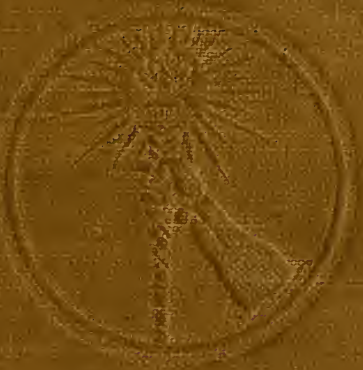
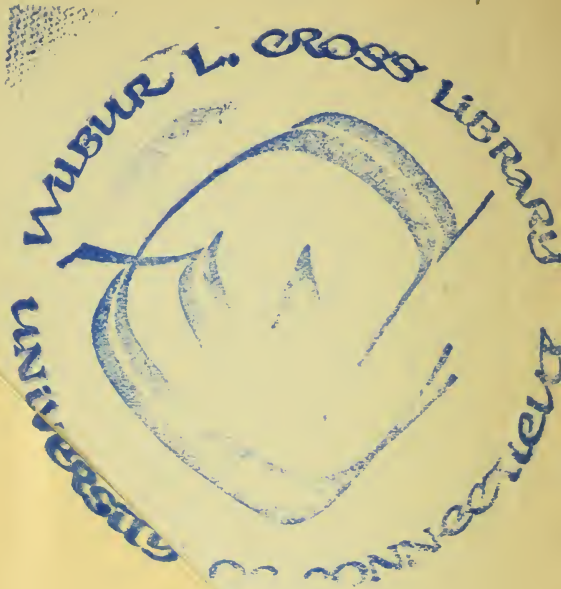
The Struggle Between Science and Superstition



ARTHUR M. LEWIS



The Struggle Between Science and Superstition

By
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PREFACE

This little book is the seventh volume to make its appearance as the result of the lecture courses delivered at the Garrick theater during the last nine years. Its theme is taken from the course of sixteen lectures on the same subject delivered in the season of 1914-15. I trust that this modest narrative will meet with as generous a reception as its half dozen predecessors. There is no lack of evidence that in this country in the coming years there will be a keen and bitter struggle between the representatives of superstition and the champions of social progress. This little book is intended to serve as a weapon in the hands of the latter.

My reason for writing it is, that most of the books covering this field, such as Draper's "Intellectual Development of Europe" and White's "History of the Warfare of Science with Theology," are expensive and therefore almost inaccessible to the general public. In overcoming this difficulty and furnishing what I hope will be an introduction and inducement to the study of the larger works, I hope to have aided the cause which they so valiantly served. I have followed as far as possible the method

of the story teller, hoping thereby to have rendered the book especially interesting. I have constantly kept in mind the idea of a book which one might give to another with the object of securing a new convert to the cause of intellectual liberty.

I wish here to acknowledge my great indebtedness to the authors named above, and also to McIntyre's biography of Bruno, Professor Bury's "History of Freedom of Thought," and especially to Karl von Gebler's splendid and scholarly work, "Galileo and the Roman Curia." I regret the lack of space that makes impossible an acknowledgement to many other authors, in whose works I have delighted while preparing this book. My thanks are also due for many valuable suggestions to my good friend Charles H. Kerr, who has always unflinchingly held that there is no hope of the emancipation of a proletariat the mind of which is cobwebbed with delusions. Last, and above all, I give cordial thanks to the Garrick audience, whose generous appreciation from year to year has made this and the preceding volumes possible.

ARTHUR M. LEWIS.

Chicago, October 2, 1915.

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CHAPTER I

THE ANTAGONISTS

BEFORE we consider the historic struggle between superstition and science we shall briefly consider the natures of these age-long adversaries. The introduction of the antagonists will follow, not the order of their importance, but the order of their appearance—the historical order. This preliminary analysis will enable the reader to avoid later misunderstandings as to the sense in which these names are used. Superstition will have a much wider scope than is given it in common usage. The casting of articles over the right shoulder, the abstention from meat on Fridays, and similar practices, will not be regarded as superstition, but as merely the buttons of its uniform. Superstition will mean what is generally meant by the word religion, and from this point the

terms will be interchangeable. This opens a path to the consideration of the nature of religion.

There have been many attempts to establish a dividing line in the animal kingdom between man and his lower relatives. Such is the unity of the universe however, that all attempts at rigid divisions have failed, and the efforts to separate the human and the subhuman have met with small success. True, the whole structure of science follows the principles of division and classification, but these divisions are not so much realities of the cosmos, as devices to overcome the limitations of the human mind.

