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The Historical Background of Medieval Intellectual Interests: A Study in Paganism, Christianity and the Decline of Ancient Science

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THE HISTORICAL BACKGROUND OF MEDIEVAL INTELLECTUAL INTERESTS

A STUDY IN PAGANISM, CHRISTIANITY AND THE DECLINE
OF ANCIENT SCIENCE¹

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I. INTRODUCTORY

In an earlier paper on the relation between history and the history of science,² I endeavored to show that the historian could be most helpful to the scientist interested in the history of science through inculcating the canons of historical research, in order to secure a more critical use of the sources of information, and by indicating the general cultural conditions of any epoch which have encouraged or retarded the growth of those attitudes of mind which are essential to the flourishing of any healthy scientific activity.

The acquisition of a knowledge of the technique of historical research is something which can come only from a long-standing and reverent contact with such works as those by Bernheim, Wolf, and Langlois and Seignobos, and cannot fall within the scope of such a paper as this. In illustrating the other phase of a possible fruitful relation between history and the history of science two periods of particular pertinence might be chosen. One is the era of the decline of ancient science, and the other that of the scientific revival of the seventeenth century. From considerations of both logic and chronology I have chosen the first of these periods as that upon which to base a brief analysis of the manner in

¹Paper prepared for the Toronto Meeting of the American Association for the Advancement of Science, Section on the History of Science, December, 1921.

²"The Historian and the History of Science," in *Scientific Monthly*, August, 1920.

which a knowledge of cultural conditions and intellectual attitudes at large is helpful in understanding the status of, and the tendencies in, natural science. It will be my aim to point out the more important historical causes for the decline of the scientific interests and activities of the Hellenic world, and for the impossibility of the development of any creative scientific endeavor until the Patristic orientation had been eliminated with the gradual growth of a different outlook and attitude after the passage of more than a thousand years.³

II. ASPECTS OF "PAGAN" CULTURE IN THE CLASSICAL WORLD WHICH OBSTRUCTED THE DEVELOPMENT OF SCIENCE

I. *The Problem of the Decline of Ancient Science*—Every student of intellectual history and the history of science is aware of the remarkable progress of the Greeks in the realm of natural science, including the brilliant origins with Thales and the Milesian group in the sixth and fifth centuries B. C.; the introduction of the atomic theory and a mechanistic theory of causation by Leucippus and Democritus; Aristotle's comprehensive work in scientific description and classification; the origins of medical science with Hippocrates; and, above all, the astonishing achievements of the scientists of the Hellenistic age—Euclid, Aristarchus, Eratosthenes, Archimedes, Hipparchus and Hero.⁴

Looking at this imposing advance from the crude beginnings of the Egyptians and the Babylonians, *purely from the standpoint of the development of science*, it is difficult to see why the process did not keep on after Hipparchus and Hero, develop applied science, and produce the modern scientific and industrial world two millenniums earlier than it actually was attained. The writer well recalls, in fact, that, as a student in one of the more noted courses on the history of science in this country, he listened to a confession on the part of the professor that scientists were at a loss to account for the decline of ancient science. The instructor placed his faith in a guess that it was because of the disintegration and disunity of Greek political life, but, as historians have made clear, Greek political conditions were more disturbed during the

³By all odds the best guide and bibliography for the field of this paper is to be found in Parts II-III of J. H. Robinson's "Outline of the History of the Western European Mind." The two most useful books, on the whole, are H. O. Taylor's "Classical Heritage of the Middle Ages" and "The Medieval Mind." I have endeavored to include as quotations some of the more notable passages from the better known books on the topics considered.

⁴Sedgwick and Tylor, "Short History of Science," Chaps. III-VI.

period of maximum scientific activity than during the age of its decline.

Yet, when the historian of culture views the classical and Patristic periods, the chief problem which confronts him is not why ancient science declined, but why it was able to persist as long as it did. He finds that nearly all phases of intellectual life, most of the prevailing attitudes of mind, and the social and economic conditions were either fundamentally opposed to the scientific frame of mind or were, in varying degrees, obstructive of the influences which would promote scientific activity. He feels the force of Professor Robinson's assertion that "there was no form of ignorance or of perversity of thought left for the Middle Ages to discover."

2. *The Weaknesses of Hellenic Science*—First, perhaps, might be mentioned the very nature of ancient science itself. Some of the more important weaknesses of ancient science were illustrated by Aristotle.⁵ His penchant for finality and definiteness in classification and arrangement of data, clarifying as it was, savored of logic quite as much as of science. His sanctification of Empedocles' animistically derived notion of the four fundamental elements prevented the adoption of the sensible atomic theory of Democritus, and held physics and chemistry in bondage until the time of Paracelsus, Boyle and Stahl. His erroneous notions with respect to static and dynamic mechanics and his fantastic cosmology tended to obscure the accurate work done along this line by the Alexandrian and Hellenistic scientists, and, by its ascendancy in scholastic thought, proved an obstruction to the growth of modern science as well. Then, his compiling tendency, valuable, perhaps, in his own hands and in those of Ptolemy, became, as early as Pliny, the vehicle for setting down as plausible vast masses of pseudo-scientific monstrosities, many of them accepted on the strength of tradition or gossip. The introduction of astrology not only brought many grotesque errors into every phase of thought, but specifically hindered the progress of astronomy.⁶ The physiological chemistry, resting on the basis of the theory of the four humors, which constituted the "scientific" basis of the classical theory of pathology, not only was fatal to physiological chemistry, but also made difficult any definite progress in medical science, especially after this notion had been sanctified by Hippocrates and Galen, much as Aristotle had

⁵A. E. Taylor, "Aristotle"; and T. E. Lones, "Aristotle's Researches in Natural Science."

⁶A. Bouché-Leclercq, "L'Astrologie grecque"; F. Cumont, "Astrology and Religion among the Greeks and Romans."

perpetuated the allied notion of the four elements of Empedocles.⁷

Even the remarkable science of the Hellenistic period possessed its definite limitations. Archimedes and Hipparchus carried it about as far as it was possible with the existing modes of scientific endeavor and the technique for research. They had few or no instruments of precision, such as the microscope, balance, stop-watch and thermometer, a circumstance which prevented their inductive investigation from going beyond relatively superficial externals. An unwillingness to observe the commonplace, growing partly out of the Greek enthusiasm for the aesthetic and the transcendental, and partly out of the contempt for mundane matters through their association with servile labor, discouraged that observant attitude which is the beginning of all true scientific endeavor. A primary interest in absolutes and transcendentals, which was characteristic of the Greeks, led to a lack of concern with the changing and the dynamic aspects of the world of sense-phenomena, and prevented a general acceptance of the evolutionary concepts of Heracleitus and the Epicureans. Finally, there should be noted the Greek inability to make a practical application of the scientific knowledge they acquired. Though Hero, for example, had produced the turbine engine a hundred years before the Christian era, he could think of no more useful purpose to which to apply it than to furnish wondering amusement through opening temple doors. Though Archimedes produced many practical devices which might have been of the greatest industrial significance, especially his development of the principles of the lever and pulley, he did little more with them than to provide edification and amusement for King Hiero of Syracuse. Professor Robinson has admirably summarized these reasons why Greek science and thought were not adapted to producing indefinite progress and why they did not bring about the régime of applied science and industrialism during the period of the existence of the Hellenistic world:⁸

After two or three hundred years of talking in the market place and of philosophic discussions prolonged until morning, such of the Greeks as were predisposed to speculation had thought all the thoughts and uttered all the criticisms of commonly accepted beliefs and of one another that could by any possibility occur to those who had little inclination to fare forth and extend their knowledge of the so-called realities of nature by painful and specialized research and examination. This is to me the chief reason why, except for some advances in mathematics, astronomy, geogra-

⁷F. H. Garrison, "Introduction to the History of Medicine," p. 59 ff.

⁸J. H. Robinson, "Mind in the Making," p. 111-3.

phy, and the refinements of scholarship, the glorious period of the Greek mind is commonly and rightfully assumed to have come to an end about the time of Aristotle's death. Why did the Greeks not go on, as modern scientists have gone on, with vistas of the unachieved still ahead of them?

In the first place, Greek civilization was founded on slavery and a fixed condition of the industrial arts. The philosopher and scholar was estopped from fumbling with those everyday processes that were associated with the mean life of the slave and servant. Consequently there was no one to devise the practical apparatus by which alone profound and ever-increasing knowledge of natural operations is possible. The mechanical inventiveness of the Greeks was slight, and hence they never came upon the lens; they had no microscope to reveal the minute, no telescope to attract the remote; they never devised a mechanical timepiece; a thermometer, nor a barometer, to say nothing of cameras and spectroscopes. Archimedes, it is reported, disdained to make any record of his ingenious devices, for they were unworthy of the noble profession of a philosopher. Such inventions as were made were usually either toys or of a heavy practical character. So the next great step forward in the extension of the human mind awaited the disappearance of slavery and the slowly dawning suspicion, and final repudiation, of the older metaphysics, which first became marked some three hundred years ago.

Roman science was, in the main, but an inferior imitation of Hellenic science. While the Romans certainly made notable contributions to the field of structural engineering, these rested much more on intuition and practical ingenuity than upon the understanding of the technical phases of the science of mechanics. They did little or nothing to advance the natural sciences, while, in the matter of the compilation of pseudo-science in such works as Pliny's "Natural History," they did much to degrade science and to block the operation of the strictly scientific impulses and procedure. Ancient science in itself thus furnished limitations upon its own development. Infinitely more important, however, in obstructing the growth of ancient science were the various non-scientific and anti-scientific currents of thought and attitudes of mind which dominated the classical world.

3. *The Ascendency of Metaphysics in Hellenic Thought—*

Perhaps the most important aspect of classical intellectual and cultural conditions in obstructing the progress of scientific thought was the tendency towards metaphysical thought, which was a primary characteristic of Hellenic thinking. Professor Robinson thus comments upon this development in Greek thought:⁹

The second great discovery of the Greek thinkers was *metaphysics*. They did not have the name, which originated long after in quite an absurd fashion, but they reveled in the thing. Nowadays metaphysics is revered by some as our noblest effort to reach the highest truth, and scorned by others as the silliest of wild-goose chases. I am inclined to rate it, like smoking, as a highly gratifying indulgence to those who like it, and, as

⁹Robinson, *Ibid*, p. 102-3.

indulgences go, relatively innocent. The Greeks found that the mind could carry on an absorbing game with itself. We all engage in reveries and fantasies of a homely, everyday type, concerned with our desires or resentments, but the fantasy of the metaphysician busies itself with conceptions, abstractions, distinctions, hypotheses, postulates, and logical inferences. Having made certain postulates or hypotheses, he finds new conclusions, which he follows in a seemingly convincing manner. This gives him the delightful emotion of pursuing Truth, something as the simple man pursues a maiden. Only Truth is more elusive than the maiden and may continue to beckon her follower for many long years, no matter how gray and doddering he may become.

