

Context, Background, and Discovery	p. 1
Chapter Overview	p. 1
Our Chemical World	p. 1
A Brief History of Catalysis	p. 2
Transition Metal Activation of Small Molecules	p. 3
Transition Metals: the Downside	p. 5
Main Group Elements	p. 5
Lewis Acids and Bases	p. 6
Contravening Lewis' Rules	p. 7
Metal-free Activation of Dihydrogen	p. 10
Simple Phosphine-borane Combinations for the Activation of Dihydrogen	p. 13
Intramolecular Phosphine-borane Species	p. 14
Reactions of 'Frustrated Lewis Pairs (FLPs)' with Olefins	p. 16
The End of the Beginning	p. 17
References	p. 18
The Nature of Frustrated Lewis Pairs	p. 20
Chapter Overview	p. 20
Initial Thoughts on the Mechanism	p. 20
Computational Studies	p. 21
Pertinent Precedent	p. 23
Experimental Evidence for Encounter Complexes	p. 25
Radical Pathway?	p. 26
Intermolecular FLPs: variations of the Lewis Base	p. 27
Intermolecular FLPs: variations of the Lewis Acid	p. 34
Intramolecular FLPs	p. 36
FLPs Without Frustration	p. 41
Implications	p. 43
References	p. 43
Borane-based FLP Hydrogenations	p. 47
Chapter Overview	p. 47
Literature Precedents for Metal-free Hydrogenations	p. 47
FLP-hydrogenation Catalysis: the Early Findings	p. 48
Borane Variation and Mechanism in Imine Reduction	p. 54
Functional Group Tolerance in Imine Reduction	p. 56
More FLP Imine Hydrogenations	p. 58
Borane-mediated Hydrogenations of N-based Heterocycles	p. 60
Intramolecular Catalyst Variations	p. 62
Hydrogenation of Olefins	p. 64
FLP Hydrogenation of Alkynes	p. 70
Aromatic Reductions	p. 71

FLP Reductions of Carbonyl Groups	p. 73
Implications	p. 76
References	p. 76
Borane-based Asymmetric FLP Hydrogenations	p. 80
Chapter Overview	p. 80
Diastereoselective Reactions	p. 80
Considerations for Enantioselective Catalysts	p. 83
Chiral Boranes and Enantioselective Reduction	p. 84
Chiral Intramolecular FLPs	p. 86
Bis-borane Catalysts	p. 88
Chiral Intermolecular FLPs	p. 92
Implications	p. 93
References	p. 94
Structural Variations of FLPs	p. 95
Chapter Overview	p. 95
Boron Cations	p. 95
Nucleophilic Boron	p. 100
Alanes, Galanes and Indanes	p. 101
Aluminium Cations	p. 103
Carbocations	p. 104
Carbon Lewis Bases	p. 106
Silicon-based Lewis Acids	p. 107
Silylene Donors	p. 108
Tin-based Lewis Acids	p. 109
Phosphorus-based Lewis Acids	p. 110
Early Transition Metal Acids	p. 112
Late Transition Metal Acids	p. 115
Transition Metal Bases	p. 118
Bimetallic Systems	p. 120
Alkali Metal Species	p. 121
Alkaline Earth Acids	p. 124
Rare Earth Acids	p. 126
Implications	p. 126
References	p. 126
Other Directions for FLP Hydrogenations	p. 129
Chapter Overview	p. 129
Radicals in FLP Reactions with Dihydrogen	p. 129
Transfer Hydrogenations	p. 131
Asymmetric Transfer Hydrogenations	p. 135
Dehydrogenations	p. 136

CO Reduction	p. 139
CO ₂ Reduction	p. 143
Oxidation of Dihydrogen	p. 147
Main Group FLP Hydrogenation	p. 148
N ₂ Reduction?	p. 149
Enzyme Models	p. 152
Solid-state FLPs	p. 153
Supported FLPs	p. 153
Zeolite and MOF Derived FLPs	p. 155
Heterogeneous Gold Catalysts	p. 156
Metal-oxide FLP Catalysts	p. 157
Other Solid-supported FLPs	p. 158
Final Thoughts	p. 159
References	p. 159
Subject Index	p. 164

Table of Contents provided by Blackwell's Book Services and R.R. Bowker. Used with permission.