The attempt to isolate man as the "social animal" collapsed with the discovery of the complex societies of bees and ants, and Aristotle's definition of man as a "political animal" perished with it, though quite unjustly, as status in these insect societies is determined by conditions that are physiological rather than political. Romanes' great book on animal intelligence, and a great mass of similar research have destroyed the idea of man as the exclusively "thinking animal." The definition which seems to have best stood the test of further investigation is the one which describes man as the "religious animal."

It is practically certain that among the creatures below man there is nothing that can be properly called religion. Many animals display fear, but while fear figures largely in religious phenomena, it does not constitute religion.

We enter a region of great uncertainty when it is asserted that there are, or have been, tribes or races of men entirely without religion. This raises the large and greatly controverted question of the universality of religion. The dogmatism of the assertions on both sides of this question has been strangely at variance with the vagueness of the evidence. In this field it has proven that the truth is not easily reached. Missionaries living among savage tribes have helped to cloud the subject, by refusing to recognize as religion, anything which did not agree with their own beliefs. Says Professor Thomas: "For the most part the religious world is so occupied in hating and despising the beliefs of the heathen whose vast regions of the globe are painted black on missionary maps, that they have little time or capacity left to understand them." Many not specially religious travelers have also erred through inability to see religion in anything short of the comparitively highly developed theological ideas of the western world. A yet further source of error

lies in failure to allow for the now well-known reluctance of the savage to parade his religious beliefs before strangers.

For these and other reasons, Lang, Moffat, Azara, and even so great an authority as Sir John Lubbock, have been deceived into asserting the absence of religion where more painstaking investigation proved it to be present. The present trend of the evidence is, undoubtedly, in favor of the universality of religion.

This tendency has been enthusiastically accepted by religious apologists, who hastily interpreted it to mean the exemption of religion from the process of evolution. It is only a case of vain grasping at straws. In half a dozen different sciences, the natural evolution of religion has been established beyond any possible refutation. As the attitude of modern ethnologists is well typified in Professor William I. Thomas in his valuable "Source Book for Social Origins," it will be well worth the reader's while to ponder his cautious but illuminating summary of the case. Having, in common with Lester F. Ward, adopted the idea of Tylor, that the essential thing in religion is "belief in the existence of spiritual beings," Thomas proceeds:

"So far as I can judge from the immense mass of accessible evidence, we have to admit that

the belief in spiritual beings appears among all low races with whom we have attained to thoroughly intimate acquaintance: whereas, the assertion of absence of such belief must apply either to ancient tribes, or to more or less imperfectly described modern ones. The exact bearing of this state of things on the problem of the origin of religion may be thus briefly stated: Were it distinctly proved that non-religious savages exist or have existed, these might be at least plausibly claimed as representatives of the condition of Man before he arrived at the religious stage of culture. It is not desirable, however, that this argument should be put forward, for the asserted existence of the non-religious tribes in question rests, as we have seen, on evidence often mistaken and never conclusive. The argument for the natural evolution of religious ideas among mankind is not invalidated by the rejection of an ally too weak at present to give effectual help. Non-religious tribes may not exist in our day, but the fact bears no more decisively on the development of religion, than the impossibility of finding a modern English village without scissors or books or lucifer-matches bears on the fact that there was a time when no such things existed in the land."

The apologists for religion have even contended, with small success where free discussion was possible, that religion has been an unmixed blessing to the human race. On the other hand, not a few of the clearest thinkers of our age have held religion to have been, throughout its career, an unmitigated curse. Among the latter may be placed America's greatest sociologist Lester F. Ward. "Whatever" says Ward "may be the benefits which supernatural beliefs have conferred and are to confer upon man in a future state of existence, they have not only conferred none upon him in the present state, but have demonstrably impeded his upward course throughout his entire career."

One of the truths which modern research has thoroughly established is, the purely human origin of all the religions. The flimsy dogma of a divine revelation has taken sanctuary in the pulpit, and even there suffers an increasing lack of unanimity. The somber gods, who were supposed to have spoken to our remote ancestors, have proved to be nothing more than the anthropomorphic shadows—the idealized self-projections—of the men who were their makers. Their barbarous codes were the disguised decrees of primitive rulers who sought, through a higher sanction, to rivet their mandates the more firmly

on the minds of men. This critical development has placed science and religion on equal ground in at least one respect—their common origin as products of the human mind. Religion then, like science, must be prepared to sustain the intellectual test. Even now—and the future is likely to grow steadily more discouraging for religion—a balloting of those possessing an elementary knowledge of the two sides of the question, and fear of social consequences of a sincere vote being eliminated, would create consternation in the religious world. Indeed, Ward has suggested a method by which religion might vote away its validity, without requiring an expression from its critics:

"If a convention of all the religions on the globe were to be called, each sect being represented by one delegate, and the question were to be voted upon in the case of each religion separately. Is this religion true? or, Is this religion beneficial to man? the result would inevitably be that only one affirmative vote would be cast in each case, and that would be the vote of the delegate of the particular religion upon which the vote was taken; and, if the action of this convention with regard to the feasibility of preserving or abolishing religions could be conclusive, it would be found that all the reli-

gions of the world would be overwhelmingly voted down and abolished, and this by the action of avowed religionists alone."

Religion and science being progeny of a common parent, the struggle between them has the nature of a civil war. The conflict is about as old as written history; it has never been suspended, and it still retains its primitive persistence. A search for causes however, serves greatly to discredit the modern tendency to worship at the shrine of reason.

Reason has undoubtedly been the savior of the human race. The contemplation of man as he existed in the cave-period, has caused more than one biologist to wonder how, in the struggle for existence, he managed to survive. The cave-man was probably physically stronger than the man of today, but in this respect he hardly compared with the animals who were his enemies and competitors. He was devoid of all natural weapons; they were armed with horns, tusks and claws, which made combat unequal He also lacked the powers of flight possessed by animals naturally unarmed. His one advantage lay in his comparatively larger brain, which enabled him to invent artificial weapons superior to any furnished by nature The mistake lies in the easy assumption that, because the power to reason

has been overwhelmingly advantageous, the acts it led to could never have been other than beneficial. The rational faculty in man, while it has been in the main, and in the long run, of inestimable service, has led him to the performance of untold disastrous acts such as no lower animal could be persuaded to imitate. An extreme example is suicide, an act of which all lower animals are totally incapable. The instinctive acts of animals are always based on a long experience almost invariably acquired at tremendous cost. Rational man partially escaped this initial cost by reasoned schemes to circumvent the baleful elements of his environment, but in so doing he often made mistakes—usually because of wrong conclusions based on false premises—which provoked calamities which could never fall on the instinct-guided animals.

Quite naturally, these tragic blunders were especially frequent in pre-historic times, when the rational faculty was in the experimental stage. Their prolific source was man's inability to comprehend the universe, due to the unfortunate combination of a very simple mental faculty and an extremely complex cosmos. Admitting for the moment the existence of the hypothetical creator, it would seem as though he created the universe with a special view to the confusion of

his children. When we consider how many apparently insoluble mysteries the universe still holds for us, notwithstanding our immense scientific progress, it is little wonder that our ancestors rarely reached the truth. Indeed they never seem to have done so, except in the few instances where appearance coincided with reality. For example: the only correct idea they had about the sun was that it was hot. They thought the sun and moon to be about the same size, as any uninstructed child would, and for the same reason—they seem so. How could they know that the golden orb of day had sixty million times the bulk of the silver disk which lit their nights? They seemed the same short distance away, and what could tell them that a measuring wand that would reach the moon would have to be placed on end four hundred times before it would touch the sun?

The earth presented another series of deceptive appearances. If they required an image of stability, they found it in the solid earth beneath their feet. There was nothing to suggest that it was spinning like a top, and that they were carried around on its surface at the rate of seventeen miles a minute—the speed of a rifle ball. They knew—if their eyes were to be trusted at all—that the earth was the center of a cir-

cuit performed by the sun. How should they know the exact opposite was the truth, and that they were being whirled around the sun at a speed of nineteen miles a second. What is there to indicate to the modern traveler, journeying from New York to Liverpool, across a surface apparently as level as a billiard table, that he is, in reality, scaling a mountain of water three hundred and fifty miles high? It was not anything suggesting itself to the senses, but a deduction from the known motion of the stars, that led astronomers to undertake those wonderful researches which resulted in the discovery that we are being carried by the sun, along with the whole solar family, toward the great star Vega at the rate of twelve miles a second. It is almost impossible, as anyone who has tried knows, to make an ignorant man believe or understand, that water in an atmospheric pressure pump is not drawn up from in front, but driven up from behind, and this because the reality is so different from the appearance.

And so it happened that man's primitive attempts to understand the universe invariably went astray, and he succeeded only in collecting a great mass of misinformation. These errors were rarely harmless, and some were probably so disastrous as to lead to the annihilation of tribes

and races who held them. What increased the destructive power of these ancient mistakes almost inconceivably, was that they constituted the solemn teachings of deified ancestors, and were thus made sacred by the halo of religion.