The significance of this type of thought in turning the Hellenic world aside from the observing mood and the concern with the concrete, essential to the scientist, can scarcely be overestimated. H. O. Taylor says: "The older Greek philosophies had sprung from open and unprejudiced observation of the visible world. They were physical inquiries. With Socrates philosophy turned, as it were, from fact to truth, to a consideration of the validity of human understanding. Thereupon the Greek mind became entranced with its own creations."¹⁰ In a similar vein John Dewey writes: "There are, indeed, but two alternative courses. We must either find the appropriate objects and organs of knowledge in the mutual interactions of changing things; or else, to escape the infection of change, we *must* seek them in some transcendent and supernal region. The human mind deliberately, as it were, exhausted the logic of the changeless, the final, and the transcendent, before it essayed adventure on the pathless wastes of generation and transformation."¹¹ So obsessed were the great Greek minds with the lofty and desirable nature of abstract speculation that Aristotle's notion of God was that of a being eternally absorbed in contemplation and divine introspection.¹²

Beyond this general *Tendenz* towards enthusiasm for the metaphysically obtained "realities," which appeared at its best in the philosophy of Aristotle, the Stoics and the Epicureans, there were special variations and manifestations of this characteristic which were even more deadly to scientific thought. Perhaps the least offensive of these was the idealism of Plato. Turning with his master, Socrates, away from the Sophistic emphasis on the relativity of knowledge and the significance of the concrete and specific, he sought reality in transcendental types. Unable to endure the thought that

¹⁰H. O. Taylor, "The Medieval Mind," third American edition, Vol. I, p. 34-5.

¹¹J. Dewey, "The Influence of Darwinism on Philosophy and other Essays," p. 6-7.

¹²C. M. Bakewell, "Source-Book in Ancient Philosophy," p. 233-5.

either the universe or man was like "a leaky pot or a man running at the nose," he endeavored to attain philosophic and aesthetic consolation in the contention that reality existed only in the ideal type, form or pattern, of which concrete and specific examples were but lowly, imperfect and ephemeral manifestations. Mr. Taylor has well summarized the significance of this attitude and position for the discouragement of the truly scientific approach to the study of natural phenomena:¹³

With Platonists—and the world was always to be filled with them—perceptions of physical facts and the data of human life and history, were henceforth to constitute the outer actuality of a creation within the mind. Every observed fact is an apparent tangibility; but its reality consists in its unison with the ultimate realities of rational conception. The apprehension of the fact must be made to conform to these. For this reason every fact has a secondary, nay, primary, because spiritual meaning. Its true interpretation lies in that significance which accords with the mind's consistent system of conceptions, which present the fact as it must be thought, and therefore as it is; it is the fact brought into right relationship with spiritual and ethical verity. Of course, methods of apprehending terrestrial and celestial phenomena as illustrations of ideally conceived principles, were unlikely to foster habits of close observation. The apparent facts of sense would probably be imaginatively treated if not transformed in the process of their apprehension. Nor, with respect to the human story, would such methods draw fixed lines between the narration of what men are pleased to call the actual occurrence, and the shaping of a tale to meet the exigencies of argument or illustration.

4. *Neoplatonism and the Mystic Attitude*—Much more deadly to the cultivation of scientific outlook and interests was Neoplatonism, which took its origin from one of the more mystical of Plato's works, the "Timaeus." It was elaborated by Posidonius of Rhodes, and much later, by an Egyptian Platonist, Plotinus (204–270 A. D.). The world of sense-phenomena—the whole field of the work of the scientist—was utterly spurned by Plotinus as unworthy of consideration by man. The concrete and material were, at best, but a necessary evil. Plotinus is said to have expressed shame, humility and embarrassment at having possessed a physical body. The metaphysical realm of the pure contemplation of the transcendental—the ideal and divine world of Plato and Aristotle—was more highly esteemed by Plotinus than the world of sense, concrete and changing, but it was not the perfect world of mental activity. This was to be found in the regions of the Absolute, which could be reached only through vision and ecstasy. This realm of emotion and ecstasy, and its goal, the Absolute, were something in which neither observation, nor reason, nor analysis had any part whatever. The

¹³Taylor, "The Medieval Mind," Vol. I, p. 35.

Absolute was ineffable, and faith and reverence were the only proper attitudes to be maintained in its quest.¹⁴ The intellectual bankruptcy implied in the Neoplatonic approach to the problems of knowledge and experience has thus been stated by Adolph Harnack, the famous historian of Christian thought:¹⁵

The contempt for reason and science (for these are condemned when relegated to a second place) finally leads to barbarism, because it results in crass superstition, and is exposed to all manner of imposture. And, as a matter of fact, barbarism succeeded the flourishing period of Neoplatonism. . . . The masses grew up in superstition, and the Christian Church, which entered on the inheritance of Neoplatonism, was compelled to reckon with this and come to terms with it. Just when the bankruptcy of the ancient civilization and its lapse into barbarism could not have failed to reveal themselves, a kindly destiny placed on the stage of European history certain barbarian nations, for whom the work of a thousand years had as yet no existence. Thus the fact is obscured, though it does not escape the eye of one who looks below the surface, that the ancient world must necessarily have degenerated into barbarism of its own accord, because of its renunciation of this world. There was no longer any desire either to enjoy it, to master it, or to know it as it really is. A new world had been disclosed for which everything in this world was to be given up, and men were ready to sacrifice insight and understanding, in order to possess that other world with certainty. In the light which radiated from the world to come, that which in this world appeared absurd became wisdom, and wisdom became folly.

In the works and teachings of some of the followers of Plotinus the intellectual degradation proceeded much further. With Iamblichus (B. C. 300), there developed the thesis that unbounded credulity was a moral principle, that the divine methods and manifestations were essentially miraculous and supernatural, and that the chief purpose of philosophy was to inculcate the essential wickedness of disbelieving or questioning anything which related to the gods or their alleged actions. Magic and theurgy were the noblest of possible human practices.¹⁶ Taylor has admirably summarized the mental collapse represented in the views of Iamblichus:¹⁷

There was no conflict, but complete surrender and happy abandonment in Iamblichus the Divine (*θεῖος*) who when he prayed might be lifted ten cubits from the ground—so thought his disciples—and around whose theurgic fingers, dabbling in a magic basin of water, Cupids played and kissed each other. His life, told by the Neo-Platonic biographer, Eunapius, is as full of miracle as the contemporary Life of St. Antony by Athanasius. Iamblichus floats before us a beautiful and marvellously garbed priest,

¹⁴T. Whittaker, "The Neo-Platonists"; W. R. Inge, "The Philosophy of Plotinus."

¹⁵A. Harnack, "History of Christian Dogma," Vol. I, p. 337-8; cited in Robinson, "The New History," p. 112-13.

¹⁶Whittaker, *op. cit.*, p. 122 ff.

¹⁷Taylor, "Medieval Mind," Vol. I, p. 47, 47-8, 48-9.

a dweller in the recesses of temples. He frankly gave himself to theurgy, convinced that the Soul needs the aid of every superhuman being—hero, god, demon, angel. He was credulous on principle. It is of first importance, he writes, that the devotee should not let the marvellous character of an occurrence arouse incredulity within him. He needs above all a "science" which shall teach him to disbelieve nothing as to the gods. For the divine principle is essentially miraculous, and magic is the open door, yes, and the way up to it, the anagogic path.

There is no lower depth. Plotinus' reason-surpassing vision of the One (which represents in him the principle of irrationality) is at last brought down to the irrational act, the occult magic deed or word. Truly the worshipper needs his best credulity—which is bespoken by Iamblichus and by this book.

So low sank Neo-Platonism in pagan circles. Of course it did not create this mass of superstitious fantasy. It merely fell in cordially, and over every superstition flung the justification of its principles. In the process it changed from a philosophy to a system of theurgic practice. The common superstitions of the time, or their like, were old enough. But now—and here was the portentous fact—they had wound themselves into the natures of intellectual people; and Neo-Platonism represents the chief formal facilitation of this result.

The historical significance of Neoplatonism relates not merely to its origins and manifestations among the pagans of the period of classical decline. It furnished the intellectual framework and background for Patristic thought and provided the mental orientation for much of medieval thought and culture.¹⁸

5. *Rhetoric and the Substitution of Well-said for Well-done*—Another phase of the decadence of pagan thought was the development of the popularity of rhetoric and the love of flowery language and sonorous phrases. This not only corrupted history, but also diverted intellectual attention away from the concrete realities with which science deals, and centered interest and approval upon the aesthetic fictions of the imagination of the orator. It tended to build up a satisfaction with words and phrases, in the place of facts and concrete achievements. "Well-said" was substituted for well-done as the criterion of excellence. It was as fatal to interest and achievement in science as the Neoplatonic absorption in the ecstasies of contemplating the absolute, the miraculous and the supernatural. Professor Bury has well summarized the great popularity of rhetoric among the Greeks in the Hellenistic period:¹⁹

We may regret this corruption, as we call it, of history. But it is more to the purpose to understand the Greek point of view. It is not easy for us to realize the importance which the art of rhetoric possessed for

¹⁸A. Harnack, "History of Dogma," Vol. I, p. 336 ff.; T. Whittaker, "The Neo-platonists."

¹⁹J. B. Bury, "The Ancient Greek Historians," p. 174-5; cf. H. Peter, "Wahrheit und Kunst," and J. T. Shotwell, "Introduction to the History of History," Chaps. XV, XVIII.

the Greeks, as a purveyor of æsthetic pleasure. Indeed, the history of Greek rhetoric testifies, perhaps as impressively as the history of Greek plastic, to the large part which æsthetic pleasure played in Greek life. For the later Greeks, the declamations of rhetoricians, which we find intolerably tedious to read, had as intense an æsthetic value as the Homeric poems for their remote ancestors, and were listened to with as eagerly attentive and as critical ears. People went to hear a rhetorical display just as we go to hear a symphony. And this interest lasted down to late Graeco-Roman times. Greek prose was always an art in as full a sense as the poetry from which it sprang, regulated by principles and canons, which have no counterpart in modern languages, even in French, and required prolonged study and practice. And rhetoric came to fulfil for Greek audiences the same rôle which had been once fulfilled by the epics. Just as the historians, or as we should say mythologers, of the Homeric age were epic poets, so the later historians were rhetoricians. If the historian were not trained in the school of the rhetorician he would have had few readers.

