- i**
- imines 110, 113
- N*-aryl imines 107–108
- N*-tosyl imine 190

- iminium activation
and coinage metal catalysis 83–85
and metal combined catalysis 75–76
and other metal catalysis 85–87
and palladium catalysis 76–83
- iminium catalysis 75–77
and metal combined 75–76
- iminium/Pd cooperative catalysis 77, 80
- In(OTf)₃ 186–188
- indolyl enones 169, 170
- indolylmethanols 102, 104, 139
- intramolecular cyclization process 270
- intramolecular Friedel–Crafts alkylation 141
- intramolecular hetero-Michael addition 319
- intramolecular hydrosilylation 136, 138, 316
- intramolecular Michael addition 205, 207
- ion-pair/photoredox combined catalysis 295–297
- Ir- π -allyl moiety 43
- iridium complex 8, 9, 25, 42–45, 70, 107, 148, 151, 251, 259, 307
- iridium cooperative catalysis 107, 109, 259
- iridium tetrafluoroborate complex 146
- isatins 205, 211, 219, 220, 243
- isobenzopyrylium ion 167
- Isothiourea/LiCl catalyzed 192, 194
- isothiourea/palladium 258, 260–262, 265
- isothioureas (ITUs) 179, 184, 271
- k**
- ketenimine 253, 254
- β -ketocarbonyls 48, 65, 67, 280, 281, 287
- α -ketoesters 205, 207, 211, 219
- β -ketoesters 47, 48, 66, 87, 229, 281
- l**
- β -lactam 5, 184, 186–188, 269, 270, 316
- lactamization 223, 250, 256, 267, 269
- Lautens' synthesis 143
- leucascandrolide A 158, 161, 319, 320
- π -Lewis acids 59, 62, 116, 119, 125
- Lewis acid/enamine cooperative catalysis 52
- π -Lewis acid mediated transformations 39, 116–119, 120
- Lewis acid-mediated S_N1 or S_N2 reaction 50–51, 52
- Lewis base 179–235
and activation intermediates 180–181
- Lewis base catalysis 2, 179–180, 255
and transition metal catalysis 241–242
- Lewis base-Lewis acid cooperative catalysis 179–235
- lithium-assisted asymmetric Baylis–Hillman reactions 184, 186
- L-proline 15, 283, 305, 315
- LUMO 2, 75, 179, 180, 203, 221, 225
- D-lyxo-Phytosphingosine 302, 303
- m**
- MacMillan catalyst 50, 52
- magnesium-assisted asymmetric Baylis–Hillman reactions 186
- malonates 83, 229–231
- Mannich reaction 39, 65, 69, 70, 116, 119, 120, 138, 142, 284
- Mannich-type reaction 5, 54, 65, 111, 113, 116, 119, 134, 139, 142, 143, 187, 270, 302
- Mannich/aza-Michael reaction 115
- metal alkynylide-mediated transformations 93–95, 97
- metal carbene-mediated transformations 110–116
- metal-catalyzed hydroformylation of alkenes 157, 160
- metal-chiral Brønsted acid relay catalysis 126
- metal/Brønsted acid cooperative catalysis 93, 94
- Metal–Allenylidene Mediated Transformations 254–257, 265–267

