

CONTENTS

<i>List of Illustrations</i>	page xv
<i>Notes on Contributors</i>	xvii
<i>General Editors' Preface</i>	xxv

I Introduction	I
PETER J. BOWLER AND JOHN V. PICKSTONE	

PART I. WORKERS AND PLACES

2 Amateurs and Professionals	15
DAVID E. ALLEN	
The Preprofessional Era	15
Categorizing the Amateurs	18
The Culture of Collecting	21
Academicization	23
Attempted Adaptations	27
Internal Salvation	30
Convergence	32
3 Discovery and Exploration	34
ROY MACLEOD	
Linking Universes	36
Science and the Expansion of Europe	39
Universal Knowledge: Humboldt's Cosmos	43
Science and National Glory	45
Science and Internationalism	52
Looking Ahead	57

4	Museums	60
	MARY P. WINSOR	
	Museums to 1792	61
	The Paris Model, 1793–1809	62
	Impact of the Paris Model, 1810–1859	64
	The Museum Movement, 1860–1901	67
	Dioramas and Diversity, 1902–1990	73
5	Field Stations and Surveys	76
	KEITH R. BENSON	
	Surveys in Nature	78
	Field Stations	84
6	Universities	90
	JONATHAN HARWOOD	
	A Map of the Changing Terrain	91
	The Power of Patrons	95
	The Consequences of Institutional Location	102
	Conclusion	106
7	Geological Industries	108
	PAUL LUCIER	
	Mining Schools	109
	Government Surveys	111
	Private Surveys	118
	Industrial Science	120
	Geology and Industry	123
8	The Pharmaceutical Industries	126
	JOHN P. SWANN	
	Influence from Alkaloids and the Dyestuff Industry	127
	Impact of Biological Medicines	130
	Political and Legal Elements	131
	Industry versus Professional Pharmacy	132
	War as a Catalyst to Industrial Development	133
	Industrial Growth and the Role of Research	136
	Regulating the Industry	137
	Consolidating the Industry	139
9	Public and Environmental Health	141
	MICHAEL WORBOYS	
	1800–1890: The Health of Towns	142
	1890–1950: The Health of Nations	150
	1950–2000: World Health	157
	Conclusion	162

PART II. ANALYSIS AND EXPERIMENTATION

10	Geology	167
	MOTT T. GREENE	
	Stratigraphy: The Basic Activity of Geology	171
	Mountains and Movement	174
	Ice Ages and Secular Cooling of the Earth	178
	Age and Internal Structure of the Earth	179
	Economic Geology	181
	Geology in the Twentieth Century	182
11	Paleontology	185
	RONALD RAINGER	
	Cuvier, Extinction, and Stratigraphy	186
	Paleontology and Progress	188
	Paleontology and Evolution	190
	Paleontology and Modern Darwinism	197
	Paleontology and Biogeography	200
	Museums and Paleontology	201
12	Zoology	205
	MARIO A. DI GREGORIO	
	The Natural System and Natural Theology	206
	The Philosophical Naturalists	208
	The Triumph of Typology	211
	From Darwin to Evolutionary Typology	214
	Tensions within Evolutionism	218
	Into the Twentieth Century	221
13	Botany	225
	EUGENE CITTADINO	
	Beyond Linnaeus: Systematics and Plant Geography	227
	Botanical Gardens	231
	The "New Botany"	233
	Linking Field and Laboratory, Theory and Practice	237
14	Evolution	243
	JONATHAN HODGE	
	The Influence of Buffon and Linnaeus	244
	Lamarck: The Direct and Indirect Production by Nature of All Living Bodies	246
	After Cuvier, Oken, and Lamarck	249
	Darwin: The Tree of Life and Natural Selection	252
	After Darwin	256
	Evolutionary Biology since Mendelism	259
	Conclusion: Controversies and Contexts	263

15	Anatomy, Histology, and Cytology	265
	SUSAN C. LAWRENCE	
	Anatomy: Humans and Animals	267
	Human Anatomy	268
	Comparative Anatomy	270
	Tissues and Cells	274
	The Cell Theory	275
	Histology	279
	Ultrastructure	282
	Conclusion	284
16	Embryology	285
	NICK HOPWOOD	
	Making Embryology	287
	Histories of Development	291
	Embryos as Ancestors	294
	Experiment and Description	298
	Organizers, Gradients, and Fields	304
	Embryos, Cells, Genes, and Molecules	308
	Embryology and Reproduction	312
17	Microbiology	316
	OLGA AMSTERDAMSKA	
	Speciation, Classification, and the Infusoria	317
	Wine, Life, and Politics: Pasteur's Studies of Fermentation	320
	The Bacteriological Revolution	323
	Institutionalization of Bacteriology	328
	Between Protozoology and Tropical Diseases	331
	Bacteriology between Botany, Chemistry, and Agriculture	333
	Microbiology between the Brewing Industry and (Bio)chemistry	335
	Genetics of Microorganisms and Molecular Biology	337
	Conclusions	340
18	Physiology	342
	RICHARD L. KREMER	
	Foundational Narratives	342
	Newer Narratives	351
	The Disappearance of Physiology?	358
19	Pathology	367
	RUSSELL C. MAULITZ	
	Pathology's Prehistory	369
	First Transition: Tissue Pathology	371
	Second Transition: Cellular Pathology	374
	Third Transition: Clinical Pathology	375
	Popular Forensic Pathology	378