Among the Romans, rhetoric, having its great expositor and defender in Quintilian, came to be even less original than among the Greeks. Mr. Taylor places it first among the "phases of pagan decadence":²⁰

In general this literary decline was a decline from relevancy of treatment of subjects having real interest to irrelevancy of treatment of subjects having no real interest; from setting forth veritable features of human life to devising preposterous fictions; from large delineation of human character to the absence of any veritable and distinctive characterization of persons real or imaginary; from setting forth the course of human life according to its most truly considered laws to setting it forth in ways of happening and accident, which bear no true relation to character and situation. These decadent traits do not all appear in any one class of compositions; but those writings which exhibit them most strikingly are those which also show characteristics of medieval literature. . . . Thus these latter-day Graeco-Roman writings illustrate how the classical, or rather the Graeco-Roman, or Hellenized Roman personality, was intellectually declining to the level of the men of the early medieval times, whether barbarians by birth or native denizens of the Empire.

Rhetorical studies, and compositions of a rhetorical character, illustrate the indiscriminate use of subjects void of real interest, as well as the irrelevancy of treatment even of the subject chosen. Roman rhetoric had been a great civilizer and Romanizer of conquered provinces. The rhetorician followed hard on the army to teach the new provincials the Roman Latin literature, and in a way which fostered oratory and the faculty of turning off rhetorically proper Latin phrases. But under the Empire, oratory, whether practised at Rome or in the provinces, was emptied of its genuine purpose, which is to express opinions held upon public matters in order to influence the action of free fellow-citizens. Outside the business of the law, oratory became empty and insincere. It had its apt preparation in the schools of rhetoric, where the rounding of grammatical periods in prose or verse was everything, while pertinency to anything real in life was nothing. Subjects of study and discourse, rhetorically selected in order to cultivate cleverness of expression, do not bind the writer or speaker to pertinency to the matter in hand. Education by such means may become an education in irrelevancy for the youth of a society which is becoming more and more dilettante as it loses power to shape its destinies.

²⁰H.O. Taylor, "The Classical Heritage of the Middle Ages," p. 33-6.

The result of this rhetorical fostering of irrelevancy is seen in compositions written for an occasion, as a panegyric on an emperor. These are flatteries, if not lies. They may, however, be pertinent. But in declining times the deeds of the great man dwindle, and the orator is tempted to fill out his speech with pretty matters not quite pertinent. At last these panegyrics become models of irrelevancy. The man praised is fulsomely addressed and flattered, and great deeds are heaped on him. Then the orator may pass to regions of mythology—safe topic—nor return. This is one mark of intellectual decline; for pertinency of treatment is as indicative of intellect as is the character of the subject treated and the reality of its relationship to life. It marks one phase of Roman decline that great numbers of such panegyrics were composed, delivered, and immensely admired. They gave Symmachus his reputation; and Sidonius Apollinaris was made *praefectus urbi* as a reward for one addressed to the shadow emperor Anthemius.

6. *The Seven Liberal Arts as the Approved Program of Intellectual Interests and Academic Studies*—Nothing could better illustrate the decline of the place of scientific interests in classical culture than the accepted classification and program of subjects for pursuit by the intellectually inclined which took form in later paganism under the historic title of the "Seven Liberal Arts"—grammar, rhetoric, and dialectic, or the *trivium*; and geometry, arithmetic, astronomy and music, or the *quadrivium*. These subjects had been for the most part developed, distinguished and isolated as early as the time of Plato and Aristotle. Varro in his "Disciplinarum Libri Novem" had carried further the process of distinction and classification. The definitive exposition of the seven liberal arts was, however, the work of an African Neoplatonist, Martianus Capella, who lived sometime during the fourth or in the early fifth century. Taylor says of his work:²¹

Perhaps the most widely used school book of the Middle Ages was the "De Nuptiis Philologiae et Mercurii" by Martianus Capella, an African Neo-platonist, who wrote in the first part of the fifth century. It is a work in nine books. The first two are devoted to the allegorical narrative of the marriage of Mercury with the polymath virgin Philology. Mercury seeks a bride; he cannot have Sophia or Mantice or Psyche; Virtus counsels him to ask Apollo's advice, and Apollo advises him to wed Philology. Under the joyful convoy of the Muses and encephyred by the music of the spheres, Virtus, Apollo, and the bridegroom fly to Jove's palace to ask his consent. A council of the gods is summoned; a favorable decision is reached; the bride shall be raised to divine rank. With the second book she appears, desiring the marriage, but fearful at the greatness of the honor. Her mother, Phronesis, adorns her for the wedding; four noble matrons, the cardinal virtues, greet her, and the Graces, with three mystic kisses, give her courage. Athanasia, daughter of Apotheosis, comes to lead her to Heaven, but first commands her to deliver that with which her bosom is seen to swell; at this she vomits forth many rolls of papyrus and of linen, which are gathered up by the Virgin Artes and Disciplinae, Urania and Calliope helping. The bride now drains the goblet of immortality, and rises to heaven, where Juno Pronuba meets

²¹Taylor, "Classical Heritage," p. 49-51.

her with offerings. Under the guidance of Juno, she traverses the circles of the planets and reaches the Milky Way, where Jove's palace is. There all the gods and beings known to Latin mythology assemble, with here and there a deity from Egypt, besides the guards of the elements (*elementorum praesides*) and a most beauteous company of the angelic folk and souls of blessed ancients. Now the bride's prudent mother demands a reading of the tables of the dower and the *lex Papia Poppaeaque*, regarding the property rights of married women. Thereupon Phoebus rises and leads forward, to place with the bridal gifts, seven maid-servants from his brother's household; these are the seven Artes—Ars Grammatica; Ars Dialectica, "a little paler"; Rhetorica; Geometria; Arithmetica; Astronomia; Harmonia. Each one, as Phoebus leads her forward, tells her parentage, and then expounds the substance of her art, most dryly, all virginal allegory laid aside. They have a book apiece, and make up the tale of the nine books of Capella.

This work became the "standard" school book of the Middle Ages. Its form and character anticipates medieval taste, upon which it was to be so influential. It is written in prose and verse, the *chantefable* form; though the song-element is unimportant in the last seven books. These are strictly instructive, and sapless as the rods of medieval schoolmasters. The allegory of the first two books is pleasingly pedantic and the whole work presents the sterile union of fantasy with pedantry, so dear to the closing years of pagan scholarship, when the old straw was thrashed, re-tied in queer-shaped bundles, and then thrashed again. The process produced *pabulum* for coming generations.

The hierarchy of the seven arts was elaborated by Boethius and others, and typical medieval text-books on the arts were provided by Cassiodorus. The concentration of the learned upon the seven liberal arts distinctly diverted their attention from both science and the scientific attitude. Of the two divisions of the arts the *trivium* was much more highly esteemed than the *quadrivium*, and, during the Middle Ages, received the bulk of the concern of students.²² Even the *quadrivium* itself did not contain the more promising and practical sciences, but merely the most logical and formal. Further, geometry, arithmetic and astronomy did not mean in their medieval content what they did in Hellenistic days or what they do now. Rather, they were chiefly concerned with formal definition and the magic potency of numbers and celestial phenomena.²³ There was, then, nothing in the seven liberal arts which could promote science and little which would not discourage it. With the coming of Christianity the seven liberal arts were regarded as but the hand-maidens of theology, which immediately became the "Queen of the Sciences."

7. *The Indiscriminate Compilation of Compendia of Pseudo-Scientific Data and Superstitious Tradition*—One of the most conspicuous aspects of the pagan decadence and something

²²L. J. Paetow, "The Arts Course in the Medieval Universities," p. 2 ff.

²³E. Brehaut, "An Encyclopedist of the Dark Ages: Isidore of Seville," p. 89-154.

which was continued by Christian scholars, was the tendency towards producing enormous compilations of alleged scientific material, accepting tradition, gossip and hearsay as the basis, instead of endeavoring to acquire however small an amount of new knowledge by the patient method of inductive investigation. While some of the best of the earliest of these compilations unquestionably embodied the prevailing scientific notions of their day, they invariably and inevitably included also much pseudo-scientific tradition, and in no case could they add anything to the sum total of human knowledge. The very best compilation is necessarily inferior to the poorest laboratory investigation as a means of extending our scientific information. Most of these compilations, however, embraced but little of the Athenian or Hellenistic science and came more and more to embody the wildest guesses and the crudest superstitions, to which were added by the Christian compilers the miraculous, the allegorical and the anagogical. This process of compilation began, and appeared at its best, in Aristotle. Its course of development and cumulative degradation runs on through Varro's works, Pliny's "Natural History," Ptolemy's "Almagest," the compilations of Boethius, Cassiodorus, and Gregory the Great, Isidore of Seville's "Etymologies," Rhabanus Maurus' "De Universo," Alexander Neckham's "De Naturis Rerum," and Vincent of Beauvais' "Speculum."²⁴ Mr. Taylor thus summarizes the significance of this compiling tendency for the history of thought and science:²⁵

For the Latin West the creative patristic epoch closes with the death of Augustine. There follows a period marked by the cessation of intellectual originality. Men are engaged upon translations from the Greek; they are busy commenting upon older writings, or are expounding with a change of emphasis the systematic constructions of their predecessors. Epitomes and compendia appear, simplified and mechanical abstracts of the bare elements of inherited knowledge and current education. Compilations are made, put together of excerpts taken unshriven and unshorn into the compiler's writing. Knowledge is brought down to a more barbaric level. Yet temperament lingers for a while, and still appears in the results.

The representatives of this post-patristic period of translation, comment, and compendium, and of re-expression with temperamental change of emphasis, are the two contemporaries, Boethius and Cassiodorus; then Gregory the Great, who became pope soon after Cassiodorus closed his eyes at the age of ninety or more; and, lastly, Isidore, Archbishop of Seville, who died in 636, twenty-two years after Gregory. All these were Latin bred, and belonged to the Roman world rather than to those new peoples whose barbarism was hastening the disruption of a decadent order, but whose recently converted zeal was soon to help on the further

²⁴See selections from such compilations in Brehaut, *op. cit.*, *passim*, R. Steele, "Medieval Lore," and G. G. Coulton, "A Medieval Garner."