Among the most calamitous of man's early blunders was the idea which stood, and still stands, at the center of all religion; belief in the existence of spiritual beings. In addition to having inspired an unremitting opposition to the progress of science, this malefic belief has directly caused deaths which it would be no exaggeration to place in the millions. A comparatively recent example of what was once the regular order of things was referred to in the following telegram, which appeared in the "New York Tribune" of April 13, 1880:

"London, April 12th—The seven hundred men, boys, girls, priests, and foreigners sacrificed at Mandalay for the restoration of the king's health, were buried alive—not burned as previously stated—under the towers of the city walls. The deed was done to appease the evil spirits."

The "United States Economist," of four days later—April 17, in a protesting article, had the following to say: "The sacrifice of seven hundred persons, including men, boys, women, girls,

priests, and foreigners, at Mandalay, for the restoration of king Thebaw's health, is an outrage and a blot on the civilization of the nineteenth century. Had such a wholesale massacre occurred in the most remote and inaccessible regions of Africa, there might be an excuse alleged for non-interference on the part of civilized governments, but no such reason can be given in this instance. Burmah is one of the important kingdoms of the far East. Mandalay, the capital and residence of the monster king, is an accessible sea-port, in which reside consuls representing European and Asiatic powers. The intention of this pagan to offer such a horrible rite to appease his gods was known to the consuls, and fear and consternation had seized upon his subjects and they were fleeing for their lives."

An outrage indeed in the twentieth century, but only because enlightened men no longer believe in evil spirits which need to be appeased, but quite proper and thoroughly logical for people holding that belief. Says Tylor "Men do not stop short at the persuasion that death releases the soul to a free and active existence, but they quite logically proceed to assist nature by slaying men in order to liberate their souls for ghostly uses." Ximenez says of the Indians of

Vera Paz, "When a lord was dying, they immediately killed as many slaves as he had, that they might precede him and prepare the house for their master." Garcilasso says that a dead Ynca's wives "volunteered to be killed, and their number was often such that the officers were obliged to interfere, saying that enough had gone at present."

The science of anthropology has proven that this pernicious belief in spirit gods, who were neither better nor worse than the Jehovah of the Old Testament, had its roots in nothing better than the inability of savages to understand the nature of their dreams or to comprehend the meaning of shadows, echos, or the reflections of themselves in pools of water. Yet these gropings after truth which resulted in religion, were really the science of those early days; they were the first attempts to grasp the structure of the universe. If they failed it was not because they used an instrument different from that used by modern science. The weapon with which they attacked their problems was the mind, but for them the mind was in an untried, undeveloped state. They failed where modern science succeeded, as a child is baffled by riddles which readily resolve for a grown man. The difference in achievement betwen the primitive thinkers,

who founded religion, and the modern thinkers, who established science, is a difference in the periods in which they worked. It is a matter of chronology.

Therefore, when we are asked to choose between science and religion, it is not a choice between science and something entirely unrelated. It is a choice between the science of a painted savage and the science of a Darwin.

It is difficult for those who have not informed themselves on the subject, to understand why religion, founded upon, and consisting chiefly of prehistoric illusions, should have persisted so many centuries, and still remains a great social power. The most important reason is its great age. While science is of yesterday, religion is almost as old as the human race. For tens of thousands of years, unrecorded in history, religion held the field unchallenged. To say that during this period it was "bred in the bone" is to speak figuratively. There is no organic process by which beliefs can be be made congenital. The doctrine of "innate ideas" has been eliminated from the thinking of the well-informed. True, almost the same result has been produced by a process known in sociology, as social heredity. According to this illuminating theory, ideas are carried from one generation to another by edu-

cation, as physical qualities are transmitted by Weismann's germ-plasm. Every infant's mind begins as a clean page upon which anything may be written. To this day the first impression made is religious; usually the first lesson is a prayer. The child is helpless; where the evidence to the contrary is not known, the mind must accept whatever is offered to it. So the child is made to begin life, not only as its parents, but as its remote ancestors of the stone age began. For it the long centuries of gradual enlightment count for nothing, and it must re-enact the long human tragedy in its own brief career. All who have fought their way out of the darkness are familiar with the stages of the struggle.

We begin with our minds choked with lies rarely believed by those who teach them. As we approach our youth, if it be our good fortune to have preserved our intellectual curiosity, and read books not recommended by conventional teachers, we begin to discover the fraud which has been practised upon us. The best of our years are given to unlearning superstitions we should never have been taught, and after we have passed the zenith, and are approaching the western horizon, we begin to acquire the knowledge which should have been given to us freely in our receptive childhood as we sat in school.

