A HISTORY OF
THE WARFARE OF SCIENCE
WITH THEOLOGY
IN CHRISTENDOM

BY
ANDREW DICKSON WHITE
L.L.D. (Yale and St. Andrews), L.H.D. (Columbia), Ph.Dr. (Jena), D.C.L. (Oxon.)
Late President and Professor of History at Cornell University; Vice-
President of the American Historical Society; Honorary Member
of the Royal Academy of Sciences at Berlin; and an Officer
of the Legion of Honor of the French Republic

IN TWO VOLUMES
VOL. I

NEW YORK AND LONDON
D. APPLETON AND COMPANY
1917

URIS LIBRARY
To the Memory of

EZRA CORNELL

I DEDICATE THIS BOOK.
Thoughts that great hearts once broke for, we
Breathe cheaply in the common air.—LOWELL.
Discipulus est prioris posterior dies.—PUBLIUS SYRUS.
Truth is the daughter of Time.—BACON.
The Truth shall make you free.—ST. JOHN, viii, 32.
INTRODUCTION.

My book is ready for the printer, and as I begin this preface my eye lights upon the crowd of Russian peasants at work on the Neva under my windows. With pick and shovel they are letting the rays of the April sun into the great ice barrier which binds together the modern quays and the old granite fortress where lie the bones of the Romanoff Czars.

This barrier is already weakened; it is widely decayed, in many places thin, and everywhere treacherous; but it is, as a whole, so broad, so crystallized about old boulders, so imbedded in shallows, so wedged into crannies on either shore, that it is a great danger. The waters from thousands of swollen streamlets above are pressing behind it; wreckage and refuse are piling up against it; every one knows that it must yield. But there is danger that it may resist the pressure too long and break suddenly, wrenching even the granite quays from their foundations, bringing desolation to a vast population, and leaving, after the subsidence of the flood, a widespread residue of slime, a fertile breeding-bed for the germs of disease.

But the patient mujiks are doing the right thing. The barrier, exposed more and more to the warmth of spring by the scores of channels they are making, will break away gradually, and the river will flow on beneficent and beautiful.

My work in this book is like that of the Russian mujik on the Neva. I simply try to aid in letting the light of historical truth into that decaying mass of outworn thought which attaches the modern world to medieæval conceptions.
of Christianity, and which still lingers among us—a most serious barrier to religion and morals, and a menace to the whole normal evolution of society.

For behind this barrier also the flood is rapidly rising—the flood of increased knowledge and new thought; and this barrier also, though honeycombed and in many places thin, creates a danger—danger of a sudden breaking away, distressing and calamitous, sweeping before it not only outworn creeds and noxious dogmas, but cherished principles and ideals, and even wrenching out most precious religious and moral foundations of the whole social and political fabric.

My hope is to aid—even if it be but a little—in the gradual and healthful dissolving away of this mass of unreason, that the stream of "religion pure and undefiled" may flow on broad and clear, a blessing to humanity.

And now a few words regarding the evolution of this book.

It is something over a quarter of a century since I labored with Ezra Cornell in founding the university which bears his honored name.

Our purpose was to establish in the State of New York an institution for advanced instruction and research, in which science, pure and applied, should have an equal place with literature; in which the study of literature, ancient and modern, should be emancipated as much as possible from pedantry; and which should be free from various useless trammels and vicious methods which at that period hampered many, if not most, of the American universities and colleges.

We had especially determined that the institution should be under the control of no political party and of no single religious sect, and with Mr. Cornell's approval I embodied stringent provisions to this effect in the charter.

It had certainly never entered into the mind of either of us that in all this we were doing anything irreligious or unchristian. Mr. Cornell was reared a member of the Society of Friends; he had from his fortune liberally aided every form of Christian effort which he found going on about him, and among the permanent trustees of the public library
which he had already founded, he had named all the clergy-
men of the town—Catholic and Protestant. As for myself,
I had been bred a churchman, had recently been elected a
trustee of one church college, and a professor in another;
those nearest and dearest to me were devoutly religious;
and, if I may be allowed to speak of a matter so personal to
myself, my most cherished friendships were among deeply
religious men and women, and my greatest sources of enjoy-
ment were ecclesiastical architecture, religious music, and
the more devout forms of poetry. So far from wishing to
injure Christianity, we both hoped to promote it; but we
did not confound religion with sectarianism, and we saw in
the sectarian character of American colleges and universities,
as a whole, a reason for the poverty of the advanced instruc-
tion then given in so many of them.

It required no great acuteness to see that a system of
control which, in selecting a Professor of Mathematics or
Language or Rhetoric or Physics or Chemistry, asked first
and above all to what sect or even to what wing or branch of
a sect he belonged, could hardly do much to advance the
moral, religious, or intellectual development of mankind.

The reasons for the new foundation seemed to us, then,
so cogent that we expected the co-operation of all good citi-
zens, and anticipated no opposition from any source.