²⁵Taylor, "Mediaeval Mind," Vol. I, p. 88-9.

diffusion of Latin Christianity. They appear as transmitters of antique and patristic thought; because, originating little, they put together matter congenial to their own lowering intellectual predilections, and therefore suitable mental pabulum for times of mingled decadence and barbarism, and also for the following periods of medieval re-emergence which continued to hark back to the obvious and the easy.

Instead of transmitters, a word indicating function, one might call these men *intermediaries*, and so indicate their position as well as rôle. Both words, however, should be taken relatively. For all the Fathers heretofore considered were in some sense transmitters or intermediaries, even though creative in their work of systematizing, adding to, or otherwise transforming their matter. Yet one would not dub Augustine a transmitter, because he was far more of a remaker or creator. But a dark refashioner indeed will Gregory the Great appear; while Boethius, Cassiodorus, Isidore are rather sheer transmitters, or intermediaries, the last-named worthy destined to be the most popular of them all, through his unerring faculty of selecting for his compilations the foolish and the flat.

8. *The Decline of the Older Greek and Roman Paganism and the Rise of the Emotional Mystery Cults*—What cultural historians regard as the most important psychological change which took place during classical paganism came during the first centuries of the Christian era. It consisted in the transformation of the religious disposition of the Roman Empire.²⁶ The old stereotyped and relatively unemotional and non-individualized religion of the early agricultural Republic gradually lost its vitality and died out in the face of the competition of the newly discovered oriental cults which the Roman legions and sailors were bringing back with them to Italy. These new mysteries—that of the Great Mother Goddess of Phrygia, that of the Invincible Sun of Syria, the Egyptian cult of Isis and Serapis, and the Persian mystery of Mithra—were designed to play upon the emotions of the individual, bringing a consciousness of sin, a desire for salvation and purification, and a promise of eternal life in a future world. They prepared the way for the emotionalism and otherworldliness of Christianity, both of which were highly destructive of the calm imperturbability and mundane interests of the natural scientist.²⁷ Particularly significant is the fact that these oriental mysteries captured the learned classes as well as the masses, while the great minds of earlier paganism had remained for the most part sceptical of the older state religion and popular cults. Franz Cumont, the most eminent authority upon this phase of classical history, thus describes this great religious transformation which was

²⁶W. Warde Fowler, "The Religious Experience of the Roman People," "Lectures XVII-XIX; F. Cumont, "Oriental Religions in Roman Paganism," Chap. II, and "The Mysteries of Mithra."

²⁷Cumont, "Oriental Religions," *passim*.

to be carried further by Christianity, itself regarded by contemporaries as but one more mystery cult:²⁸

In very early times Greece—later imitated by Rome—became resolutely rationalistic; her greatest originality lies here. Her philosophy was purely laical; thought was unrestrained by any sacred tradition; it even pretended to pass judgment upon these traditions and condemned or approved of them. Being sometimes hostile, sometimes indifferent and sometimes conciliatory, it always remained independent of faith. But while Greece thus freed herself from the fetters of a superannuated mythology, and openly and boldly constructed those systems of metaphysics by means of which she claimed to solve the enigmas of the universe, her religion lost its vitality and dried up because it lacked the strengthening nourishment of reflection. It became a thing devoid of sense, whose *raison d'être* was no longer understood; it embodied dead ideas and an obsolete conception of the world. In Greece as well as at Rome it was reduced to a collection of unintelligible rites, scrupulously and mechanically reproduced without addition or omission because they had been practised by the ancestors of long ago, and formulas hallowed by the *mos maiorum*, that were no longer understood or sincerely cherished. Never did a people of advanced culture have a more infantile religion. . . .

To recapitulate, the Oriental religions acted upon the senses, the intellect and the conscience at the same time, and therefore gained a hold on the entire man. Compared with the ancient creeds, they appear to have offered greater beauty of ritual, greater truth of doctrine and a far superior morality. The imposing ceremonial of their festivities and the alternating pomp and sensuality, gloom and exaltation of their services appealed especially to the simple and the humble, while the progressive revelation of ancient wisdom, inherited from the old and distant Orient, captivated the cultured mind. The emotions excited by these religions and the consolations offered strongly attracted the women, who were the most fervent and generous followers and the most passionate propagandists of the religions of Isis and Cybele. Mithra was worshipped almost exclusively by men, whom he subjected to a rigid moral discipline. Thus souls were gained by the promise of spiritual purification and the prospect of eternal happiness.

The worship of the Roman gods was a civic duty, the worship of the foreign gods the expression of a personal belief. The latter were the objects of the thoughts, feelings and intimate aspirations of the individual, not merely of the traditional and, one might say, functional adoration, of the citizen. The ancient municipal devotions were connected with a number of earthly interests that helped to support each other. They were one of various forms of family spirit and patriotism and guaranteed the prosperity of the community. The Oriental mysteries, directing the will toward an ideal goal and exalting the inner spirit, were less mindful of economic utility, but they could produce that vibration of the moral being that caused emotions, stronger than any rational faculty, to gush forth from the depths of the soul. Through a sudden illumination they furnished the intuition of a spiritual life whose intensity made all material happiness appear insipid and contemptible. This stirring appeal of supernatural life made the propaganda irresistible. The same ardent enthusiasm guaranteed at the same time the uncontested domination of neo-Platonism among the philosophers. Antiquity expired and a new era was born.

9. *The Rise of Pagan Diabolism and Eschatology*—Growing in large part out of the acceptance of these Oriental mystery

²⁸*Ibid.*, p. 31, 43-5.

cults, particularly out of Mithraism and the Persian influences, was the development of a belief in cosmic dualism, diabolism and eschatology and the growth of a dominating interest in "last things."²⁹ The distinction between good and evil spirits and a belief in their interference in human affairs has been common among all peoples where the scientific spirit has not gained ascendancy, but the idea of the universe as an arena specifically created for the struggle between the principles and personified powers of good and evil was a concept which came to the classical world from the Persian tradition of the duel of Ormuzd and Ahriman. This notion not only prepared the way for the development of the sordid Christian diabolism, but was the actual historical source of the derivation of this belief.³⁰ As Cumont says:³¹

In his treatise against the magi, Theodore of Mopsuestia speaks of Ahriman as Satan. At first sight there really is a surprising resemblance between the two. Both are heads of a numerous army of demons; both are spirits of error and falsehood, princes of darkness, tempters and corrupters. An almost identical picture of the pair could be drawn, and in fact they are practically the same figure under different names. It is generally admitted that Judaism took the notion of an adversary of God from the Mazdeans along with portions of their dualism. It was therefore natural that Jewish doctrine, of which Christianity is heir, should have been closely allied to the mysteries of Mithra. A considerable part of the more or less orthodox beliefs and visions that gave the Middle Ages their nightmare of hell and the devil thus came from Persia by two channels: on the one hand Judeo-Christian literature, both canonical and apocryphal; and on the other, the remnants of the Mithra cult and the various sects of Manicheism that continued to preach the old Persian doctrines on the antagonism between the two world principles.

Intimately related to this was the Persian belief in a final cataclysmic close of this cosmic duel, the discomfiting of Ahriman and the powers of darkness, the destruction of his followers, and the eternal bliss of the faithful who had chosen to support Ormuzd and had aided their saviour, Mithra. The Greeks and Romans had possessed no very clear or vital conception of immortality and had not taken any conspicuous interest in "last things," but, with the wide-spread acceptance of the Persian eschatology, the attention of men became more and more directed towards preparation for death rather than for life, and towards the assurance of immortal existence rather than towards the concern with the affairs of this world.³² This culminated in the Patristic attitude, best reflected in Augustine's "City of God," in which earthly existence was

²⁹R. H. Charles, "A Critical History of the Doctrine of a Future Life."

³⁰A. Reville, "The Devil: His Origin, Greatness and Decadence."

³¹Cumont, "Oriental Religions," p. 153-4.

³²Charles, *op. cit.*; Cumont, Chaps. II, VI, VIII.

pictured as but an ephemeral and inferior experience, designed solely to test fitness for entry into the blessed immortality of the elect in the City of God. For such as espoused these beliefs, science had less than any attraction.

III. THE MORE IMPORTANT ASPECTS OF THE CHRISTIAN OR PATRISTIC CULTURAL TRADITION WHICH MADE IMPOSSIBLE THE FLOURISHING OF NATURAL SCIENCE

1. *Syncretic Nature of Christianity*—The obstruction of scientific development by orthodox theological notions is a matter which is common knowledge among historians and scientists, owing to the remarkable exposition of the subject by J. W. Draper, Andrew D. White, J. M. Robertson, J. B. Bury and others, and calls for nothing more than a brief summary in this paper.

Both critics and apologists of Christianity have usually erred in analyzing the influence of Christianity upon the culture of the later Roman Empire and the Middle Ages. Sceptical and critical students have normally assigned to Christianity full responsibility for the intellectual and cultural degradation of the first millennium of the Christian era. Christian apologists, on the other hand, have been wont to follow Orosius in picturing the pagan past as one of unmixd sin, misery, corruption and ignorance, and in representing Christianity as having introduced an altogether new and higher form of moral and intellectual life. If the above discussion of the decline of pagan learning has demonstrated anything, it must have made it clear that, without any Christian influences whatever, the cultural conditions of the later classical period would have effectively stifled all or most productive scientific effort. On the other hand, it is equally clear that Christianity did not help matters at all, but rather contributed to the pre-existing tendencies towards intellectual degradation. It added relatively little which was new to the intellectual tendencies of the times, but was chiefly a synthesis of the culture of the period. As Professor Robinson has well described the facts in the case: "It has been the habit of Christian apologists to contrast Christianity, pure and undefiled, with an unspeakable 'paganism' or idol worship. Historical Christianity now appears to the modern student of comparative religion to have been the highly complex result of a long development, and to resemble in certain important respects a number of world religions—Stoicism, Hellenistic paganism, Neoplatonism, Mithraism, Manichaeism, Judaism (all of which carried over with them more primitive elements)—with which it found itself in

rivalry during the early centuries of its existence. It was the product of religious *syncretism*, a process of unconscious borrowing and lending."³³

2. *Christian Cosmology, Teleology and Eschatology*—Perhaps the most significant contribution of Christianity to the anti-scientific movement lay in the general *Weltanschauung* which it wrought out for itself from the many religious and intellectual currents of the Roman Empire. It accepted the Persian view of cosmic dualism—the world as the arena of the contest between good and evil—substituting Yahweh and Christ for Ormuzd and Mithra, and Satan or the Devil for Ahriman, as the leaders of the hosts of righteousness and evil.³⁴

This view of cosmology furnished a most significant impulse to the vigorous Christian teleology. There was no event in history and no aspect of natural phenomena which failed to reflect this great cosmic struggle. There was a divine purpose in all creation and all existence. History and "science" were useful only in so far as they aided one in understanding this divine purpose, and in better adapting his personal existence to its fulfilment. As Professor Robinson well says:³⁵

One of the greatest contrasts between medieval thinking and the more critical thought of to-day lies in the general conception of man's relation to the cosmos. To the medieval philosopher, as to the stupidest serf of the time, the world was made for man. All the heavenly bodies revolved about man's abode as their center. All creatures were made to assist or to try man. God and the devil were preoccupied with his fate, for had not God made him in his own image for his glory, and was not the devil intent on populating his own infernal kingdom? It was easy for those who had a poetic turn of mind to think of nature's working as symbols for man's edification. The habits of the lion or the eagle yielded moral lessons or illustrated the divine scheme of salvation. Even the written word was to be valued, not for what it seemed to say, but for hidden allegories depicting man's struggles against evil and cheering him on his way.