- 3-(*p*-methoxybenzyloxy)propionaldehyde 313
O-methyl chinconidinium 24
 5-methylhex-5-enal 308
 methyl L-proline 65
 Michael addition 15, 45, 54, 60, 70, 77, 81–85, 87, 141, 205, 207, 223, 225, 227, 229–231, 243, 270, 305, 316, 319
 Minisci-type addition 292
 molecular chirality 1, 2
 molecular oxygen 2, 83, 111, 294
 mono-enone mono-allylic acetate 241
 monoamine oxidase (MAO) 302–304
 Morita–Baylis–Hillman reaction 235, 242, 267
 Morita–Baylis–Hillman carbonates 221, 223, 224
 Mukaiyama–Michael addition 305
 multiple catalyst system 283
 multivariate linear regression (MLR) 292
- n**
 2-naphthalenylmethyl diphenyl phosphate 264, 265
 Nazarov cyclization 169, 170
 neurokinin-1 (NK-1) receptor 303
N-fluorodibenzenesulfonimide (NFSI) 196, 198
 NHC-Mediated α,β -Unsaturated Acyl Azoliums 225–235
 NHC-Mediated Azolium Enolates 216–221
 NHC-Mediated Homoenolates 198–216
 NHC/Ca²⁺ 207, 210
 NHC/Li 209, 211–214, 221, 222, 227, 229, 231–233
 NHC/Li-catalyzed 213, 222, 229, 231, 232
 NHC/Li catalyzed [3+3] annulation reaction 227, 229
 NHC/Li-catalyzed cascade reactions 232
 NHC/Li-catalyzed Michael addition 231
 NHC/Mg-catalyzed annulation reactions 203
 NHC/palladium 249–251
 NHC/Ti(IV) 208
 NHC/Ti-catalyzed annulation reactions 202
 NHC/Ti-catalyzed dimerization of enals 204
N-heterocyclic carbenes (NHCs) 179, 198, 199, 201, 203, 207, 215, 216, 225, 235, 241, 242, 244, 245, 271, 288, 289
 nitroalkynes 139
 nitrone or nitro group 138–139
m-NO₂C₆H₄COOH 283
 norephedrine/Er(OTf)₃ 196
 Noyori-diamine ligand 8, 107
 nucleophilic azolium enamide 254
 nucleophilic organocatalyst 187, 288–290
- o**
 olefin migration 144, 151, 152
 olefins transformation 68–70
 organocatalysis (OC) 2–4, 6, 7, 10, 11, 15, 16, 91, 179, 243, 277, 278, 282, 284, 288, 297, 301, 310–312
 organohalide 269
 organo/metal combined catalysis early stage of 3–7
 relay and sequential 11–16
 organo/metal cooperative catalysis chemical bond 9–11
 stereochemistry control 7–9
 ortho-quinone methides 243, 244
 1,3-oxazaheterocycles 146
 oxindole anion 104
 α -oxo gold carbene formation 138
 α -oxyamination of aldehyde process 285
- p**
 palladium catalyst 25, 30, 41, 77, 116, 158, 248, 259
 palladium-catalyzed carboxylation 269

- palladium complex 3, 5, 8–10, 22–25, 40–42, 45–49, 58–59, 77, 98–100, 102, 104, 156, 158, 243–246, 249–250, 258–259, 261, 263–264, 269, 304
 palladium cooperative catalysis 30, 98, 102, 104, 117, 246, 258, 260, 261
 palladium-Xantphos 260
 para-toluenesulfonic acid (pTSA) 85
 (–)-Paroxetine 307, 308
 PCET 290, 291, 293, 297
 Pd(0)/NHC 247, 248
 Pd(II)/Brønsted acid relay catalysis 154
 Pd-catalyzed α -allylation of aldehydes 95
 Pd/Brønsted acid cooperative catalysis 116
 perfluorophenyl 2-arylacetate 258
 phase-transfer catalysis (PTC) 19
 transition metal co-catalyzed reactions 19–20, 21
 phosphate/photoredox combined catalysis 290–295
 phosphine catalyst 243, 244
 phosphines 241–243, 261
 phosphoramides 91, 126
 phosphoramidite ligand 59, 252
 phosphoric acid-metal cooperative catalysis 301–305
 phosphoric acids 33, 91, 109, 113, 115, 126, 143, 160, 167, 172, 290, 294
 photoirradiation 277
 photoredox catalyst 277–297, 310, 311
 photoredox combined catalysis 279–284, 288–297
 photoredox-mediated SOMO catalysis 284–288
 picolinaldehydes 93, 246, 248
 Pictet–Spengler reaction 142
 Pictet–Spengler-type cyclization reaction 144, 148
 pinacodiborate 156
 pinacol rearrangement 117, 138, 139, 294
 Pinnick oxidation 309
 (–)-Pironetin 312–314
 polycyclic indole derivatives 139, 140
 potassium 2-oxo-3-enoates 211, 212, 227
 Povarov reaction 132, 136
 2-(2-Propynyl)anilines 132, 133
 N-protecting group 302
 protodemettallation 254
 protodepalladation step 117
 β -protonation 211, 215, 248, 251
 (–)-Psychotriazine 312
 proton-coupled electron transfer (PCET) pathway 290, 293, 297
 pyrazol-5-ones 100, 102–104
 pyrroloindoline intermediate 311
 pyrroloindolines 292, 293, 311
- q**
- quinolines 109, 136, 154, 292
 quinoxalines 15, 109, 152–154
- r**
- Rauhut–Currier type addition 5
 Redox annulation 139
 redox-active esters (RAEs) 292, 294, 295
 relay catalysis 11
 catalytic asymmetric cross dehydrogenative coupling 64–68
 Gold/chiral Brønsted acid 13–14
 olefins transformation 68–70
 relay catalytic hydroformylation and Mannich reaction 69–70
 hydroformylation/ α -alkylation 69–70
 relay catalytic systems 16
 Rh(II)/chiral Brønsted acid relay catalysis 162–163
 Rh(II)/chiral phosphine combined catalysis 243, 244
 Rh-catalyzed hydroformylation of styrenes 158
 ring closing metathesis (RCM) reaction 142, 143, 145, 309
 ring-opening oxidative addition 77