By the time we have learned to really live, we are about ready to fall face foremost into the grave. Yet the stupid, tragic waste of life continues unabated. Every new generation of children begins where every other generation began, and it never occurs to us that it might be better for our children to begin, not where we began, but where we leave off. Of course there is a reason for this perpetual mummery, and the reason is not far to seek. Of all the instruments which have effectually served the ruling class, in the oppression of the exploited mass, none have compared with religion. This alone has saved religion from annihilation at the hands of science. At last the oppressed of the world are beginning to understand, what the more enlightened among them have long known, that whoever announces himself a friend of social emancipation, and is at the same time a defender of some religious cult, may be counted as a cipher in the struggle for freedom.

The most important difference between religion and science is, that while the primitive gropings of prehistoric men became fixed to the point of petrifaction as religion, science vigilantly maintains its fluid state. This is the difference which is responsible for their historic conflict, and so long as this difference exists there can

never be any suspension of hostilities. As neither side can make concessions without ceasing to exist, the annihilation of one of the combatants is the only alternative to a perpetual warfare. For many centuries the struggle was unequal, and it seemed as if science were destined to be strangled in its infancy. With the revival of Greek learning at the Renaissance, the tide of battle turned, since when science has never suffered a defeat, and religion has never won a victory.

There has been no lack of well-meaning, but cloudy-minded people, seeking to achieve a reconciliation, but the fixity of religion, and the mobility of science, have made amalgamation impossible. Science has many settled opinions, but they are settled only in proportion to the amount of evidence in their favor. No scientific generalization is regarded as beyond challenge. All that is necessary to the overthrow, and consequent relinquishment, of the most widely accepted scientific theory is the production of evidence sufficient to disprove it. Thousands of times, in every field, science has found it necessary to modify, and often to completely recast its position. If during some of these transitions there have been controversies conducted with unnecessary heat, it has usually been because

some gentleman has imported theological habits of mind into an intellectual atmosphere where they are alien and undesirable. Science has never demanded unwilling acquiesence in any of her doctrines, and while countless thousands have sneered at her conclusions, none have been burned at the stake or broken on the wheel.

Science, as represented by her illustrious sons, has always held that truth needed no adventitious aids, believing with the wise Gamaliel, that an idea, if true, would successfully withstand all opposition, while if false, in the end nothing could save it. While this is a rather optimistic view of the constitution of the universe, it has given science a stainless record which is a striking contrast to the bloody career of religion. As our brief narrative will show, when men were slain for opinions sake, the opinion of the slayer was always some hoary delusion. No modern writer has stated the case more eloquently than Robert Blatchford. The following vivid indictment is from the closing pages of "Not Guilty."

"We cannot look back over that trampled and sanguinary field of history without a shudder; but we must look. It reaches back into the impenetrable mists of time, it reaches forward to our own thresholds, which still are wet with blood and tears, and on every rood of it, in

ghastly horror, are heaped the corpses of the men, and women, and children slain by the righteous, in the name of God. Though the gods perished, though the vane of justice veered until right became wrong, and wrong right, yet the crimes continued, the horrible mistakes were repeated; the holy, and the noble, and cultivated still cried for their brother's blood, still trampled the infants under their holy feet, still forced the maidens and the mothers to slavery and shame.

"Men and women, is it not true?

"From fear of ghosts and devils, and for the glory of the gods of India, of Babylon, of Egypt, of Greece, of Rome, of France, of Spain, of England, were not millions tortured, and burnt, and whipped, and hanged, and crucified?

"Witchcraft, and heresy, idolatry, sacrifice propitiation, divine vengeance; what seas of blood, what holocausts of crime, what long-drawn tragedies of agony and bloody sweat do these names not recall? And they were all mistakes! They were all nightmares, born of ignorance and superstition! We have awakened from those nightmares. Our gods no longer lust after human blood. We know that heresy is merely difference of education, that there never was a witch; we know that all those millions wept

and bled and died for nothing; that they were tortured, enslaved, degraded and murdered, by the holy, through ignorance, and fear, and superstition."