Even more than the Persians the Christians were interested in eschatology, which was the Christian analogue or, rather, antithesis, of the modern theory of progress. The creation and existence of the world and the life of all creatures upon it had, as the underlying *rationale* of their existence and the desirable orientation of their activities, the securing of the final triumph

³³J. H. Robinson, "An Outline of the History of the Western European Mind," p. 17. The best available treatments of the syncretic nature of Christianity are F. C. Conybeare, "Myth, Magic and Morals"; T. R. Glover, "The Conflict of Religions in the Roman Empire"; P. Gardner, "Exploratio Evangelica"; and W. R. Cassels, "Supernatural Religion."

³⁴M. N. Dhalla, "Zoroastrian Theology," Chaps. XVIII, XXX.

³⁵Robinson, "Mind in the Making," p. 142-3.

of good over evil, the destruction of the Devil and his forces, and the salvation of God's creatures from the fiery torture which awaited the servants of sin after the last great cataclysmic overthrow of Satan and his cohorts. "This was especially true in the Middle Ages," says Professor Robinson. "During these centuries men's single objective was the assurance of heaven and escape from hell. Life was an angry river into which men were cast. Demons were on every hand to drag them down. The only aim could be, with God's help, to reach the celestial shore. There was no time to consider whether the river might be made less dangerous by concerted effort, through the deflection of its torrents and the removal of its sharpest rocks. No one thought that human efforts should be directed to making the lot of humanity progressively better by intelligent reforms in the light of advancing knowledge."³⁶ This majestic illusion, created by the synthetic capacity of the Patristic mind, and best set forth in Augustine's "City of God," so destructive of any justification of scientific interest in the concrete and fleeting things of this earth, has been most eloquently described by Santayana in his summary of the "Christian Epic":³⁷

There was in the beginning, so runs the Christian story, a great celestial King, wise and good, surrounded by a court of winged musicians and messengers. He had existed from all eternity, but had always intended, when the right moment should come, to create temporal beings, imperfect copies of himself in various degrees. These, of which man was the chief, began their career in the year 4004 B. C., and they would live on an indefinite time, possibly, that chronological symmetry might not be violated, until A. D. 4004. The opening and close of this drama were marked by two magnificent tableaux. In the first, in obedience to the word of God, sun, moon, and stars, and earth with all her plants and animals, assumed their appropriate places, and nature sprang into being with all her laws. The first man was made out of clay, by a special act of God, and the first woman was fashioned from one of his ribs, extracted while he lay in a deep sleep. They were placed in an orchard where they often could see God, its owner, walk in the cool of the evening. He suffered them to range at will and eat of all the fruits he had planted save that of one tree only. But they, incited by a devil, transgressed this single prohibition, and were banished from that paradise with a curse upon their head, the man to live by the sweat of his brow and the woman to bear children in labour. These children possessed from the moment of conception the inordinate natures which their parents had acquired. They were born to sin and to find disorder and death everywhere within and without them.

At the same time God, lest the work of his hands should wholly perish, promised to redeem in his good season some of Adam's children and restore them to a natural life. This redemption was to come ultimately through a descendant of Eve, whose foot should bruise the head of the serpent. But it was to be prefigured by many partial and special redemp-

³⁶*Ibid.*, p. 137.

³⁷G. Santayana, "The Life of Reason: Reason in Religion," p. 92-7.

tions. Thus, Noah was to be saved from the deluge, Lot from Sodom, Isaac from the sacrifice, Moses from Egypt, the captive Jews from Babylon, and all faithful souls from heathen forgetfulness and idolatry. For a certain tribe had been set apart from the beginning to keep alive the memory of God's judgments and promises, while the rest of mankind, abandoned to its natural depravity, sank deeper and deeper into crimes and vanities. The deluge that came to punish these evils did not avail to cure them. "The world was renewed and the earth rose again above the bosom of the waters, but in this renovation there remained eternally some trace of divine vengeance. Until the deluge all nature had been exceedingly hardy and vigorous, but by that vast flood of water which God had spread out over the earth, and by its long abiding there, all saps were diluted; the air, charged with too dense and heavy a moisture, bred ranker principles of corruption. The early constitution of the universe was weakened, and human life, from stretching as it had formerly done to near a thousand years, grew gradually briefer. Herbs and roots lost their primitive potency and stronger food had to be furnished to man by the flesh of other animals. . . . Death gained upon life and men felt themselves overtaken by a speedier chastisement. As day by day they sank deeper in their wickedness, it was but right they should daily, as it were, stick faster in their woe. The very change in nourishment made manifest their decline and degradation, since as they became feebler they became also more voracious and blood-thirsty."

Henceforth there were two spirits, two parties, or, as Saint Augustine called them, two cities in the world. The City of Satan, whatever its artifices in art, war, or philosophy, was essentially corrupt and impious. Its joy was but a comic mask and its beauty the whitening of a sepulchre. It stood condemned before God and before man's better conscience by its vanity, cruelty, and secret misery, by its ignorance of all that it truly behoved a man to know who was destined to immortality. Lost, as it seemed, within this Babylon, or visible only in its obscure and forgotten purlieu, lived on at the same time the City of God, the society of all the souls God predestined to salvation; a city which, however humble and inconspicuous it might seem on earth, counted its myriad transfigured citizens in heaven, and had its destinies, like its foundations, in eternity. To this City of God, belonged, in the first place, the patriarchs and the prophets who, throughout their plaintive and ardent lives, were faithful to what echoes still remained of a primeval revelation, and waited patiently for the greater revelation to come. To the same city belonged the magi who followed a star till it halted over the stable in Bethlehem; Simeon, who divined the present salvation of Israel; John the Baptist, who bore witness to the same and made straight its path; and Peter, to whom not flesh and blood, but the spirit of the Father in heaven, revealed the Lord's divinity. For salvation had indeed come with the fulness of time, not, as the carnal Jews had imagined it, in the form of an earthly restoration, but through the incarnation of the Son of God in the Virgin Mary, his death upon a cross, his descent into hell, and his resurrection at the third day according to the Scriptures. To the same city belonged finally all those who, believing in the reality and efficacy of Christ's mission, relied on his merits and followed his commandment of unearthly love.

All history was henceforth essentially nothing but the conflict between these two cities; two moralities, one natural, the other supernatural; two philosophies, one rational, the other revealed; two beauties, one corporeal, the other spiritual; two glories, one temporal, the other eternal; two institutions, one the world, the other the Church. These, whatever, their momentary alliances or compromises, were radically opposed and funda-

mentally alien to one another. Their conflict was to fill the ages until, when wheat and tares had long flourished together and exhausted between them the earth for whose substance they struggled, the harvest should come; the terrible day of reckoning when those who had believed the things of religion to be imaginary would behold with dismay the Lord visibly coming down through the clouds of heaven, the angels blowing their alarming trumpets, all generations of the dead rising from their graves, and judgment without appeal passed on every man, to the edification of the universal company and his own unspeakable joy or confusion. Whereupon the blessed would enter eternal bliss with God their master and the wicked everlasting torments with the devil whom they served.

The drama of history was thus to close upon a second tableau: long-robed and beatified cohorts passing above, amid various psalmodies, into an infinite luminous space, while below the damned, howling, writhing, and half transformed into loathsome beasts, should be engulfed in a fiery furnace. The two cities, always opposite in essence, should thus be finally divided in existence, each bearing its natural fruits and manifesting its true nature.

This synthesis of the Patristic view was doubly deadly to science on account of the authoritative way in which it was inculcated for a thousand years. Professor Robinson says:³⁸

This general account of man, his origin and fate, embraced in the Christian Epic, was notable for its precision, its divine authenticity, and the obstacles which its authority consequently presented to any revision in the light of increasing knowledge. The fundamental truths in regard to man were assumed to be established once and for all. The Greek thinkers had had little in the way of authority on which to build, and no inconsiderable number of them frankly confessed that they did not believe that such a thing could exist for the thoroughly sophisticated intelligence. But medieval philosophy and science were *grounded wholly in authority*. The medieval schoolmen turned aside from the hard path of skepticism, long searchings and investigation of actual phenomena, and confidently believed that they could find truth by the easy way of revelation and the elaboration of unquestioned dogmas.

This reliance on authority is a fundamental primitive trait. We have inherited it not only from our medieval forefathers, but, like them and through them, from long generations of prehistoric men. We all have a natural tendency to rely upon established beliefs and fixed institutions. This is an expression of our spontaneous confidence in everything that comes to us in an unquestioned form. As children we are subject to authority and cannot escape the control of existing opinion. We unconsciously absorb our ideas and views from the group in which we happen to live. What we see about us, what we are told, and what we read has to be received at its face value so long as there are no conflicts to arouse skepticism.

We are tremendously suggestible. Our mechanism is much better adapted to credulity than to questioning. All of us *believe* nearly all the time. Few doubt, and only now and then. The past exercises an almost irresistible fascination over us. As children we learn to look up to the old, and when we grow up we do not permit our poignant realization of elderly incapacity among our contemporaries to rouse suspicions of Moses, Isaiah, Confucius, or Aristotle. Their sayings come to us unquestioned; their remoteness makes inquiry into their competence impossible. We readily assume that they had sources of information and wisdom superior to the prophets of our own day.