Ru(bpy)₃(PF₆)₂ 283
 Ru/enamine cooperative catalysis 62, 63
 RuClH(CO)(PPh₃)₃ 144
 ruthenium catalyzed DKR 268
 ruthenium-allenylidene complex 62, 63

S

Saegusa-type oxidation 68, 83
 self-quenching 6, 182, 184, 186, 192, 199, 235, 241, 271
 semipinacol rearrangement 117, 294
 sequenital catalysis 6, 11
 gold/chiral Brønsted acid 13–14
 Si-substituted allyl methylsulfonates 261
 silver/enamine cooperative catalysis 61
 β-silylation of enals 85
 single electron transfer (SET) reaction 170, 277, 279, 280, 285, 287, 296
 S_N1 or S_N2 reaction 50–51, 52
 sodium-assisted asymmetric
 Baylis–Hillman reactions 184–185
 sp³-chemical bonds 64
 P-spiro aminophosphonium 296
 spirobenzazepinones 256
 spirocyclic oxindoles 81, 82
 spiro phosphoric acids (SPAs) 113
 spiro-ketones 117
 spiro-γ-lactam 281
 spirooxindoles 243, 256
 Stephadiamine 100, 304, 305
 (+)-Stephadiamine 304
 stereochemical control 1, 3, 7–9, 15, 21, 25, 28, 42, 61, 94, 95, 98, 99, 100, 262, 266, 267, 301
 stereodivergent Ir/amine catalytic 308
 stereodivergent synthesis 42, 43
 2-substituted allyl methylsulfonates 260
 11-substituted-10,11-dihydronaphthalene [b,f][1,4]oxazepine 95
 N-sulfonyl aldimines 296
 N-sulfonylation step 192
 N-sulfonyliminium cyclization 131
 Suzuki–Miyaura coupling 318

t

tandem catalysis 6
 tandem Michael addition 285
 terminal oxidant 2
 tertiary alcohols 231, 234
 tetrabutylammonium decatungstate (TBADT) 281
 Δ⁹-tetrahydrocannabinols 44, 309
 tetrahydrocarbazoles 130, 131
 tetrahydro-β-carbolines (THBCs) 141, 142, 144
 tetrahydroisoquinoline 95, 115, 144, 267, 283, 288, 289, 296
 tetrahydropyran 141, 158, 319
 tetrahydropyrano[3,4-*b*]indoles (THPI) 141
 tetrahydropyanones 158
 tetrahydroquinolines 13, 65, 66, 109, 127–129, 169
 tetrahydroquinoxaline 152
 2,2,6,6-tetramethylpiperidine-1-oxyl radical (TEMPO) 63, 285, 292, 293, 311
 thiourea 95, 97, 104, 105, 163, 164, 207, 210, 211, 243, 296
 thiourea ternary catalysis 207, 210
 (R)-tol-BINAP 250, 251
 N-tosyl imine 190
 N-tosyl imino ester 190
 transition metal catalysts 19, 104, 119, 120, 160, 162, 163, 271, 301
 transition metal cooperative catalysis 91–120, 241–271
 transition metal-catalyzed reactions initiated
 with oxidative addition 2
 tributyl phosphine 241
 trichloromethylacetaldehyde 196
 tricyclohexylphosphine 146
 α-trifluoromethylation 55, 57
 trifluoromethyl ketones 218, 219
 O-trimethylsilyl quinidine (TMSQD) 188, 190, 196, 223, 225, 312

- O*-trimethylsilyl quinine (TMSQ) 187, 196, 223, 226, 313
 trimethylsilyloxyfuran 15, 305
 trimethylsilylquinidine 188, 196
 triphenyl phosphite 3, 22–25
 Trost–Tsuji reaction 242
 tryptamine 14, 144, 146, 292, 311, 312
 (*S*)-Tumerone 307
- U**
 unsaturated aldehydes 45, 46, 55, 62, 75, 76, 83, 198, 203, 207, 219, 225, 227, 285
 γ,Δ -unsaturated aldehyde 307–309
 α,β -unsaturated carbonyls 76, 281
 unsaturated ketoesters 206
- V**
 vinyl benzoxazinanones 249, 252
 vinyl cyclopropanes 77, 80, 81
 vinylcyclopropane azlactones 77
- W**
 vinylethylene carbonates 106, 243
 4-vinyl-2-morphan 60
 4-vinyl-2-oxamorphan 60
 visible light photocatalysis 10
- X**
 Xantphos ligand 261
- Y**
 ylide intermediate 111
 ynal–metal π -complexation 60
- Z**
 ZnCl_2 /chiral spirophosphoric acid relay catalytic 169, 170
 zwitterionic intermediates 86, 110, 111, 278