As I look back across the intervening years, I know not
whether to be more astonished or amused at our sim-
plicity.

Opposition began at once. In the State Legislature it
confronted us at every turn, and it was soon in full blaze
throughout the State—from the good Protestant bishop
who proclaimed that all professors should be in holy orders,
since to the Church alone was given the command, "Go,
teach all nations," to the zealous priest who published a
charge that Goldwin Smith—a profoundly Christian scholar
—had come to Cornell in order to inculcate the "infidelity
of the Westminster Review"; and from the eminent divine
who went from city to city denouncing the "atheistic and
pantheistic tendencies" of the proposed education, to the
perfervid minister who informed a denominational synod
that Agassiz, the last great opponent of Darwin, and a de-
vout theist, was "preaching Darwinism and atheism" in the new institution.

As the struggle deepened, as hostile resolutions were introduced into various ecclesiastical bodies, as honored clergymen solemnly warned their flocks first against the "atheism," then against the "infidelity," and finally against the "indifferentism" of the university, as devoted pastors endeavoured to dissuade young men from matriculation, I took the defensive, and, in answer to various attacks from pulpits and religious newspapers, attempted to allay the fears of the public. "Sweet reasonableness" was fully tried. There was established and endowed in the university perhaps the most effective Christian pulpit, and one of the most vigorous branches of the Christian Association, then in the United States; but all this did nothing to ward off the attack. The clause in the charter of the university forbidding it to give predominance to the doctrines of any sect, and above all the fact that much prominence was given to instruction in various branches of science, seemed to prevent all compromise, and it soon became clear that to stand on the defensive only made matters worse. Then it was that there was borne in upon me a sense of the real difficulty—the antagonism between the theological and scientific view of the universe and of education in relation to it; therefore it was that, having been invited to deliver a lecture in the great hall of the Cooper Institute at New York, I took as my subject The Battlefields of Science, maintaining this thesis which follows:

In all modern history, interference with science in the supposed interest of religion, no matter how conscientious such interference may have been, has resulted in the direst evils both to religion and to science, and invariably; and, on the other hand, all untrammeled scientific investigation, no matter how dangerous to religion some of its stages may have seemed for the time to be, has invariably resulted in the highest good both of religion and of science.

The lecture was next day published in the New York Tribune at the request of Horace Greeley, its editor, who was also one of the Cornell University trustees. As a result of this widespread publication and of sundry at-
tacks which it elicited, I was asked to maintain my thesis before various university associations and literary clubs; and I shall always remember with gratitude that among those who stood by me and presented me on the lecture platform with words of approval and cheer was my revered instructor, the Rev. Dr. Theodore Dwight Woolsey, at that time President of Yale College.

My lecture grew—first into a couple of magazine articles, and then into a little book called *The Warfare of Science*, for which, when republished in England, Prof. John Tyndall wrote a preface.

Sundry translations of this little book were published, but the most curious thing in its history is the fact that a very friendly introduction to the Swedish translation was written by a Lutheran bishop.

Meanwhile Prof. John W. Draper published his book on *The Conflict between Science and Religion*, a work of great ability, which, as I then thought, ended the matter, so far as my giving it further attention was concerned.

But two things led me to keep on developing my own work in this field: First, I had become deeply interested in it, and could not refrain from directing my observation and study to it; secondly, much as I admired Draper's treatment of the questions involved, his point of view and mode of looking at history were different from mine.

He regarded the struggle as one between Science and Religion. I believed then, and am convinced now, that it was a struggle between Science and Dogmatic Theology.

More and more I saw that it was the conflict between two epochs in the evolution of human thought—the theological and the scientific.

So I kept on, and from time to time published *New Chapters in the Warfare of Science* as magazine articles in *The Popular Science Monthly*. This was done under many difficulties. For twenty years, as President of Cornell University and Professor of History in that institution, I was immersed in the work of its early development. Besides this, I could not hold myself entirely aloof from public affairs, and was three times sent by the Government of the United States to do public duty abroad: first as a commissioner
to Santo Domingo, in 1870; afterward as minister to Germany, in 1879; finally, as minister to Russia, in 1892; and was also called upon by the State of New York to do considerable labor in connection with international exhibitions at Philadelphia and at Paris. I was also obliged from time to time to throw off by travel the effects of overwork.

The variety of residence and occupation arising from these causes may perhaps explain some peculiarities in this book which might otherwise puzzle my reader.

While these journeyings have enabled me to collect materials over a very wide range—in the New World, from Quebec to Santo Domingo and from Boston to Mexico, San Francisco, and Seattle, and in the Old World from Trondhjem to Cairo and from St. Petersburg to Palermo—they have often obliged me to write under circumstances not very favorable: sometimes on an Atlantic steamer, sometimes on a Nile boat, and not only in my own library at Cornell, but in those of Berlin, Helsingfors, Munich, Florence, and the British Museum. This fact will explain to the benevolent reader not only the citation of different editions of the same authority in different chapters, but some iterations which in the steady quiet of my own library would not have been made.