³⁸Robinson, "Mind in the Making," p. 126-8.

3. *Asceticism and the Emphasis upon Withdrawal from Worldly Occupations and Mundane Interests*—In view of the Patristic emphasis on the supreme importance of securing entry on a favorable basis into the world to come, and the related warning against absorption with mundane matters, it is not surprising that a large group of Christians in the early Middle Ages separated themselves from the majority of mankind and devoted themselves entirely, in theory at least, to spiritual exercises, which they believed would insure their certain salvation.³⁹ While this precaution seems rather superfluous, in view of the prevailing dogmas as to the efficacy of the sacramental scheme of salvation, yet the popularity of the monastic life is not to be wondered at in the light of the philosophy of life which dominated the Patristic period. Withdrawal from the world was certainly additional insurance against its seductions. The intensity of the emotional complex which prompted the ascetic career can be discerned in the following citation from Saint Jerome's exhortation to escape the dangerous attractions of earthly cares and joys and to enter upon the holy life of the monk:⁴⁰

Though your little nephew twine his arms around your neck; though your mother, with disheveled hair and tearing her robe asunder, point to the breast with which she nourished you; though your father fall down on the threshold before you, pass on over your father's body. Fly with tearful eyes to the banner of the cross. In this matter cruelty is the only piety. . . . Your widowed sister may throw her gentle arms around you. . . . Your father may implore you to wait but a short time to bury those near to you, who will soon be no more. Your weeping mother may recall your childish days, and may point to her shrunken breast and to her wrinkled brow. Those around you may tell you that all the household rests upon you. Such chains as these the love of God and the fear of hell can easily break. You say that Scripture orders you to obey your parents, but he who loves them more than Christ loses his soul. The enemy brandishes a sword to slay me. Shall I think of a mother's tears?

(When once his friend has cast off the responsibilities of the world he will discover that the desert is full of attractions.) O solitude, whence are brought the stones of the city of the Great King! O wilderness rejoicing close to God! What would you, brother, in the world,—you that are greater than the world? How long are the shades of roofs to oppress you? How long the dungeon of a city's smoke? Believe me, I see more of light! How refreshing to cast off the things that oppress the body and fly away into the pure sparkling ether!

Do you fear poverty? Christ called the poor "blessed." Are you terrified at labor? No athlete without sweat is crowned. Do you think of food? Faith fears not hunger. Do you dread the naked ground for limbs consumed with fasts? The Lord lies with you. Does the thought of unkempt locks disturb you? Your head is Christ. Does the infinite vastness of the desert affright you? In the mind walk abroad in Paradise.

³⁹Taylor, "Classical Heritage of the Middle Ages," Chap. VII.

⁴⁰Robinson, "Readings in European History," Vol. I, p. 86-7.

So often as you do this there will be no desert. Does your skin roughen without baths? Who is once washed in Christ needs not to wash again. In a word, hear the apostle as he answers: "The sufferings of the present time are not worthy to be compared with the glory which shall be revealed in us!" You are too pleasure-loving, brother, if you wish to rejoice in this world and hereafter to reign with Christ!

Some have contended that the monastic life was an impulse to scientific activity and have pointed to the example of scientific achievements by monks from the time of Albertus Magnus and Roger Bacon to Gregor Mendel, but it must not be forgotten that the scholarly and scientific activities of the monks were incidental to their avowed concentration on spiritual matters. Indeed, one may go further and say that all the scientific activity they carried on was consciously or unconsciously a complete negation of the basic justification of the monastic career. As a matter of fact according to the authoritative opinion of Augustine, all science and secular learning, past and present, belonged essentially to the City of the Devil.

4. *Allegory, Symbolism and Vagueness of Expression*—Allegory and symbolism were no innovation of Christianity. They were present in both Oriental and Classical thought, particularly in Hellenistic Judaism and in Neoplatonism.⁴¹ But Christianity supplied additional impulses. With the acceptance of the orthodox view of the literal inspiration and complete harmony of the Scriptures, it became necessary to resort to allegorical interpretation in order to explain away obvious discrepancies, to excuse incidents of conduct not appropriate in the chosen servants of God, and to interpret literal impossibilities. Another impulse came from teleology and eschatology. If all incidents or events were linked together as a part of the majestic scheme of universal orientation and purpose, one should seek in all things, particularly in the Scriptures, a deeper and loftier meaning than that which appears in the literal sense of the passage.⁴² The most effective exponent of the allegorical method was the great Alexandrian Father, Origen. Shotwell and Conybeare have well stated Origen's justification of this procedure:

Interpretation of the scriptures by allegory is not, in Origen's eyes, an unwarranted liberty. The scriptures themselves sanction it—allegorically! "There is a hidden and secret meaning," he says, "in each individual word. The treasure of divine wisdom is hid in the vulgar and unpolished vessels of words; as the apostle also points out when he says, 'We have this treasure in earthen vessels.'" Quaintly naïve as such reasoning seems when based upon a single text, its weakness becomes its

⁴¹Taylor, "Classical Heritage of the Middle Ages," p. 90 ff.

⁴²Taylor, "Medieval Mind," Vol. II, Chap. XXVIII.

strength when sufficient texts are adduced, to convey the impression that the scriptures themselves do really proclaim their own symbolic character. This Origen endeavors to do. "If the texts of Moses had contained nothing which was to be understood as having a secret meaning, the prophet would not have said in his prayer to God: 'Open thou mine eyes and I will behold wondrous things out of thy law (Psalms, 119-18).'" What, he asks, can one make out of the prophecy of Ezekiel except allegorically? Prophetic literature implies allegory in its very structure. But the strongest proof of the legitimacy of allegorical interpretation is its use in the New Testament, and so largely by St. Paul.⁴³

Wherever, Origen argues, we meet with such useless, nay impossible, incidents and precepts as these, we must discard a literal interpretation and consider of what moral interpretation they are capable, with what higher and mysterious meaning they are fraught, what deeper truths they were intended symbolically and in allegory to shadow forth. The divine wisdom has of set purpose contrived these little traps and stumbling-blocks in order to cry halt to our slavish historical understanding of the text, by inserting in its midst sundry things that are impossible and unsuitable. The Holy Spirit so waylays us in order that we may be driven by passages which taken in their *prima facie* sense cannot be true or useful, to search for the ulterior truth, and seek in the Scriptures which we believe to be inspired by God a meaning worthy of Him.⁴⁴

The absurdities of the allegorical method and symbolism, and the vast gulf which separates them from the scientific procedure can, perhaps, best be illustrated by two typical passages, one from the Epistle of Barnabas and the other from Gregory the Great's "Moralia" or commentary on the Book of Job:

Now what do you suppose this to be a type of, that a command was given to Israel, that men of the greatest wickedness should offer a heifer, and slay and burn it, and that then boys should take the ashes, and put these into vessels, and bind round a stick purple wool along with hyssop, and that thus the boys should sprinkle the people, one by one, in order that they might be purified from their sins? Consider how He speaks to you with simplicity. The calf is Jesus: the sinful men offering it are those who lead Him to the slaughter. But now the men are no longer guilty, are no longer regarded as sinners. And the boys that sprinkle are those that have proclaimed to us the remission of sins and purification of heart. To these He gave the authority to preach the gospel, being twelve in number, corresponding to the twelve tribes of Israel. But why are there three boys that sprinkle? To correspond to Abraham, and Isaac, and Jacob, because these were great with God. And why was the wool (placed) upon the wood? Because by wood Jesus holds His kingdom, so that (through the cross) those believing on Him shall live for ever. But why was hyssop joined with the wool? Because in His kingdom the days will be evil and polluted in which we shall be saved, (and) because he who suffers in body is cured through the cleansing efficacy of hyssop. And on this account the things which stand thus are clear to us, but obscure to them, because they did not hear the voice of the Lord.⁴⁵

⁴³J. T. Shotwell, in *Journal of Philosophy, Psychology and Scientific Methods*, February 26, 1920, p. 115-6.

⁴⁴F. C. Conybeare, "A History of New Testament Criticism," p. 14-5.

⁴⁵The Epistle of Barnabas, in "Apostolic Fathers," Ante-Nicene Christian Library, Vol. I, p. 114-5.

(The manner of this allegorical interpretation, so popular throughout the Middle Ages, may be illustrated by Gregory's commentary on the statement that Job possessed, among other property, "five hundred yoke of oxen and five hundred she asses.")

We have said above that by the number fifty, which is completed by seven weeks and the addition of an unit, rest is signified, and by the number ten the sum of perfection is set forth. Now, forasmuch as the perfection of rest is promised to the faithful, by multiplying fifty ten times, we arrive at five hundred. But in Sacred Writ the title of oxen sometimes represents the dullness of the foolish sort, and sometimes the life of well-doers. For because the stupidity of the fool is represented by the title of an ox, Solomon says rightly, "He goeth after her straightway, as an ox goeth to the slaughter." Again, that the life of every laborer is set forth by the title of oxen, the precepts of the Law are a testimony, which enjoined through Moses, "Thou shalt not muzzle the ox when he treadeth out the corn." And this again is declared in plain words, "The labourer is worthy of his hire."

By the title of asses, too, we have represented sometimes the unrestrained indulgence of the wanton, sometimes the simple-mindedness of the Gentiles; for the inertness of fools is imaged by the designation of asses, as where it is said through Moses, "Thou shalt not plough with an ox and an ass together." As though he said, "Do not associate fools and wise men together in preaching, lest by means of him who has no power to accomplish the work you hinder him who has abundant power." The unrestrained indulgence of the wanton is likewise set forth by the appellation of asses, as the prophet testifies when he says, "whose flesh is as the flesh of asses."

Again, by the title asses is shown the simplicity of the Gentiles. Hence, when the Lord went up to Jerusalem, he is related to have sat upon a young ass. For what is it for him to come to Jerusalem sitting upon an ass, except taking possession of the simple hearts of the Gentiles to conduct them to the vision of peace, by ruling and ordering them? And this is shown by one passage, and that a very easy one, in that both the workmen of Judea are represented by oxen, and the Gentile peoples by an ass, when it is said by the prophet, "The ox knoweth his owner, and the ass his master's crib." For who appears as the ox saving the Jewish people, whose neck was worn by the yoke of the Law? And who was the ass but the Gentile world, which was like a brute animal readily seduced by every deceiver, for he did not resist by exercise of reason?⁴⁶

This development of allegory and symbolism was not only obstructive of the general attitude of scientific endeavor, it even colored the content of the pseudo-science of the period. Stones, plants and animals were supposed to possess magic qualities and symbolically to shadow forth divine verities or spiritual values.⁴⁷ "Natural science," says Professor Robinson, "like history, was only valuable as illustrating God's ways to man. Magic was useful to foretell the future, heal the sick, and to make gold."⁴⁸ The following citation

⁴⁶Selection from the "Moralia" in Robinson, "Readings in European History," Vol. I, p. 79-80.

