CONTENTS

List of Illustrations  page xvii
Notes on Contributors  xxi
General Editors’ Preface  xxix

1  Introduction  1
ROY PORTER

PART I. SCIENCE AND SOCIETY

2  The Legacy of the “Scientific Revolution”: Science and the Enlightenment  23
PETER HANNES REILL
The Scientific Revolution, Mechanical Natural Philosophy, and the Enlightenment  25
The Mid-Century Skeptical Critique of Mechanical Natural Philosophy  28
Vitalizing Nature: A Late Enlightenment Response to Skepticism  32
Conclusion: Between Enlightenment Vitalism and Romantic Naturphilosophie  41

3  Science, the Universities, and Other Public Spaces: Teaching Science in Europe and the Americas  44
LAURENCE BROCKLISS
Around 1700  44
Science in the University in the Eighteenth Century: Creating Space  52
Science in the University in the Eighteenth Century: The Curriculum  59
The Expansion in Provision  73
Conclusion  79
## Contents

4 Scientific Institutions and the Organization of Science 87  
JAMES MCCLELLAN III  
- The "Organizational Revolution" of the Seventeenth Century 87  
- The Age of Academies 90  
- The Periodical Journal 95  
- Universities and Colleges 96  
- Observatories 98  
- Scientific Institutions and European Expansion 100  
- Botanical Gardens 101  
- Organized Science in Society 103  
- A Nineteenth-Century Postscript 105

5 Science and Government 107  
ROBERT FOX

6 Exploring Natural Knowledge: Science and the Popular 129  
MARY FISSELL AND ROGER COOTER  
- Newtonianism 134  
- Agriculture 139  
- Medicine 146  
- Botany 151  
- Conclusion 156

7 The Image of the Man of Science 159  
STEVEN SHAPIN  
- The Godly Naturalist 162  
- The Moral Philosopher 164  
- The Polite Philosopher of Nature 167  
- Conclusion: The Civic Expert and the Future 178

8 The Philosopher's Beard: Women and Gender in Science 184  
LONDA SCHIEBINGER  
- Institutional Landscapes 184  
- "Learned Venues," "Austere Minervas," and "Homosocial Brotherhoods" 192  
- The Science of Woman 197  
- Gendered Knowledge 201  
- Beyond Europe 207  
- Past and Future 210

9 The Pursuit of the Prosopography of Science 211  
WILLIAM CLARK  
- What Is Prosopography? 212  
- Prosopography in the History of Science 213  
- Students 214  
- Jesuits 218  
- European National and Provincial Communities of Science 220  
- France 222
# Contents

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Britain</td>
<td>225</td>
</tr>
<tr>
<td>The Austro-German Lands</td>
<td>227</td>
</tr>
<tr>
<td>Women</td>
<td>232</td>
</tr>
<tr>
<td>The Scientific Community of the Eighteenth Century</td>
<td>233</td>
</tr>
<tr>
<td>Enlightened Prosopography</td>
<td>235</td>
</tr>
</tbody>
</table>

## PART II. DISCIPLINES

10 **Classifying the Sciences**

   **RICHARD YEO**

   Classification in Practice                                | 241  |
   Maps of Sciences in Encyclopedias                          | 245  |
   Baconian Division of the Sciences                          | 249  |
   Harris's *Lexicon Technicum*                               | 253  |
   Chambers's *Cyclopaedia*                                   | 254  |
   *The Encyclopédie*                                         | 256  |
   The Demise of Maps of Knowledge in Encyclopedias           | 260  |
   Conclusion                                                 | 263  |

11 **Philosophy of Science**

   **ROB ILLIFE**

   Approaches to Natural Philosophy in the Seventeenth Century | 267  |
   The Heritage of Newton                                      | 268  |
   Metaphysics, Theology, and Matter Theory                    | 272  |
   Methodology                                                 | 273  |
   Conclusion                                                  | 275  |

12 **Ideas of Nature: Natural Philosophy**

   **JOHN GASCOIGNE**

   The Establishment of Newtonianism within Britain            | 278  |
   The Diffusion of Newton's Work on the Continent             | 285  |
   Conclusion                                                  | 288  |

13 **Mathematics**

   **CRAIG FRASER**

   The Century of Analysis                                    | 295  |
   Leonhard Euler                                              | 303  |
   Joseph Louis Lagrange                                       | 307  |
   Robert Woodhouse and George Peacock                         | 320  |
   Conclusion                                                  | 325  |

14 **Astronomy and Cosmology**

   **CURTIS WILSON**

   The Astronomy of the Solar System in 1700: Newton's First Efforts to Derive Precise Astronomical Predictions | 329  |
   The Figure of the Earth                                     | 332  |
Contents

The First Analytical Formulation of the Perturbational Problem: Euler 334
Star Positions and Physical Theory: Bradley, d’Alembert, and Euler 338
The Lunar Problem: Clairaut, Euler, d’Alembert, and Mayer 339
The Return of Halley’s Comet in 1759 342
The Transits of Venus of 1761 and 1769 343
Secular and Long-Term Inequalities 344
Cosmology and the Nebular Hypothesis 348
Conclusion: The Laplacian Synthesis in the 1790s and Later 351