It has been my constant endeavour to write for the general reader, avoiding scholastic and technical terms as much as possible and stating the truth simply as it presents itself to me.

That errors of omission and commission will be found here and there is probable—nay, certain; but the substance of the book will, I believe, be found fully true. I am encouraged in this belief by the fact that, of the three bitter attacks which this work in its earlier form has already encountered, one was purely declamatory, objurgatory, and hortatory, and the others based upon ignorance of facts easily pointed out.

And here I must express my thanks to those who have aided me. First and above all to my former student and dear friend, Prof. George Lincoln Burr, of Cornell University, to whose contributions, suggestions, criticisms, and cautions I am most deeply indebted; also to my friends U.
INTRODUCTION.

G. Weatherly, formerly Travelling Fellow of Cornell, and now Assistant Professor in the University of Indiana,—Prof. and Mrs. Earl Barnes and Prof. William H. Hudson, of Stanford University,—and Prof. E. P. Evans, formerly of the University of Michigan, but now of Munich, for extensive aid in researches upon the lines I have indicated to them, but which I could never have prosecuted without their co-operation. In libraries at home and abroad they have all worked for me most effectively, and I am deeply grateful to them.

This book is presented as a sort of Festschrift—a tribute to Cornell University as it enters the second quarter-century of its existence, and probably my last tribute.

The ideas for which so bitter a struggle was made at its foundation have triumphed. Its faculty, numbering over one hundred and fifty; its students, numbering but little short of two thousand; its noble buildings and equipment; the munificent gifts, now amounting to millions of dollars, which it has received from public-spirited men and women; the evidences of public confidence on all sides; and, above all, the adoption of its cardinal principles and main features by various institutions of learning in other States, show this abundantly. But there has been a triumph far greater and wider. Everywhere among the leading modern nations the same general tendency is seen. During the quarter-century just past the control of public instruction, not only in America but in the leading nations of Europe, has passed more and more from the clergy to the laity. Not only are the presidents of the larger universities in the United States, with but one or two exceptions, laymen, but the same thing is seen in the old European strongholds of metaphysical theology. At my first visit to Oxford and Cambridge, forty years ago, they were entirely under ecclesiastical control. Now, all this is changed. An eminent member of the present British Government has recently said, "A candidate for high university position is handicapped by holy orders." I refer to this with not the slightest feeling of hostility toward the clergy, for I have none; among them are many of my dearest friends; no one honours their proper work more than I; but the above fact is simply noted as proving the
continuance of that evolution which I have endeavoured to describe in this series of monographs—an evolution, indeed, in which the warfare of Theology against Science has been one of the most active and powerful agents. My belief is that in the field left to them—their proper field—the clergy will more and more, as they cease to struggle against scientific methods and conclusions, do work even nobler and more beautiful than anything they have heretofore done. And this is saying much. My conviction is that Science, though it has evidently conquered Dogmatic Theology based on biblical texts and ancient modes of thought, will go hand in hand with Religion; and that, although theological control will continue to diminish, Religion, as seen in the recognition of "a Power in the universe, not ourselves, which makes for righteousness," and in the love of God and of our neighbour, will steadily grow stronger and stronger, not only in the American institutions of learning but in the world at large.

Thus may the declaration of Micah as to the requirements of Jehovah, the definition by St. James of "pure religion and undefiled," and, above all, the precepts and ideals of the blessed Founder of Christianity himself, be brought to bear more and more effectively on mankind.

I close this preface some days after its first lines were written. The sun of spring has done its work on the Neva; the great river flows tranquilly on, a blessing and a joy; the mujiks are forgotten.

A. D. W.

Legation of the United States, St. Petersburg,
April 14, 1894.

P. S.—Owing to a wish to give more thorough revision to some parts of my work, it has been withheld from the press until the present date.

A. D. W.

Cornell University, Ithaca, N. Y.,
August 15, 1895.
CONTENTS OF THE FIRST VOLUME.

CHAPTER I.
FROM CREATION TO EVOLUTION.

I. The Visible Universe.
Ancient and mediaeval views regarding the manner of creation .......................... 1-4
Regarding the matter of creation ........................................................................ 4-5
Regarding the time of creation ......................................................................... 5-9
Regarding the date of creation .......................................................................... 9
Regarding the Creator ....................................................................................... 10-12
Regarding light and darkness ........................................................................... 12, 13
Rise of the conception of an evolution: among the Chaldeans, the Hebrews, the Greeks, the Romans ................................................................. 14
Its survival through the Middle Ages, despite the disfavour of the Church ...... 14, 15
Its development in modern times.—The nebular hypothesis and its struggle with theology .......................................................... 15-19
The idea of evolution at last victorious ............................................................. 19-22
Our sacred books themselves an illustration of its truth ............................... 22-24
The true reconciliation of Science and Theology ........................................... 24