CHAPTER II

STRUGGLES IN GREECE

GREECE had the good fortune to escape the curse of a sacred book. This is why all European science traces its beginning to the Greeks. Like all other peoples they had their superstitious period, and during that period their myths were little better or worse than those of the North American Indian. Greek mythology is linked with the name of Homer, as the Hebrew mythology, preserved in the Old Testament, gathers about the name of Moses. All students of primitive thought are impressed by the striking similarity of the beliefs of widely separated races. This however, has found a comparatively simple explanation; they were all confronted with the same natural phenomena, and the laws of thought were the same for all. The Christian who imagines that the marvels of Christian theology were peculiar to the Hebrews, displays a simplicity bordering on the pathetic.

In the Homeric age the blue sky was the floor of heaven. There Zeus held his court, surrounded by a goodly company of Gods, who with their wives and mistresses, indulged some very human passions, not a few of their acts belonging to the

category of crime. The sons of Gods by human mothers were quite common. Says Draper: "Immaculate conceptions and celestial descents were so currently received in those days, that whoever had greatly distinguished himself in the affairs of men was thought to be of supernatural lineage." Divine progenitors by immaculate conception were not limited to the Jews and Greeks. Romulus, the mythical founder of Rome, resulted from a chance meeting of the God Mars with Rhea Sylvia, as she went with her pitcher for water to the spring. The Egyptians who adopted the platonic philosophy, sincerely and devoutly believed that Plato's mother Perictione, owed her illustrious son to the influences of the God Apollo. At a much later period, the conquering Alexander signed his orders and decrees "King Alexander, the son of Jupiter Ammon." His mother, Olympias, who of course knew the facts, often jestingly said she "wished Alexander would cease from incessantly embroiling her with Jupiter's wife." In Alexander's age the educated Greeks had ceased to believe in supernatural pedigrees, and his proclamations were made for the effect that they had on the common soldiers. Arrian, who wrote the history of the Macedonian expedition, says: "I cannot condemn him for endeavoring to draw his

subjects into the belief of his divine origin, nor can I be induced to think it any great crime, for it is very reasonable to imagine that he intended no more by it than merely to procure the greater authority among his soldiers.'' Greek mythology had miracles and marvels of many types, but fortunately they were not recorded in a sacred book to be perpetuated by a priesthood, and serve as fetters for the Greek mind. Says Huxley: ''The dead hand of a book sets and stiffens, amidst texts and formulae, until it becomes a mere petrifaction, fit only for that function of stumbling block, which it so admirably performs.''

It must not be assumed that religion was completely disregarded by the later Greeks. This was true of the educated classes only. It was part of the sagacity of Greek statesmen, that they clearly perceived the value of religion as a means of perpetuating the subject condition of the lower classes. Long after religion had been discarded by Greek orators, philosophers, and legislators, it was loudly applauded in public. In the conversations of the educated it was unanimously held that, while religion had no functions for them, it was, and always would be, indispensable for the common people. This is so generally the attitude of our own time, that we

are surprised to find it in vogue at so remote a date, as it had been for centuries in Egypt. Education was very highly valued in Greece, but even among the sophists, who were the educationalists of Greece, there was no idea of spreading knowledge among the masses.

There were many reasons for the decay of the Greek national faith, though all may be massed under the general title—the growth of knowledge. A conspicuous factor was travel. Fixity of opinion is a notorious characteristic of all people rooted to one spot. In any intellectual advance, peasants are always the last to move. People living always in one place never come in contact with conflicting ideas, and eventually come to believe their own are invulnerable. Travel in other countries effectively destroys the illusion, and convinces the traveler that opinions and creeds are matters of geography. The pious Herodotus found that at the very time Greek social life was supposed to teem with the supernatural, human affairs were following their ordinary course along the banks of the Nile, and Eratosthenes discovered the legends of Odysseus were contradicted by the facts of geography.

Thoughtful Greeks began to ask why the miracles of the Iliad had so completely ceased, and why the gods, once so often seen, had so

utterly disappeared? They refused to accept different standards for different times, and general scepticism was the result. The Ionian Gods of Homer, and the Doric Gods of Hesiod, lost their hold on the educated Greek mind.

Greek scholars were destined to pay the penalty for their failure to educate the general public. To escape the wrath of the ignorant, they were obliged to pretend to believe things they found no longer credible. When they raised the veil of hypocrisy, they invariably suffered. The father of Greek tragedy, Aeschylus, allowed his heretical opinions to appear in his plays; he was condemned to be stoned to death for blasphemy, and was saved only by his brother Aminias raising the arm which had been mutilated in the battle of Salamis. Euripides, another dramatist, sought to escape the consequences of his own unbelief by the ignoble expedient of denouncing the heresies of his fellow-scholars.

