CONTENTS

List of Figures viii
List of Text Boxes x
Preface and Acknowledgments xi
A Short Time Line of Big History xx

Chapter One  Introduction to Big History 1
   Introduction 1
   Studying the Past 2
   A Very Short History of Academic History 12
   A Short History of Big History 18
   A Historical Theory of Everything? 29

Chapter Two  General Approach 42
   Introduction 42
   Matter and Energy 45
   Complexity 48
   Energy Flows and the Emergence of Complexity 54
   The Goldilocks Principle 63

Chapter Three  Cosmic Evolution: The Emergence of Simple Forms of Complexity 74
   Introduction 74
   The Big Bang: No Complexity 75
   Recent Issues Concerning the Big Bang Scenario 77
   The Radiation Era: The Emergence of Complexity at the Smallest Scales 80
   The Matter Era: The Emergence of Complexity at Atomic and Molecular Scales 86
   Galaxy Formation: The Emergence of Complexity at Larger Scales 89
   The Emergence of Stars 95
   Stars as Nuclear Forges 100
Chapter Four  Our Cosmic Neighborhood: The Emergence of Greater Complexity 107
   Introduction 107
   The Galactic Habitable Zone 110
   The Emergence of Our Cosmic Neighborhood 111
   The Solar System Habitable Zone 116
   Major Characteristics of Earth 118
   Early Inner Planetary History 122
   Early Earth History 125
   Life Is Very Special 126
   The Emergence of Life 130

Chapter Five  Life on Earth: The Widening Range of Complexity 140
   Life, Energy and Complexity 140
   Planetary Energy Flows and Life 147
   The Gaia Hypothesis 149
   The Emergence of Energy Harvesting from Outside 153
   The Emergence of the Biological Food Web 156
   The Emergence of Multicellular Organisms 160
   The Emergence of Brains and Consciousness 162
   The Increase and Expansion of Biological Complexity 166
   Conquest of the Land 168
   Further Increasing Complexity 170

Chapter Six  Early Human History: The Emergence of the Greatest Known Complexity 179
   Introduction 179
   What Makes Humans Different 180
   Energy and Complexity 183
   The Emergence of Early Humans 185
   Improving Social Coordination 188
   Tool Making and Brain Growth 189
   Brains and Intestines 193
   Fire Control 194
   Migration 197
   The Rise of Modern Humans 200
   Early Religion 205

Chapter Seven  Recent Human History: The Development of the Greatest Known Complexity 214
   Introduction 214
   The Agrarian Revolution 220