II. Theological Teachings regarding the Animals and Man.
Ancient and mediaeval representations of the creation of man ....................... 24
Literal acceptance of the book of Genesis by the Christian fathers ............... 25
By the Reformers .............................................................................................. 26
By modern theologians, Catholic and Protestant ........................................... 27, 28
Theological reasoning as to the divisions of the animal kingdom ................. 28-30
The Physiologus, the Bestiaries, the Exempla ................................................. 32-36
Beginnings of sceptical observation ................................................................. 37-40
Development of a scientific method in the study of Nature ......................... 40-44
Breaking down of the theological theory of creation .................................... 44-49

III. Theological and Scientific Theories of an Evolution in Animated Nature.
Ideas of evolution among the ancients ......................................................... 50-52
In the early Church ....................................................................................... 52-54
In the mediaeval Church .............................................................................. 55, 56
Development of these ideas from the sixteenth to the eighteenth centuries ... 57, 58
CONTENTS OF THE FIRST VOLUME.

The work of De Maillot .................................................. 58, 59
Of Linnaeus ........................................................................ 59–61
Of Buffon ............................................................................. 61
Contributions to the theory of evolution at the close of the eighteenth century ............. 62
The work of Treviranus and Lamarck .................................... 62, 63
Geoffroy Saint-Hilaire and Cuvier .......................................... 63, 64
Development of the theory up to the middle of the nineteenth century ......................... 64–66
The contributions of Darwin and Wallace .................................. 66–68
The opposition of Agassiz ..................................................... 68, 69

IV. The Final Effort of Theology.

Attacks on Darwin and his theories in England .................................. 70, 71
In America ........................................................................... 71, 72
Formation of sacro-scientific organizations to combat the theory of evolution .............. 72
The attack in France .............................................................. 73
In Germany ........................................................................... 73
Conversion of Lyell to the theory of evolution .................................. 74
The attack on Darwin's Descent of Man .................................... 74–77
Difference between this and the former attack ...................................... 77, 78
Hostility to Darwinism in America ............................................ 78–81
Change in the tone of the controversy.—Attempts at compromise ............................. 81, 82
Dying-out of opposition to evolution .......................................... 83
Last outbursts of theological hostility .......................................... 83–85
Final victory of evolution ...................................................... 86

CHAPTER II.

GEOGRAPHY.

I. The Form of the Earth.

Primitive conception of the earth as flat .................................... 89
In Chaldea and Egypt ................................................................ 89
In Persia ................................................................................ 90
Among the Hebrews ............................................................... 90
Evolution, among the Greeks, of the idea of its sphericity ......................... 91
Opposition of the early Church ................................................ 91, 92
Evolution of a sacred theory, drawn from the Bible ............................. 92
Its completion by Cosmas Indicopleustes .................................... 93–95
Its influence on Christian thought ............................................. 95–97
Survival of the idea of the earth's sphericity—its acceptance by Isidore and Bede ........ 97
Its struggle and final victory .................................................... 97, 98

II. The Delineation of the Earth.

Belief of every ancient people that its own central place was the centre of the earth .................. 98
Hebrew conviction that the earth's centre was at Jerusalem ......................... 99
III. The Inhabitants of the Earth.
The idea of antipodes ........................................ 102
Its opposition by the Christian Church—Gregory Nazianzen, Lactantius, Basil, Ambrose, Augustine, Procopius of Gaza, Cosmas, Isidore .................................................. 102-104
Virgil of Salzburg’s assertion of it in the eighth century . 105, 106
Its revival by William of Conches and Albert the Great in the thirteenth ............................................... 106
Surrender of it by Nicolas d’Oresme .......................... 106
Fate of Peter of Abano and Cecco d’Ascoli ................... 106, 107
Timidity of Pierre d’Ailly and Tostatus ..................... 107, 108
Theological hindrance of Columbus ............................ 108
Pope Alexander VI’s demarcation line ....................... 108
Cautious conservatism of Gregory Reysch .................... 109
Magellan and the victory of science .......................... 109, 110

IV. The Size of the Earth.
Scientific attempts at measuring the earth .................. 110
The sacred solution of the problem ........................... 111
Fortunate influence of the blunder upon Columbus .......... 112

V. The Character of the Earth’s Surface.
Servetus and the charge of denying the fertility of Judea . 112, 113
Contrast between the theological and the religious spirit in their effects on science ............................................. 113

CHAPTER III.
ASTRONOMY.

I. The Old Sacred Theory of the Universe.
The early Church’s conviction of the uselessness of astronomy .................................................. 114
The growth of a sacred theory—Origen, the Gnostics, Philastrius, Cosmas, Isidore .......................... 114, 115
The geocentric, or Ptolemaic, theory: its origin, and its acceptance by the Christian world ............... 115
Development of the new sacred system of astronomy—the pseudo-Dionysius, Peter Lombard, Thomas Aquinas . 116, 117
Its popularisation by Dante ..................................... 117
Its details ................................................................ 118-120
Its persistence to modern times ................................ 120

II. The Heliocentric Theory.
Its rise among the Greeks—Pythagoras, Philolaus, Aristarchus .................................................. 120
Its suppression by the charge of blasphemy ................. 121
CONTENTS OF THE FIRST VOLUME.