15 Mechanics and Experimental Physics 354
R. W. Home
Mechanics 360
Experimental Physics 363
Toward a Quantified Physics 371

16 Chemistry 375
Jan Golinski
Discipline and Enlightenment 377
The Philosophy of Matter 381
Affinities and Composition 384
Gases and Imponderables 388
The Making of a Revolution 392

17 The Life Sciences 397
Shirley A. Roe
The Rise of Newtonian Physiology 400
Animism, Vitalism, and the Rejection of Mechanism 404
Mechanistic Preformation 406
Organisms at the Borders 409
Generation through Newtonian Forces 411
The Resurgence of Preexistence Theories 413
The Rise of Materialism 414
Conclusion 416

18 The Earth Sciences 417
Rhoda Rappaport
Fossils and the Flood 419
Buffon’s Synthesis at Mid-Century 421
New Approaches at Mid-Century 423
The Roles of Fire and Water in Earth Science 426
Fossils, Time, and Change 431

19 The Human Sciences 436
Richard Olson
Notions of “Science” in the Human Sciences 437
Notions of “Human” in the Human Sciences 440
Contents

The Reservoir of Human "Experiments": History and Travel Accounts 442
Legal Localism, Moral Philosophy, and Philosophical History: The Triumph of Environmentalism and the Stadal Theory of Social Change 444
Race and the Place of Humans in the Natural Order: The Background to Physical Anthropology 450
Enriching the State and Its Citizens: Cameralism and Political Economy 451
Quantification in the Human Sciences 456
Sensationalist/Associationist Psychology, Utility, and Political Science 457
General Evaluation of Eighteenth-Century Human Sciences 461

20 The Medical Sciences 463
THOMAS H. BROMAN
The Shape of Medical Education 465
Physiology 468
Pathology 476
Conclusion: The Medical Sciences in the 1790s 481

21 Marginalized Practices 485
PATRICIA FARA
Rhetorics of Enlightenment 486
Animal Magnetism 492
Physiognomy 495
Astrology 497
Alchemy 499
Hutchinsonianism 503
Conclusion 506

PART III. SPECIAL THEMES

22 Eighteenth-Century Scientific Instruments and Their Makers 511
G. L'E. TURNER
The Role of Apparatus in Lectures 521
Instruments in Scientific Research 522
Methods, Materials, and Makers 525
The Instrument Trade in Europe and North America 531
A Scientific Collaboration 534

23 Print and Public Science 536
ADRIAN JOHNS
Cultures of Print at the Onset of Enlightenment 536
Property and Piracy in the Production of Enlightenment 540
**Contents**

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reading and the Redefinition of Reason</td>
<td>550</td>
</tr>
<tr>
<td>24</td>
<td>Authorship, Genius, and the End of Enlightenment</td>
<td>555</td>
</tr>
<tr>
<td></td>
<td><strong>Scientific Illustration in the Eighteenth Century</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>BRIAN J. FORD</strong></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Illustration before the Eighteenth Century:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A Tradition of Obscurantism</td>
<td>563</td>
</tr>
<tr>
<td>25</td>
<td>A Respite of Realism</td>
<td>564</td>
</tr>
<tr>
<td></td>
<td>From Wood to Metal Engraving</td>
<td>568</td>
</tr>
<tr>
<td>24</td>
<td>Early Technical Problems</td>
<td>572</td>
</tr>
<tr>
<td></td>
<td>Acknowledged and Unacknowledged Reuse</td>
<td>572</td>
</tr>
<tr>
<td>24</td>
<td>Zoology: A New Realism</td>
<td>574</td>
</tr>
<tr>
<td></td>
<td>New Studies in Human Anatomy</td>
<td>577</td>
</tr>
<tr>
<td>24</td>
<td>A New View: Microscopy</td>
<td>579</td>
</tr>
<tr>
<td></td>
<td>New Technology for a New Century</td>
<td>582</td>
</tr>
<tr>
<td></td>
<td><strong>Science, Art, and the Representation of the Natural World</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>CHARLOTTE KLOINK</strong></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>The Archive of Nature</td>
<td>585</td>
</tr>
<tr>
<td>25</td>
<td>History Painting and Cosmogonies</td>
<td>587</td>
</tr>
<tr>
<td>25</td>
<td>Nature's Long History and the Emergence of the Sublime</td>
<td>592</td>
</tr>
<tr>
<td>25</td>
<td>Beyond the Immediately Observable: Geological Sections and Diagrams</td>
<td>609</td>
</tr>
<tr>
<td></td>
<td><strong>Science and Voyages of Discovery</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>ROB ILLIFFE</strong></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>The Background to Scientific Voyages</td>
<td>621</td>
</tr>
<tr>
<td>26</td>
<td>The Importance of Venus</td>
<td>622</td>
</tr>
<tr>
<td>26</td>
<td>Imperial Voyaging</td>
<td>624</td>
</tr>
<tr>
<td>26</td>
<td>Terra Australis: Cook's First Two Voyages</td>
<td>626</td>
</tr>
<tr>
<td>26</td>
<td>The Northwest Passage: Cook's Final Voyage</td>
<td>631</td>
</tr>
<tr>
<td>26</td>
<td>Implications of Cook's Voyages: Longitude and Scurvy</td>
<td>634</td>
</tr>
<tr>
<td>26</td>
<td>After Cook</td>
<td>638</td>
</tr>
<tr>
<td>26</td>
<td>Spanish Voyages</td>
<td>641</td>
</tr>
<tr>
<td>26</td>
<td>Conclusion</td>
<td>644</td>
</tr>
</tbody>
</table>

