

# CONTENTS

<i>List of Illustrations</i>	ix
<i>List of Tables</i>	xiii
<i>Foreword</i>	xv
<i>Acknowledgments</i>	xix
Introduction: A Modern Creation Myth?	1
PART I. THE INANIMATE UNIVERSE	
1. The First 300,000 Years: Origins of the Universe, Time, and Space	17
2. Origins of the Galaxies and Stars: The Beginnings of Complexity	39
3. Origins and History of the Earth	57
PART II. LIFE ON EARTH	
4. The Origins of Life and the Theory of Evolution	79
5. The Evolution of Life and the Biosphere	107
PART III. EARLY HUMAN HISTORY: MANY WORLDS	
6. The Evolution of Humans	139
7. The Beginnings of Human History	171
PART IV. THE HOLOCENE: FEW WORLDS	
8. Intensification and the Origins of Agriculture	207

9.	From Power over Nature to Power over People: Cities, States, and "Civilizations"	245
10.	Long Trends in the Era of Agrarian "Civilizations"	283
PART V. THE MODERN ERA: ONE WORLD		
11.	Approaching Modernity	335
12.	Globalization, Commercialization, and Innovation	364
13.	Birth of the Modern World	406
14.	The Great Acceleration of the Twentieth Century	440
PART VI. PERSPECTIVES ON THE FUTURE		
15.	Futures	467
	<i>Appendix 1. Dating Techniques, Chronologies, and Timelines</i>	493
	<i>Appendix 2. Chaos and Order</i>	505
	<i>Notes</i>	513
	<i>Bibliography</i>	563
	<i>Index</i>	595

# ILLUSTRATIONS

## TIMELINES

1.1. The scale of the cosmos: 13 billion years	16
3.1. The scale of the earth, the biosphere, and "Gaia": 4.5 billion years	58
5.1. The scale of multicellular organisms: 600 million years	106
5.2. The scale of mammalian radiations: 70 million years	126
6.1. The scale of human evolution: 7 million years	138
7.1. The scale of human history: 200,000 years	170
8.1. The history of agrarian societies and urban civilizations: 5,000 years	206
11.1.1. The scale of modernity: 1,000 years	334

## MAPS

3.1. The changing earth: tectonic movements over 540 million years	74
7.1. Extent of glaciation during the ice ages	192
7.2. Migrations of <i>Homo sapiens</i> from 100,000 BP	193
8.1. World zones of the Holocene era	213
8.2. The Afro-Eurasian world zone	214
8.3. Ancient Mesopotamia	237
9.1. Ancient Sumer	246

9.2. Ancient Mesoamerica	247
10.1. The American world zone before Columbus	314

FIGURES

1.1. Parallax: measuring the distance of stars using elementary trigonometry	29
2.1. The position of the Sun within the Milky Way	40
3.1. The structure of the earth's interior	66
5.1. Prokaryotic and eukaryotic cells compared	115
5.2. Temperature fluctuations at different timescales	132
5.3. Basic rhythm of population growth	134
6.1. Populations of <i>Homo sapiens</i> , 100,000 BP (before present) to now	142
6.2. A reconstruction of Lucy, an australopithecine	157
6.3. The evolution of stone tools over 2.5 million years	161
7.1. Neanderthal and human skulls	176
7.2. Behavioral innovations of the Middle Stone Age in Africa	181
7.3. Extinct (and dwarfed) Australian megafauna	200
8.1. Three eras of human history compared	208
8.2. Human populations, 10,000 BP to now	209
8.3. Intensification in Australia: eel traps	226
8.4. Intensification in Australia: stone houses	227
8.5. Early agricultural villages from Ukraine	240
9.1. Scales of social organization	250
9.2. Agriculture and population growth: a positive feedback loop	253
9.3. Productivity thresholds in human history: population densities under different lifeways	268
9.4. Early monumental architecture: the "White Temple" at Uruk	270
9.5. The evolution of cuneiform writing in Mesopotamia	277
10.1. Models of different types of exchange networks	292
10.2. Hammurabi's law code	296
10.3. Teotihuacán	303
10.4. Malthusian cycles in China, India, and Europe, 400 BCE–1900 CE	310

10.5. A negative feedback cycle: population, agriculture, and the environment	311
10.6. Population and technological change: Malthusian cycles and irrigation technologies in lowland Mesopotamia	313
11.1. Human populations, 1000 CE to now	343
11.2. An eighteenth-century pin factory	356
12.1. Commercial activity in China under the Song dynasty	377
12.2. Boatbuilding in China and Europe in the fifteenth century	379
12.3. Aztec victims of smallpox in the sixteenth century	383
13.1. Global industrial potential, 1750–1980	409
13.2. Evolution of the steam engine in eighteenth-century Britain	422
13.3. The “rise of the West”	436
15.1. Earthrise as seen from the Moon	468
15.2. A modern “Malthusian cycle,” 1750–2100?	477
15.3. A possible design for a space colony	485

## TABLES

1.1. A chronology of the early universe	27
4.1. Some estimated free energy rate densities	81
5.1. The five-kingdom scheme of classification	122
6.1. Human per capita energy consumption in historical perspective	141
6.2. World populations and growth rates, 100,000 BP to now	143
6.3. Growth rates in different historical eras	144
8.1. A periodization of human history	210
8.2. First recorded evidence of domesticates	219
9.1. Scales of social organization	249
9.2. Energy input and population density over time	254
9.3. Typology of major technologies and lifeways	279
10.1. Chronology of early agrarian civilizations	294
10.2. Areas of Afro-Eurasia within agrarian civilizations	305
10.3. Transportation revolutions in human history	307
10.4. Information revolutions in human history	308
10.5. Areas ruled by particular states and empires	317
10.6. Long-term trends in urbanization in Afro-Eurasia	326
11.1. World populations by region, 400 BCE–2000 CE	344
13.1. Total industrial potential, 1750–1980	407

13.2. Total industrial potential, 1750–1980, as a percentage of global total	408
13.3. Estimates of economic growth rates in Britain, 1700–1831	412
13.4. Output of principal agricultural commodities in Britain, 1700–1850	417
13.5. Value added in British industry, 1770–1831	425
14.1. World populations, 1900–2000	443
14.2. Economic entities ranked by market value, January 2000	445
14.3. Gross national income per capita, 2000	450
14.4. Life expectancies at birth, 2000	450
14.5. Some global demographic and economic indicators, 1994	452
14.6. War-related deaths, 1500–1999	458
14.7. Human-induced environmental change, 10,000 BCE to the mid-1980s CE	462
15.1. A chronology of the cosmic future in an open universe	490
A1. The geological timescale	504