The difficulties of the philosophers were even more serious than those of the poets, probably because their attacks were more fundamental and were therefore more dangerous to the faith. Forever famous among these was the courageous Anaxagoras. He was drawn from Asia Minor to Athens as ambitious provincial intellects are ever attracted to the national metropolis. He

lived in Athens thirty years, became famous for the severity of his mode of life, and earned the lasting admiration and friendship of the mightiest of all Greek statesmen—Pericles. He was a pre-eminent astronomer and mathematician, and he sought, with amazing diligence and insight, for natural explanations of celestial phenomena. His search finally caused him to fall foul of the worshippers of the sun-god Apollo. Says Professor William Wallace of Oxford: "He removed the halo of deity from the sun, and profanely turned Apollo into a mass of blazing metal, larger than Peloponnesus." The Peninsula of the Peloponnesus had an average diameter of about a hundred miles, and to assert that the small disk in the sky had any such enormous proportions was ridiculous, as well as blasphemous. It required all the eloquence and power of Pericles to save Anaxagoras from the clutches of his prosecutors, who had arrested him on the charge of contravening the established dogmas of religion. Even then he was heavily fined and obliged to flee from Athens. He went to Lampsacus, where he was received with honor, and where he spent the remainder of his life.

Another victim of popular ignorance and religious bigotry was Protagoras, the first of the Sophists. He was very successful teaching and

lecturing in the principal cities. His criticism was that religious believers claimed to know things that were beyond the reach of the human mind. He published a book entitled "On the Gods," which opened as follows: "Concerning the gods, I cannot say that they exist nor yet that they do not exist. There are more reasons than one why we cannot know. There is the obscurity of the subject and there is the brevity of human life." For these sage observations he was charged with blasphemy. He fled from Athens, and on his way to Sicily, was lost at sea. Copies of his book were collected and burned, though the book for which Anaxagoras had been fined was still displayed for sale on the Athenian book-stalls.

The most celebrated case of Athenian persecution is, of course, the martyrdom of Socrates, and it would be pleasant to be able to record him as a martyr for science's sake. Unfortunately that is impossible, as Socrates was far from being a champion of science. He regarded mathematical studies and physical research as useless and misleading. It would be difficult to imagine a more unfortunate attitude, as these studies were the very sources of scientific development, and it was the successful prosecution of them which later made Alexandria the city of un-

rivalled learning, and the real progenitor of modern science. Thus Socrates rejected that interrogation of the outward, objective universe, which has proven to be the real avenue to truth, and he set up in its place that perennial pitfall of the classic philosophers, "The introspective analysis of the contents of consciousness." His resultant ethical philosophy was almost worthless, and consisted chiefly in juggling with words and definitions. He added almost nothing to the rich store of Greek knowledge, and about the only elements in his teaching of real value were his insistence that unfounded assumptions should not be accepted as established knowledge, and that acceptance by a majority could not be admitted as a warrant of truth.

It must not be inferred from the unfortunate experiences of Anaxagoras, and Socrates, that Greece had any organized repression of freedom of opinion that could, in any way, be compared with the Inquisition of the Roman Church in the middle ages. There was nothing at all approaching the wholesale murder of that sinister institution. Among the educated classes of Greece unbelievers were the rule rather than the exception, yet there are only a few isolated cases of persecution for opinions sake, and even in these instances the differing views were almost cer-

tainly not the real causes of the accusation. A searching inquiry clearly demonstrates that Socrates was brought to trial by the enemies he made in his career as an Athenian politician. He had shown sturdy opposition on various occasions to the schemes of powerful political leaders, and they awaited the opportunity for revenge. The political parties of Athens were chiefly two, which represented respectively the aristocrats and the democrats. Socrates belonged to a middle party, the Moderates, who sought to pit the middle against both ends. The Moderates were really a wing of the Aristocrats, and Socrates was an aristocrat in all his inclinations and the sworn foe of Athenian democracy. In politics, as in philosophy, he was a reactionary. His party followed the now familiar policy of keeping the masses ignorant, and denying them the franchise for their lack of intelligence. Socrates had long held his obnoxious opinions, but it was not until he was seventy years old that they were challenged, and had the democratic party not come into power at that time, he would almost certainly have remained undisturbed. With their advent to power, the democrats unwisely decided to reach their opponents through Socrates, and teach them a lasting

lesson, and two of Socrates' three accusers were its leading politicians.