Recent Translational Medicine	379
Conclusion	380

PART III. NEW OBJECTS AND IDEAS

20	Plate Tectonics	385
	HENRY FRANKEL	
	The Classical Stage of the Mobilist Controversy: From Alfred Wegener to the End of the Second World War	386
	The Modern Controversy over Continental Drift	391
21	Geophysics and Geochemistry	395
	DAVID OLDROYD	
	The Size, Shape, and Weight of the Earth: Gravimetry and Associated Theories	397
	Seismology	402
	Geomagnetism	405
	Geological Synthesis from Results of Geophysical Investigations	408
	Chemical Analyses of Rocks and Minerals	409
	Geochemistry	410
	Physico-chemical Petrology	412
	Geochemical Cycles	413
22	Mathematical Models	416
	JEFFREY C. SCHANK AND CHARLES TWARDY	
	Physiology and Psychology	419
	Evolution and Ecology	421
	Development and Form	425
	Mathematical Statistics	427
	Integrative Modeling: An Example from the Neurosciences	428
	Computers and Mathematical Modeling	429
	Conclusions	430
23	Genes	432
	RICHARD M. BURIAN AND DORIS T. ZALLEN	
	Before Mendel	432
	From Mendel to the Turn of the Century	433
	The Development of Genetics and the Gene Concept up to World War II	435
	Postwar Novelties: The Material of the Gene and Gene Action	440
	The Gene in the Light of Recent Historiography	444
	Conclusion	450
24	Ecosystems	451
	PASCAL ACOT	
	The Study of Plant Communities	453
	The Concept of "Biocoenosis"	454

	The Integration of Physical Factors	456
	The First Qualitative Outline of an Ecological System	456
	From Plant Successions to Organicism in Ecology	457
	Thirty Years of Controversies	459
	Population Dynamics	461
	The Trophic-Dynamic Aspect of Ecosystems	462
	Odum's Fundamentals of Ecology	463
	From Ecosystems to Global Ecology	464
25	Immunology	467
	THOMAS SÖDERQVIST, CRAIG STILLWELL, AND MARK JACKSON	
	Immunology	467
	Immunity as a Scientific Object	468
	The Emergence of Immunology	471
	The Consolidation of Immunology	474
	Immunity as an Object for Historical Inquiry	478
26	Cancer	486
	JEAN-PAUL GAUDILLIÈRE	
	The Clinical Cancer: Tumors, Cells, and Diagnosis	487
	The First Technological Disease: Cancer and Radiotherapy	489
	Cancer as Social Disease: Voluntary Health Organizations and Big Biomedicine	491
	Cancer as a Biological Problem	494
	Routine Experimentation: Chemotherapy and Clinical Trials	498
	Cancer Numbers: Risk and the Biomedicalization of Everyday Life	499
	Conclusion: The Cancer Cell after a Century?	502
27	The Brain and the Behavioral Sciences	504
	ANNE HARRINGTON	
	Ghosts and Machines: Descartes, Kant, and Beyond	505
	The Piano that Plays Itself: From Gall to Helmholtz	507
	Imagining Building Blocks: From Language to Reflex	510
	Electricity, Energy, and the Nervous System from Galvani to Sherrington	513
	Haunted by Our Past: The Brain in Evolutionary Time	516
	The Subject Strikes Back: Hysteria and Holism	519
	Technological Imperatives and the Making of "Neuroscience"	521
28	History of Biotechnology	524
	ROBERT BUD	
	The Early History	528
	From Zymotechnics to Biotechnics	530
	Biochemical Engineering	533
	Molecular Biology	535

PART IV. SCIENCE AND CULTURE

29	Religion and Science	541
	JAMES MOORE	
	A Victorian Rubric	542
	Freethought	545
	Natural Theology	547
	Earth History	550
	Darwin	553
	The Conflict	556
	Beyond "Religion and Science"	559
30	Biology and Human Nature	563
	PETER J. BOWLER	
	Mind and Brain	565
	Evolution, Psychology, and the Social Sciences	568
	Human Origins and Social Values	573
	Biology and Gender	576
	Heredity and Genetic Determinism	579
31	Experimentation and Ethics	583
	SUSAN E. LEDERER	
	Before Claude Bernard	584
	Animals and the Victorians	586
	Science in the Service of the State	592
	The World Medical Association and Research after Nuremberg	595
	Animals and Ethics	598
	Living with the Past History of Human Experimentation	600
32	Environmentalism	602
	STEPHEN BOCKING	
	Environmentalism and Science in the Nineteenth Century	604
	The Emergence of the Administrative State	606
	Entering the Twentieth Century	609
	The Environmental Revolution	613
	The Roles and Authority of Science	617
	Politics and Science	619
33	Popular Science	622
	PETER J. BOWLER	
	The "Dominant View" and Its Critics	622
	Nineteenth-Century Popular Science Writing	624
	The Early Twentieth Century	627
	Later Developments	631
	<i>Index</i>	635