⁴⁷L. Thorndike, "The Place of Magic in the Intellectual History of Europe."

⁴⁸J. H. Robinson, "History of the Western European Mind," p. 25.

from Mr. Taylor's paraphrase of a section of the "Physiologus," a much used work on natural history during the Patristic period, will constitute a sufficient illustration of the so-called "theistic biology" so characteristic of the prevailing symbolism of all branches of Patristic "science":⁴⁹

Well known as these stories are, one or two examples may be given to recall their character: The Lion has three characteristics; as he walks or runs he brushes his foot-prints with his tail, so that the hunters may not track him. This signifies the secrecy of the Incarnation—of the Lion of the tribe of Judah. Secondly, the Lion sleeps with his eyes open; so slept the body of Christ upon the Cross, while His Godhead watched at the right hand of the Father. Thirdly, the Lioness brings forth her cub dead; on the third day the father comes and roars in its face, and wakes it to life. This signifies the Lord's resurrection on the third day.

The Pelican is distinguished by its love for its young. As these begin to grow they strike at their parents' faces, and the parents strike back and kill them. Then the parents take pity, and on the third day the mother comes and opens her side and lets the blood flow on the dead young ones, and they become alive again. Thus God cast off mankind after the Fall, and delivered them over to death; but He took pity on us, as a mother, for by the Crucifixion He awoke us with His blood to eternal life.

The Unicorn cannot be taken by hunters, because of his great strength, but lets himself be captured by a pure virgin. So Christ, mightier than the heavenly powers, took on humanity in a virgin's womb.

The Phoenix lives in India, and when five hundred years old fills his wings with fragrant herbs and flies to Heliopolis, where he commits himself to the flames in the Temple of the Sun. From his ashes comes a worm, which the second day becomes a fledgling, and on the third a full-grown phoenix, who flies away to his old dwelling-place. The Phoenix is the symbol of Christ; the two wings filled with sweet-smelling herbs are the Old and New Testaments, full of divine teaching.

Another expedient of the Patristic mind in evading the concrete direct and specific methods of science was the realization of the "resources of vagueness of expression" in matters of dialectic and of doctrinal exegesis. Augustine clearly sets forth his appreciation of the possible virtue of ambiguity in his "Confessions," where he says, "I assuredly,—and this I assert without apprehension and from the bottom of my heart,—if I were writing something of most unquestioned credibility, should prefer so to write that my words should convey whatever truth concerning the things in question any person might be able to compass, rather than to write in such a fashion that I should express a single true idea with such a degree of clarity that I should exclude all other ideas the falsity of which would not be able to trouble me."⁵⁰

5. *The Flourishing of the Miraculous and the Notion of a "God of Arbitrariness"*—The phase of Patristic learning which was probably the most directly opposed to the scientific

⁴⁹Taylor, "The Medieval Mind," Vol. I, p. 76-7.

⁵⁰Augustine, "Confessions," XI, 31.

point of view was the all-pervading belief in miracles and supernatural intervention. As Christianity itself was founded essentially upon a complex of alleged miraculous occurrences, it was but natural that the Christian Fathers should expect a continuance of these miraculous acts. To be sure, the pagan thinkers, particularly the Neoplatonists, had contended that divine action was essentially miraculous, but the Christians developed the lust for the miraculous much farther than the Neoplatonists. The miraculous was the surest proof of divine intervention in the interests of the faithful and to the embarrassment or discomfort of the Devil and his sinful followers. But the Devil himself was also prolific in miraculous acts, and it was often difficult for the good Christian of the Middle Ages to be certain whether God or the Devil had performed the miracle in question. Taylor has well summed this Patristic enthusiasm for miracle mongering.⁵¹

Here are fundamental principles of patristic faith. The will of God is the one cause of all things. It is unsearchable. But we have been taught much regarding God's love and compassionateness, and of His desire to edify and save His people. These qualities prompt His actions towards them. Therefore we may expect His acts to evince edifying and saving purpose. All the narratives of Scripture are for our edification. How many mighty saving acts do they record, from the Creation, onward through the story of Israel, to the birth and resurrection of Christ! And surely God still cares for His people. Nor is there any reason to suppose that He has ceased to edify and save them through signs and wonders. Shall we not still look for miracles from His grace?

Thus in the nature of Christianity, as a miraculously founded and revealed religion, lay the ground for expecting miracles, or, at least, for not deeming them unlikely to occur. And to the same result from all sides conspired the influences which had been obscuring natural knowledge. We have followed those influences in pagan circles from Plato on through Neo-Platonism and other systems current in the first centuries of the Christian era. We have seen them obliterate rational conceptions of nature's processes and destroy the interest that impels to unbiassed investigation. The character and exigencies of the Faith intensified the operation of like tendencies among Christians. Their eyes were lifted from the earth. They were not concerned with its transitory things, soon to be consumed. Their hope was fixed in the assurance of their Faith; their minds were set upon its confirmation. They and their Faith seemed to have no use for a knowledge of earth's phenomena save as bearing illustrative or confirmatory testimony to the truth of Scripture. Moreover, the militant exigencies of their situation made them set excessive store on the miraculous foundation and continuing confirmation of their religion.

This absorption in the expectancy and contemplation of the miraculous also reflected the Christian idea of God and the mode of his manifestation in nature. Since the days of the Deists we have come to conceive of God as manifesting himself, if he does so at all, in the orderly workings of nature.⁵²

⁵¹Taylor, "Medieval Mind," Vol. I, p. 74-5.

⁵²A. C. McGiffert, "Protestant Thought since Kant," Chap. X.

Natural law and divine law have been assimilated, and no one of a scientific turn of mind expects or wishes any deviation from the norm of nature. But in the Patristic period God was expected to express himself primarily through aberrations and eccentricities in nature—the great prototype of which was the stopping of the sun in the interest of Joshua's military strategy. This Christian conception of God has been called by Harnack the belief in the "God of arbitrariness." Professor Robinson has well described this conventional Patristic attitude towards God:⁵³

The medieval Christian was essentially more polytheistic than his pagan predecessors, for he pictured hierarchies of good and evil spirits who were ever aiding him to reach heaven or seducing him into the paths of sin and error. Miracles were of common occurrence and might be attributed either to God or the devil; the direct intervention of both good and evil spirits played a conspicuous part in the explanation of daily acts and motives.

As a distinguished church historian has said, the God of the Middle Ages was a God of arbitrariness—the more arbitrary the more Godlike. By frequent interferences with the regular course of events he made his existence clear, reassured his children of his continued solicitude, and frustrated the plots of the Evil One. Not until the eighteenth century did any considerable number of thinkers revolt against this conception of the Deity and come to worship a God of orderliness who abode by his own laws.

Closely related to the Patristic and medieval conception of the "God of arbitrariness" was the parallel view of the imminence and ubiquity of the Devil. Indeed, the activities of man and nature both were held to be but the resultant of the ever varying pressure of forces exerted either by God or the Devil. This was the whole basis of psychic causation in medieval psychology. M. Réville has well stated this paralyzing medieval belief in the omnipresence, activity and ingenuity of the Devil:⁵⁴

The absorbing nature of the belief in the devil during the middle ages is the point we wish to make clear. Those who have still this faith can hardly imagine to what a degree it then controlled men's whole lives. It was the one fixed idea with every one. A fixed idea tends, among those whom it possesses, to center everything in itself. When, at the present day, we observe closely those of our contemporaries who devote themselves to spiritualism, it is surprising to see how fertile their imagination becomes when they are busy in interpreting, in favour of their hobby, the most trifling and unimportant circumstances. The unlatching of a half-closed door, an insect describing arabesques in its flight, the fall of a badly-balanced article, the creaking of furniture at night-time, any of these petty accidents suffices to give wing to their fancy. If we generalize such a mental state, by substituting faith in the incessant interventions of the devil for the harmless illusions of our spiritualists, we shall get a fair notion of what took place in the middle ages.

⁵³Robinson, "Mind in the Making," p. 124-5.

⁵⁴A. Réville, "The Devil, His Origin, Greatness and Decadence," p. 37-8.

6. *The Repression of Heresy and the Machinery for Enforcing Acquiescence in Authority and Crushing Independent Thought*—With the growth of Christianity there inevitably developed many different notions as to the nature of Christianity. There were widely divergent beliefs as to the nature of Christ, the purpose of his ministry, and the character and results of the Christian life. It soon became evident to the leaders of the Christian cult that some method must be found for checking this diversity or Christianity would be split into many irreconcilable sects and would perish from internal divisions in the face of imperial persecution and the competition of contemporary religions. By the middle of the second century we find the writers of Jude and Second Peter denouncing the heretics in exceedingly intemperate language, and a century later St. Cyprian set forth his famous dogma that outside of the one Catholic Church there was no salvation for any one, be his moral life as pure as that of St. Anthony and his impurity complex as highly developed as that of Anthony Comstock.⁵⁵ Within another century the Church had won over the Roman Empire to its side, and it was not long before imperial legislation in the Theodosian Code of 438 was directed towards enforcing obedience and conformity to accepted Christian doctrine. A man might suffer death if he failed to accept the view of the Trinity expounded by Damasus of Rome or Peter of Alexandria.⁵⁶ Heresy remained a capital crime for some twelve hundred years. As Christian dogma and the Christian Epic were almost wholly anti-scientific, and as deviation from this accepted body of knowledge was as hazardous as it was unlikely, it can readily be seen that science had little opportunity to exist, had other circumstances been favorable. It was not long after Cyprian until it was veritably true that "reason was in prison." Professor Robinson has admirably described this Christian intolerance and the psychological and historical basis from which it developed.⁵⁷

The Christian Epic did not have to rely for its perpetuation either on its intellectual plausibility or its traditional authority. During the Middle Ages there developed a vast and powerful religious State, the medieval Church, the real successor, as Hobbes pointed out, to the Roman Empire; and the Church with all its resources, including its control over "the secular arm" of kings and princes, was ready to defend the Christian beliefs against question and revision. To doubt the teachings of the Church was the supreme crime; it was treason against God himself, in comparison with which—to judge from medieval experts on heresy—murder was a minor offense.