Its loss from sight for six hundred years, then for a thousand ..... 121
Its revival by Nicholas de Cusa and Nicholas Copernicus ..... 121-124
Its toleration as a hypothesis ..... 124
Its prohibition as soon as Galileo teaches it as a truth ..... 124
Consequent timidity of scholars—Acosta, Apian ..... 125, 126
Protestantism not less zealous in opposition than Catholicism—Luther, Melanchthon, Calvin, Turrettin ..... 126, 127
This opposition especially persistent in England—Hutchinson, Pike, Horne, Horsley, Forbes, Owen, Wesley ..... 127, 128
Resulting interferences with freedom of teaching ..... 128, 129
Giordano Bruno's boldness and his fate ..... 130
The truth demonstrated by the telescope of Galileo ..... 130

III. The War upon Galileo.
Concentration of the war on this new champion ..... 130
The first attack ..... 131, 132
Fresh attacks—Elci, Busseus, Caccini, Lorini, Bellarmin ..... 132-134
Use of epithets ..... 135
Attempts to entrap Galileo ..... 136
His summons before the Inquisition at Rome ..... 137
The injunction to silence, and the condemnation of the theory of the earth's motion, 1616 ..... 137, 138
The work of Copernicus placed on the Index ..... 138
Galileo's seclusion ..... 138
Renewed attacks upon Galileo—Inchofer, Fromundus ..... 139, 140

IV. Victory of the Church over Galileo.
Publication of his Dialogo, 1632 ..... 140
Hostility of Pope Urban VIII ..... 141
Galileo's second trial by the Inquisition ..... 141, 142
His abjuration ..... 143
Later persecution of him ..... 143
Measures to complete the destruction of the Copernican theory ..... 143-146
Persecution of Galileo's memory ..... 146, 147
Protestant hostility to the new astronomy and its champions ..... 147-153

V. Results of the Victory over Galileo.
Rejoicings of churchmen over the victory ..... 153
The silencing of Descartes ..... 153
Persecution of Campanella and of Kepler ..... 153
Persistence and victory of science ..... 154
Dilemma of the theologians ..... 154, 155
Vain attempts to postpone the surrender ..... 155-157

VI. The Retreat of the Church after its Victory over Galileo.
The easy path for the Protestant theologians ..... 158
The difficulties of the older Church.—The papal infallibility fully com-
mitted against the Copernican theory ..... 158
Attempts at evasion—first plea: that Galileo was condemned not for
affirming the earth's motion, but for supporting it from Scripture ..... 159
CONTENTS OF THE FIRST VOLUME.

Its easy refutation ........................................... 159, 160
Second plea: that he was condemned not for heresy, but for contumacy 160
Folly of this assertion ........................................ 160
Third plea: that it was all a quarrel between Aristotelian professors and those favouring the experimental method ........................................... 161
Fourth plea: that the condemnation of Galileo was “provisory” .............. 161
Fifth plea: that he was no more a victim of Catholics than of Protestants 161
Efforts to blacken Galileo’s character ................................ 162
Efforts to suppress the documents of his trial ................................ 162
Their fruitlessness .............................................. 163
Sixth plea: that the popes as popes had never condemned his theory ........ 163
Its confutation from their own mouths ................................ 163, 164
Abandonment of the contention by honest Catholics ......................... 165, 166
Two efforts at compromise—Newman, De Bonald .......................... 166, 167
Effect of all this on thinking men .................................. 167, 168
The fault not in Catholicism more than in Protestantism—not in religion, but in theology .............................................. 168–170

CHAPTER IV.

FROM “SIGNS AND WONDERS” TO LAW IN THE HEAVENS.

I. The Theological View.
Early beliefs as to comets, meteors, and eclipses ....................... 171–173
Their inheritance by Jews and Christians .................................. 173
The belief regarding comets especially harmful as a source of superstitious terror .............................................. 174
Its transmission through the Middle Ages .................................. 174–176
Its culmination under Pope Calixtus III .................................... 177
Beginnings of scepticism—Copernicus, Paracelsus, Scaliger ............... 178
Firmness of theologians, Catholic and Protestant, in its support ........ 178–183

II. Theological Efforts to crush the Scientific View.
The effort through the universities.—The effort through the pulpits ... 183
Heerbrand at Tübingen and Dieterich at Marburg ......................... 184
Maestlin at Heidelberg ........................................... 184
Böttner, Vossius, Torreblanca, Frommundus ................................ 185, 186
Father Augustin de Angelis at Rome .................................... 186–188
Reinzer at Linz ..................................................... 188, 189
Celichius at Magdeburg ............................................. 190
Conrad Dieterich’s sermon at Ulm ....................................... 191–193
Erni and others in Switzerland ......................................... 193, 194
Comet doggerel ..................................................... 193
Echoes from New England—Danforth, Morton, Increase Mather ....... 194–196

III. The Invasion of Scepticism.
Rationalism of Cotton Mather, and its cause ........................... 196, 197
Blaise de Vigenère ................................................... 197
Erastus ............................................................... 198
Bekker, Lubienitzky, Pierre Petit ....................................... 198
CONTENTS OF THE FIRST VOLUME.

