

## Contents

### Acknowledgments *vii*

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Marcus Theory of Electron Transfer</b>	<b>5</b>
<b>3</b>	<b>Photosynthetic Reaction Center Models</b>	<b>7</b>
<b>4</b>	<b>Electron Donor–Acceptor Dyads</b>	<b>11</b>
<b>5</b>	<b>Supramolecular Electron Transfer</b>	<b>25</b>
5.1	Cation–Anion Binding	25
5.2	$\pi$ -Complexes	35
5.3	Electron-Transfer Switching	46
5.4	Dendrimers	53
5.5	Supramolecular Solar Cells	55
<b>6</b>	<b>Effects of Metal Ions on Photoinduced Electron Transfer</b>	<b>65</b>
<b>7</b>	<b>Photoredox Catalysis</b>	<b>69</b>
7.1	Photocatalytic Oxygenation	69
7.2	Photocatalytic Oxibromination	77
7.3	Carbon–Carbon Bond Formation	77
7.4	DNA Cleavage	81
7.5	Anti-Markovnikov Hydroetherification	81
7.6	Photocatalytic Cycloaddition	83
7.7	Photocatalytic Hydrotrifluoromethylation	85
7.8	Photocatalytic Hydrogen Evolution	86
<b>8</b>	<b>Hydrogen Storage</b>	<b>93</b>
8.1	Interconversion Between Hydrogen and Formic Acid	95
8.2	Interconversion Between Hydrogen and NADH	101

8.3	Hydrogen Evolution from Alcohols	104
8.4	Hydrogen Evolution from Paraformaldehyde	107
<b>9</b>	<b>Metal Ion-Coupled Electron Transfer (MCET)</b>	<b>109</b>
9.1	MCET of O <sub>2</sub>	109
9.2	Binding Modes of Metal Ions	114
9.3	Self-Organized MCET	124
9.4	Accelerating and Decelerating Effects of Metal Ions	132
9.5	Driving Force Dependence of MCET Rate Constants	137
9.6	MCET Coupled with Hydrogen Bonding	143
9.7	MCET Catalysis	148
9.7.1	Hydride Transfer vs. Cycloaddition	148
9.7.2	Superoxide Dismutase (SOD) Models	152
9.8	MCET of Metal-Oxo Complexes	157
9.9	PCET of Metal-Oxo Complexes	162
9.10	Unified Mechanism of MCET and PCET of Metal-Oxo Complexes	165
9.11	MCET of Metal-Peroxo Complexes	169
<b>10</b>	<b>Catalytic Reduction of O<sub>2</sub></b>	<b>173</b>
<b>11</b>	<b>Catalytic Oxidation of H<sub>2</sub>O</b>	<b>181</b>
<b>12</b>	<b>Production of Hydrogen Peroxide from Water and Oxygen as a Solar Fuel</b>	<b>187</b>
<b>13</b>	<b>Production and Usage of Hydrogen Peroxide as a Solar Fuel in Seawater</b>	<b>193</b>
<b>14</b>	<b>Photosystem II Mimic</b>	<b>197</b>
<b>15</b>	<b>Conclusion and Perspective</b>	<b>201</b>
	<b>References</b>	<b>203</b>
	<b>Index</b>	<b>225</b>