⁵⁵See Robinson, "Readings in European History," Vol. I, p. 19-21.

⁵⁶*Ibid.*, p. 21-7.

⁵⁷Robinson, "Mind in the Making," p. 131-3.

We do not, however, inherit our present disposition to intolerance solely from the Middle Ages. As animals and children and savages, we are naïvely and unquestioningly intolerant. All divergence from the customary is suspicious and repugnant. It seems perverse, and readily suggests evil intentions. Indeed, so natural and spontaneous is intolerance that the question of freedom of speech and writing scarcely became a real issue before the seventeenth century. We have seen that some of the Greek thinkers were banished, or even executed, for their new ideas. The Roman officials, as well as the populace, pestered the early Christians, not so much for the substance of their views, as because they were puritanical, refused the routine reverence to the gods, and prophesied the downfall of the State.

But with the firm establishment of Christianity edicts began to be issued by the Roman emperors making orthodox Christian belief the test of good citizenship. One who disagreed with the emperor and his religious advisers in regard to the relation of the three members of the Trinity was subject to prosecution. Heretical books were burned, the houses of heretics destroyed. So, organized medieval religious intolerance was, like so many other things, a heritage of the later Roman Empire, and was duly sanctioned in both the Theodosian and Justinian Codes. It was, however, with the Inquisition, beginning in the thirteenth century, that the intolerance of the Middle Ages reached its most perfect organization.

Heresy was looked upon as a contagious disease that must be checked at all costs. It did not matter that the heretic usually led a conspicuously blameless life, that he was arduous, did not swear, was emaciated with fasting and refused to participate in the vain recreations of his fellows. He was, indeed, overserious and took his religion too hard. This offensive parading as an angel of light was explained as the devil's camouflage. No one tried to find out what the heretic really thought or what were the merits of his divergent beliefs. Because he insisted on expressing his conception of God in slightly unfamiliar terms, the heretic was often branded as an atheist, just as to-day the Socialist is so often accused of being opposed to all government, when the real objection to him is that he believes in too much government. It was sufficient to classify a suspected heretic as an Albigensian, or Waldensian, or a member of some other heretical sect. There was no use in his trying to explain or justify; it was enough that he diverged.

7. *Necessity of an Alteration of Intellectual Attitudes and Interests before a Scientific Revival Could be Possible*—The above brief enumeration of the chief phases of pagan and Christian culture, which either discouraged or opposed the scientific point of view, should at least be sufficient to prove that, far from there being no evident reasons for the decline of Hellenistic scientific activity, the real truth is that there was almost every possible cultural reason for the extinction of scientific activity in the early Middle Ages. Before any promising revival of science could be expected it was necessary, as Professor Robinson insists, that there be a fundamental revolution in intellectual attitudes and interests.⁵⁸

In order that modern science might develop it is clear that a wholly new and opposed set of fundamental convictions had to be substituted

⁵⁸*Ibid.*, p. 144-5.

for those of the Middle Ages. Man had to cultivate another kind of self-importance and a new and more profound humility. He had to come to believe in his capacity to discover important truth through thoughtful examination of things about him, and he had to recognize, on the other hand, that the world did not seem to be made for him, but that humanity was apparently a curious incident in the universe, and its career a recent episode in cosmic history. He had to acquire a taste for the simplest possible and most thoroughgoing explanation of things. His whole mood had to change and impel him to reduce everything so far as possible to the commonplace.

The process of the dissolution of the Christian Epic and the Patristic tradition was a gradual one to which many forces contributed. In the later Middle Ages there developed an interest in observing the commonplace things of nature, noticeable in the work of Albertus Magnus, Adelard of Bath and Roger Bacon. Bacon also risked at least a mild assault upon the metaphysical scholastic method and upon the régime of authority. The Humanists revived an interest in the secular matters which had attracted the pagan past. Copernicus, Tycho Brahe, Galileo, Kepler and Newton initiated the modern scientific movement by their notable discoveries in the field of astronomy and mechanics. Bruno, Bacon, Descartes and the later Rationalists set forth the philosophic implications of the progress of natural science, as exemplified by the work of Copernicus and his successors. The period of oversea expansion brought in a vast mass of new scientific data and did much to break down the rigidity of the medieval intellectual attitudes and to dissipate the European provincialism of the Middle Ages. Finally, Voltaire and Tom Paine launched a comprehensive attack upon the whole Christian Epic, and Diderot for the first time popularized the new learning. The rule of Augustine and the spell of the Patristic obsession had at last been challenged, if not broken.

IV. ECONOMIC, SOCIAL AND POLITICAL CONDITIONS IN THE LATER ROMAN EMPIRE WHICH DISCOURAGED SCIENTIFIC ACTIVITY

While science may flourish under adverse conditions in the economic, social and political environment to better advantage than under obstacles in the intellectual environment, it is fostered by conditions of peace, prosperity, order and social flexibility. None of these existed in the society of the later Roman Empire and the Early Middle Ages. Economic conditions became progressively worse. Depending largely upon Gaul and the Orient for its sustenance, Rome developed the psychology and practices of the spendthrift

and the parasite. Senseless waste characterized the upper classes and publicly engendered pauperism the proletariat. The provinces were ravaged by administrative grafters, and the sources of imperial revenue were slowly but surely exhausted before the time when they were most needed at the time of Diocletian. The cities became less prosperous and populous, the social basis of Roman imperial civilization slowly shifted back to an agrarian order, in which land-ownership by great landlords replaced the earlier agricultural era of peasant freeholding. Poverty increased and the cost of living went up, in spite of efforts at government control. The middle class—the backbone of Roman society—were crushed by the burden of taxation which fell upon them with an unjust incidence, and they gradually slipped down into a condition in which they merged with the peasantry in a semi-servile class—the *colonate*.⁵⁹ The Roman world became a feudal régime, lacking only the military element, which was to be supplied by Charles Martel and the early Carolingians. In the later Roman Empire there came a great centralization of governmental powers and an increase of political functions, but it was at a time when it was least easy to raise the revenue necessary to support the newly acquired burdens of administration and when the administrators could be most readily ignored by the powerful group of arrogant and plutocratic landlords, who were laying the basis for what was to be the economic, social and political system which prevailed in Europe for a millennium. Anarchy, confusion and disorder grew apace and were powerfully forwarded by the barbarian permeation.⁶⁰ Not until the ninth century were conditions even partially stabilized, and the twelfth century marks the first emergence of an era which, in economic, social and political conditions, was even moderately adapted to forming the environment out of which might develop the preliminary stages of a revival of scientific interest and achievement. Mr. Dill, in his remarkable account of the decline of Roman society, presents the following graphic picture of the economic, social and political disintegration of Roman society which accompanied the decadence of pagan learning and the rise of the Christian Epic.⁶¹

We have hitherto been occupied with the condition of Roman society in the West as it is revealed to us in its literary remains. But Symmachus,

⁵⁹W. L. Westermann, "The Economic Basis of the Decline of Ancient Culture," in *American Historical Review*, July, 1915.

⁶⁰S. Dill, "Roman Society in the Last Century of the Western Empire," Books III-IV.

⁶¹*Ibid.*, p. 227-9.

Ausonius, Sidonius and their class throw little light on the condition of other classes than their own, or on the deep-seated and inveterate diseases which for generations had been undermining the strength of the imperial system. The general tendency of modern inquiry has been to discover in the fall of that august and magnificent organization, not a cataclysm, precipitated by the impact of barbarous forces, but a process slowly prepared and evolved by internal and economic causes. It is probable that the barbarian invasions of the fifth century were not more formidable than those of the third, which were triumphantly repelled by the Illyrian Caesars, or than those of the fourth, which were rolled back by the genius of Julian and the ferocious energy of Valentinian. The question why the invasions of the fifth century succeeded, while the earlier failed, is best answered by an appeal to the Imperial Code. In the voluminous enactments issued from Constantine to Majorian, the student has before him a melancholy diagnosis of the maladies which, by a slow and inevitable process of decay, were exhausting the strength of Roman society. He will see municipal liberty and self-government dying out, the upper class cut off from the masses by sharp distinctions of wealth and privilege, yet forbidden to bear arms, and deprived of all practical interest in public affairs. He will find that not only has an Oriental monarchy taken the place of the principate of Augustus, but that an almost Oriental system of caste has made every social grade and every occupation practically hereditary, from the senator to the waterman on the Tiber, or the sentinel at a frontier post; and that human nature is having its revenge in wholesale flight from a cruel servitude and the chaos of administration. It will be seen that in a society in which poverty is almost branded with infamy, poverty is steadily increasing and wealth becoming more insolent and aggressive; that the disinherited, in the face of an omnipotent government, are carrying brigandage even up to the gates of Rome; that parents are selling their children into slavery; that public buildings are falling into decay; that the service on the great post roads is becoming disorganized. At a time when every frontier was threatened, it will be found that the frontier posts are being abandoned, that there is wholesale desertion from the ranks of the army; while in the failure of free recruits, the slaves have to be called to arms. But the unscientific and inefficient financial system will chiefly attract the notice of the historical inquirer. The collection of imposts in kind opened the door to every species of corruption. Still more fatal to pure administration was the system which left to the municipal class the assessment and collection of the revenue in their district. That doomed order are at once branded as the worst oppressors, and invested with the melancholy glory of being the martyrs of a ruinous system of finance. Their lingering fate, recorded in 192 edicts, a tragedy prolonged through more than five generations, is one of the most curious examples of obstinate and purblind legislation, contending hopelessly with inexorable laws of society and human nature. In that contest the middle or bourgeois class was almost extinguished, Roman financial administration was paralyzed, and at its close the real victors and survivors were the great landholders, surrounded by their serfs and dependents. A volume might be written on the corruption and cruel oppression of the officials of the treasury, servile to the great, tyrannical to the poor, and calmly defying all the menaces of the emperor in their unchecked career of rapacity. The last and deepest impression which the inquirer will carry with him, as he rises from a study of the Theodosian Code, is that fraud and greed are everywhere triumphant, that the rich are growing richer and more powerful, while the poor are becoming poorer and more helpless, and that the imperial government, inspired with the best intentions, has lost all control of the vast machine.

It must be remembered, however, that these adverse economic, social and political conditions did not initiate the beginnings of the decline of ancient science. This had started before the passing of the most peaceful and prosperous days of the Roman Empire. Rather, these conditions in the social environment simply helped along the process during the Patristic and early medieval periods, but they were too significant in the era of their influence to be ignored.