PAGE
Bayle ........................................ 199
Fontenelle .................................... 200
The scientific movement beneath all this .... 200, 201

IV. Theological Efforts at Compromise.—The Final Victory of Science.
   The admission that some comets are supralunar ........ 202
   Difference between scientific and theological reasoning .... 202, 203
   Development of the reasoning of Tycho and Kepler—Cassini, Hevel,
   Doerfel, Bernouilli, Newton ........................................ 203
   Completion of the victory by Halley and Clairaut .......... 203, 204
   Survivals of the superstition—Joseph de Maistre, Forster ..... 205
   Arago’s statistics ..................................................... 205
   The theories of Whiston and Burnet, and their influence in Germany .... 206
   The superstition ended in America by the lectures of Winthrop .... 207
   Helpful influence of John Wesley ................................. 207
   Effects of the victory .............................................. 207, 208

CHAPTER V.

FROM GENESIS TO GEOLOGY.

I. Growth of Theological Explanations.
   Germs of geological truth among the Greeks and Romans ........ 209
   Attitude of the Church toward science ............................ 209
   Geological theories of the early theologians ................. 210, 211
   Attitude of the schoolmen ........................................... 212
   Contributions of the Arabian schools ............................ 212
   Theories of the earlier Protestants .............................. 212, 213
   Influence of the revival of learning ............................. 214

II. Efforts to Suppress the Scientific View.
   Revival of scientific methods ................................. 214, 215
   Buffon and the Sorbonne ........................................... 215
   Beringer’s treatise on fossils .................................... 216, 217
   Protestant opposition to the new geology—the works of Burnet, Whis-
   ton, Wesley, Clark, Watson, Arnold, Cockburn, and others .... 217–225

III. The First Great Effort at Compromise, based on the Flood of Noah.
   The theory that fossils were produced by the Deluge ........ 225
   Its acceptance by both Catholics and Protestants—Luther, Calmet .... 226
   Burnet, Whiston, Woodward, Mazurier, Torrubia, Increase Mather .... 227
   Scheuchzer .......................................................... 228
   Voltaire’s theory of fossils ....................................... 229
   Vain efforts of enlightened churchmen in behalf of the scientific view 229, 230
   Steady progress of science—the work of Cuvier and Brongniart .... 230, 231
   Granville Penn’s opposition ....................................... 231
   The defection of Buckland and Lyell to the scientific side .... 232, 233
   Surrender of the theologians ..................................... 234–236
   Remnants of the old belief ....................................... 236, 237
CONTENTS OF THE FIRST VOLUME.

Death-blow given to the traditional theory of the Deluge by the discovery of the Chaldean accounts ........................................ 237, 238
Results of the theological opposition to science ........................................ 238, 239

IV. Final Efforts at Compromise—The Victory of Science complete.
Efforts of Carl von Raumer, Wagner, and others ........................................ 239, 240
The new testimony of the caves and beds of drift as to the antiquity of man ........................................ 240
Gosse’s effort to save the literal interpretation of Genesis ........................................ 241, 242
Efforts of Continental theologians ........................................ 243, 244
Gladstone’s attempt at a compromise ........................................ 243, 244
Its demolition by Huxley ........................................ 245
By Canon Driver ........................................ 246
Dean Stanley on the reconciliation of Science and Scripture ........................................ 247

CHAPTER VI.

THE ANTIQUITY OF MAN, EGYPTOLOGY, AND ASSYRIOLOGY.

I. The Sacred Chronology.
Two fields in which Science has gained a definite victory over Theology ........................................ 249
Opinions of the Church fathers on the antiquity of man ........................................ 249–251
The chronology of Isidore ........................................ 251
Of Bede ........................................ 251
Of the medieval Jewish scholars ........................................ 252
The views of the Reformers on the antiquity of man ........................................ 252, 253
Of the Roman Church ........................................ 253
Of Archbishop Usher ........................................ 253
Influence of Egyptology on the belief in man’s antiquity ........................................ 254
La Peyrère’s theory of the Pre-Adamites ........................................ 255
Opposition in England to the new chronology ........................................ 255, 256

II. The New Chronology.
Influence of the new science of Egyptology on biblical chronology ........................................ 257
Manetho’s history of Egypt and the new chronology derived from it ........................................ 257–259
Evidence of the antiquity of man furnished by the monuments of Egypt ........................................ 259, 260
By her art ........................................ 260, 261
By her science ........................................ 261, 262
By other elements of civilisation ........................................ 262
By the remains found in the bed of the Nile ........................................ 263
Evidence furnished by the study of Assyriology ........................................ 264

CHAPTER VII.