**PART IV. NON-WESTERN TRADITIONS**

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td><strong>Islam</strong></td>
<td>649</td>
</tr>
<tr>
<td></td>
<td><strong>EMILIE SAVAGE-SMITH</strong></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Military Technology and Cartography</td>
<td>653</td>
</tr>
<tr>
<td>27</td>
<td>Mechanical Clocks and Watches</td>
<td>655</td>
</tr>
<tr>
<td>27</td>
<td>The Printing Press</td>
<td>656</td>
</tr>
<tr>
<td>27</td>
<td>Astronomy</td>
<td>659</td>
</tr>
<tr>
<td>27</td>
<td>Medicine</td>
<td>661</td>
</tr>
<tr>
<td>27</td>
<td>European Interest in the Middle East</td>
<td>665</td>
</tr>
<tr>
<td>27</td>
<td>The Intermingling of Traditions</td>
<td>666</td>
</tr>
</tbody>
</table>
Contents

28 India

DEEPAK KUMAR

The Three Shades of Opinion 669
Astronomy 671
A Lone Light 674
Maqul in Education 675
Medicine: Its Texts and Practices 678
Tools and Technologies 680
Reflections 683

29 China

FRANK DIKOTTER

Jesuit Science 688
Evidential Scholarship 691
Medicine 695

30 Japan

SHIGERU NAKAYAMA

Science as an Occupation 699
The Ban on Western Scientific Knowledge 700
Translations of Western Works 702
The Independent Tradition of Mathematics 703
Mathematics as an Occupation 705
Publication in Mathematics 705
Astronomy within the Traditional Framework 706
Astronomy as an Occupation 708
Publication in Astronomy 709
Introduction of Copernicanism and Newtonianism 709
Physicians as Intellectual Connoisseurs 710
From the Energetic to the Solidist View of the Human Body 711
The Medical Profession as an Occupation 713
Materia Medica 715
Conclusion 716

31 Spanish America: From Baroque to Modern Colonial Science

JORGE CANIZARES ESQUIERRO

Early Institutions 718
Patriotic, Neoplatonic, and Emblematic Dimensions 719
In Service to Crown and Commerce 722
Travelers and Cultural Change 730
A Unifying Theme 733

PART V. RAMIFICATIONS AND IMPACTS

32 Science and Religion

JOHN HEDLEY BROOKE

The Diversity of Natural Religion 741
# Table of Contents

## Relating the Sciences to Religion
- 744

## Science and Secularization
- 749

## Providence and the Utility of Science
- 753

## Religion and the Limitations of Reason
- 755

## The Legacy of Enlightenment Critiques
- 758

### 33 Science, Culture, and the Imagination:

#### Enlightenment Configurations
- 762

**GEORGE S. ROUSSEAU**

- A Century of Change
- 762
- Doctrines of Optimism
- 764
- Parallel Mental Universes
- 771
- Optimism and Doubt
- 774
- Forms of Representation
- 777
- Science and Reverie
- 782
- Progresses to Perfection
- 785
- The Imaginations of Consumers
- 790

### 34 Science, Philosophy, and the Mind

**PAUL WOOD**

- Seventeenth-Century Exemplars
- 802
- Newtonian Legacies
- 809
- Quantification
- 814
- Anatomizing the Mind
- 817
- The Natural History of Human Nature
- 819
- Conclusion
- 824

### 35 Global Pillage: Science, Commerce, and Empire

**LARRY STEWART**

- The Progress of Trade and Learning
- 825
- Merchants and Imperial Science
- 828
- The Botanic Empire
- 833
- The Transport of Nature
- 838
- Instruments of Empire
- 841
- Conclusion
- 843

### 36 Technological and Industrial Change:

#### A Comparative Essay
- 845

**IAN INKSTER**

- Europe: The Strength of Weak Ties
- 846
- The Case of Britain
- 853
- European Limit: Russia and Technological Progress
- 858
- Beyond Europe, I: Japan
- 866
- Beyond Europe, II: India and China
- 871
- Conclusions
- 878

## Index
- 883