THE ANTIQUITY OF MAN AND PREHISTORIC ARCHAEOLOGY.

I. The Thunder-stones.
Early beliefs regarding “thunder-stones” ........................................ 266
Theories of Mercati and Tollius regarding them ........................................ 267
CONTENTS OF THE FIRST VOLUME.

Their identification with the implements of prehistoric man ... 267, 268
Remains of man found in caverns ... 268, 269
Unfavourable influence on scientific activity of the political conditions of
the early part of the nineteenth century ... 269
Change effected by the French Revolution of 1830 ... 270
Rallying of the reactionary clerical influence against science ... 270, 271

II. The Flint Weapons and Implements.
Boucher de Perthes's contributions to the knowledge of prehistoric man 271–273
His conclusions confirmed by Lyell and others ... 273
Cave explorations of Lartet and Christy ... 273, 274
Evidence of man's existence furnished by rude carvings ... 274, 275
Cave explorations in the British Islands ... 276, 277
Evidence of man's existence in the Drift period ... 277–280
In the early Quaternary and in the Tertiary periods ... 281–283

CHAPTER VIII.
THE "FALL OF MAN" AND ANTHROPOLOGY.
The two antagonistic views regarding the life of man on the earth ... 284
The theory of "the Fall" among ancient peoples ... 285, 286
Inheritance of this view by the Christian Church ... 286
Appearance among the Greeks and Romans of the theory of a rise of
man ... 286, 287
Its disappearance during the Middle Ages ... 288
Its development since the seventeenth century ... 288
The first blow at the doctrine of "the Fall" comes from geology ... 289
Influence of anthropology on the belief in this doctrine ... 289
The finding of human skulls in Quaternary deposits ... 290
Their significance ... 290, 291
Results obtained from the comparative study of the remains of human
handiwork ... 291
Discovery of human remains in shell-heaps on the shores of the Baltic Sea 292
In peat-beds ... 292, 293
The lake-dwellers ... 294, 295
Indications of the upward direction of man's development ... 295
Mr. Southall's attack on the theory of man's antiquity ... 296
An answer to it ... 297
Discovery of prehistoric human remains in Egypt ... 297–299
Hamard's attack on the new scientific conclusions ... 300
The survival of prehistoric implements in religious rites ... 300, 301
Strength of the argument against the theory of "the Fall of Man" ... 301

CHAPTER IX.
THE "FALL OF MAN" AND ETHNOLOGY.
The beginnings of the science of Comparative Ethnology ... 303
Its testimony to the upward tendency of man from low beginnings ... 303, 304
CONTENTS OF THE FIRST VOLUME.

Theological efforts to break its force—De Maistre and De Bonald 304
Whatley's attempt 304, 305
The attempt of the Duke of Argyll 305–307
Evidence of man's upward tendency derived from Comparative Philology 307
From Comparative Literature and Folklore 308
From Comparative Ethnography 308
From Biology 308

CHAPTER X.

THE "FALL OF MAN" AND HISTORY.

Proof of progress given by the history of art 310
Proofs from general history 310
Development of civilization even under unfavourable circumstances 310, 311
Advancement even through catastrophes and the decay of civil-
izations 311, 312
Progress not confined to man's material condition 312
Theological struggle against the new scientific view 313
Persecution of Prof. Winchell 313–315
Of Dr. Woodrow 316–318
Other interferences with freedom of teaching 319
The great harm thus done to religion 320
Rise of a better spirit 320
The service rendered to religion by Anthropology 320–322

CHAPTER XI.

FROM "THE PRINCE OF THE POWER OF THE AIR" TO METEOROLOGY.

I. Growth of a Theological Theory.

The beliefs of classical antiquity regarding storms, thunder, and lightning 323
Development of a sacred science of meteorology by the fathers of the
Church 323–325
Theories of Cosmas Indicopleustes 325
Of Isidore of Seville 326
Of Bede 326–328
Of Rabanus Maurus 328
Rational views of Honorius of Autun 328, 329
Orthodox theories of John of San Geminiano 329
Attempt of Albert the Great to reconcile the speculations of Aristotle
with the theological views 329
The monkish encyclopedists 330
Theories regarding the rainbow and the causes of storms 330, 331
Meteorological phenomena attributed to the Almighty 331–335

II. Diabolical Agency in Storms.

Meteorological phenomena attributed to the devil—"the prince of
the power of the air" 336, 337
Propagation of this belief by the medieval theologians 337, 338
Its transmission to both Catholics and Protestants—Eck, Luther 339
CONTENTS OF THE FIRST VOLUME.

The great work of Delrio. ........................................... 339
Guacci’s Compendium .................................................. 340
The employment of prayer against “the powers of the air”.................. 340
Of exorcisms ............................................................ 340-342
Of fetiches and processions ........................................... 342-344
Of consecrated church bells .......................................... 344-350

III. The Agency of Witches.
The fearful results of the witch superstition ......................... 350
Its growth out of the doctrine of evil agency in atmospheric phenomena 351
Archbishop Agobard’s futile attempt to dispel it ....................... 351
Its sanction by the popes .............................................. 351, 352
Its support by confessions extracted by torture ........................ 352, 353
Part taken in the persecution by Dominicans and Jesuits ............ 353
Opponents of the witch theory—Pomponiaus, Paracelsus, Agrippa of Nettesheim ...................................................... 354, 355
Jean Bodin’s defence of the superstition .............................. 355
Fate of Cornelius Loos .................................................. 356
Of Dietrich Flade ........................................................ 356, 357
Efforts of Spee to stem the persecution ................................ 357
His posthumous influence .............................................. 358
Upholders of the orthodox view—Bishop Binsfeld, Remigius ........... 358
Vain protests of Wier ................................................... 359
Persecution of Bekker for opposing the popular belief ................. 359
Effect of the Reformation in deepening the superstition ............. 359, 360
The persecution in Great Britain and America ......................... 360, 361
Development of a scientific view of the heavens ...................... 362
Final efforts to revive the old belief ................................ 362, 363

IV. Franklin’s Lightning-Rod.
Franklin’s experiments with the kite .................................. 364
Their effect on the old belief ......................................... 364
Efforts at compromise between the scientific and theological theories 365
Successful use of the lightning-rod ................................... 365
Religious scruples against it in America .............................. 366
In England ................................................................. 367
In Austria ................................................................. 367
In Italy ........................................................................... 367, 368
Victory of the scientific theory ........................................ 368
This victory exemplified in the case of the church of the monastery of Lérins ......................................................... 369-371
In the case of Dr. Moorhouse .......................................... 372
In the case of the Missouri droughts ................................... 372

CHAPTER XII.

FROM MAGIC TO CHEMISTRY AND PHYSICS.

I. The Supremacy of Magic.
Primitive tendency to belief in magic .................................. 373
The Greek conception of natural laws .................................. 374
CONTENTS OF THE FIRST VOLUME.

Influence of Plato and Aristotle on the growth of science .................................................. 374, 375
Effect of the establishment of Christianity on the development of the physical sciences ........ 375-377
The revival of thought in the twelfth and thirteenth centuries ............................................ 377
Albert the Great ......................................................................................................................... 377, 378
Vincent of Beauvais .................................................................................................................. 378
Thomas Aquinas ......................................................................................................................... 379, 380
Roger Bacon’s beginnings of the experimental method brought to nought .................... 381
The belief that science is futile gives place to the belief that it is dangerous ..................... 381
The two kinds of magic ............................................................................................................. 381
Rarity of persecution for magic before the Christian era ...................................................... 382
The Christian theory of devils ................................................................................................. 382
Constantine’s laws against magic ............................................................................................. 383
Increasing terror of magic and witchcraft ................................................................................ 383, 384
Papal enactments against them ................................................................................................. 384, 385
Persistence of the belief in magic ............................................................................................. 385
Its effect on the development of science .................................................................................. 385, 386
Roger Bacon ............................................................................................................................... 386-390
Opposition of secular rulers to science ................................................................................... 391, 392
John Baptist Porta .................................................................................................................... 392
The opposition to scientific societies in Italy ............................................................................ 393
In England .................................................................................................................................. 394
The effort to turn all thought from science to religion ............................................................ 394
The development of mystic theology ....................................................................................... 395
Its harmful influence on science .............................................................................................. 395-397
Mixture of theological with scientific speculation ................................................................. 397, 398
This shown in the case of Melanchthon ................................................................................. 399
In that of Francis Bacon ............................................................................................................ 400, 401
Theological theory of gases ....................................................................................................... 402
Growth of a scientific theory ..................................................................................................... 402
Basil Valentine and his contributions to chemistry ................................................................. 403
Triumph of the scientific theory ............................................................................................... 403

II. The Triumph of Chemistry and Physics.

New epoch in chemistry begun by Boyle ............................................................................... 404
Attitude of the mob toward science ......................................................................................... 405
Effect on science of the reaction following the French Revolution ...................................... 405, 406
Development of chemistry since the middle of the nineteenth century ............................. 406
Development of physics .......................................................................................................... 406, 407
Modern opposition to science in Catholic countries .............................................................. 408
Attack on scientific education in France ................................................................................... 409, 410
In England ................................................................................................................................ 411
In Prussia ................................................................................................................................... 411
Revolt against the subordination of education to science ..................................................... 411, 412
Effect of the International Exhibition of 1851 at London ................................................... 413
Of the endowment of State colleges in America by the Morrill Act of 1862 ................... 413, 414
The results to religion ............................................................................................................... 414, 415