Socrates was charged with (1) denying the gods recognized by the state, and (2) introducing instead of them strange divinities, and (3) corrupting the young. Xenophon, his faithful disciple, relates that specific instances were given in support of the last charge. Among these were: teaching his associates to despise the institutions of the state; teaching the young to disobey their parents and guardians and to prefer his own authority to theirs; quoting mischievious passages from Homer and Hesiod to the prejudice of morality and democracy. It is almost certain that, had he adopted a pose of at least respectful deference, there being no disposition to extreme severity, he would have been found not guilty by his large body of judges. To the great distress of his friends, he adopted an attitude of open defiance. Even then, of the large jury of 501 Athenians, selected to try his case, 220 are said to have voted for his acquittal. A further dispay of contempt for consequences brought the death sentence by an increased majority. The charges were unjust, the penalty was extreme, and the whole affair was an ugly blot on the reputation of Athens. As a warning to his friends not to meddle with politics, it was

a complete success. His chief disciples, including Plato, left Athens until the storm blew over, and when they returned, Plato made it clear that he had retired permanently from political life.

Less celebrated, but contributing more brilliantly to the growth of knowledge, was Xenophanes. As I have already briefly recounted this in "Evolution Social and Organic" I may be permitted to quote the following paragraph from its opening chapter:

Xenophanes, of Colophon, had ventilated ideas obnoxious to the priests. He had done for his age what Feuerbach did to the Nineteenth century—he had explained the origin of the gods by anthropomorphism. Said he: "If oxen or lions had hands, and could paint with their hands and produce works of art as men do, horses would paint the forms of the gods like horses and oxen like oxen. Each would represent them with bodies according to the form of each. So the Ethiopians make their gods black and snubnosed; the Thracians give theirs red hair and blue eyes." Had Xenophanes lived at Athens, where a religious revival had just taken place, he would have shared the fate which later overtook the impious Socrates. Luckily for Xenophanes, in the colony where he lived "the gods were left to take care of themselves."

That Xenophanes could travel from city to city expounding his theories, and denouncing Homer for relating stories of the gods which would have disgraced men, is evidence of the general freedom of opinion which, with some exceptions, prevailed in Greece. But while tolerance was generally practiced by the Greeks, they did not realize its tremendous social value, and they did nothing to make it permanent. It was left for them to learn by bitter experience, at the hands of the Christians, in their wonderful city Alexandria, what a fearful curse is the complete abrogation of the freedom of thought.

CHAPTER III

SCIENCE IN ALEXANDRIA

THE Satraps of the Persian empire observed that their hired Greek soldiers were far superior to the native troops. The Greek soldiers themselves were not blind to their own great prowess, and the stories they told on their visits home gradually created an impression that a Greek conquest of Persia, hitherto almost unthinkable, might be within the range of possibility. This notion came to maturity in the brain of Philip, the king of Macedonia. As a result of the schemes and labors of twenty years, Philip had not only secured the recognition of Macedonia as a Greek province, but had made the rest of Greece subservient to it. Demosthenes had tried to check his progress by eloquent appeals to the Athenians, but his warnings had fallen on indifferent ears. Philip had triumphed because of his superior military organization; the Macedonian phalanx proved unconquerable until confronted by the Roman legion. Now he planned to clinch his supremacy by an enterprise which would arouse the enthusiasm of all Greeks. He announced his intention of avenging the old invasions of Greece by Xerxes and Darius, by leading the united Greek

armies to the conquest of Persia. Whether the military genius of Philip would have proved equal to the task can never be known; while he was still shaping his plans he was assassinated by one of his own subjects in the year 336 B. C., sixty-three years after the death of Socrates.

Greek hopes for the conquest of Persia did not die with Philip; indeed it is quite probable that his demise was the best thing that could have happened for the success of his plans, for he was succeeded by a boy of twenty who, in five years from his father's death, had established a reputation for military genius, which is paralleled only in the history of the world by the fame of Napoleon. In five years Alexander, with a comparatively small but immensely capable Greek army, was complete master of the Persian Empire, with the emperor Darius a fugitive.

In the decisive battle of Arbela, it is recorded, though probably with exaggeration, that fifty thousand Greeks defeated a million Persians. The three Persian capitals, Susa, Persepolis, and Babylon, immediately surrendered, and soon after, Darius suffered the fate which seems to have been common to the monarchs of the period both Greek and Persian; he was assassinated. The debasing effects of war and conquest, combined with the almost inconceivable luxury and

dissipation of the Orient, resulted in the commission by Alexander, in his later years, of a series of revolting crimes which gravely challenge his surname—"The Great."

It must be conceded, however, that his exploits brought benefits to modern Europe which were unequalled by any results of the careers of Hannibal and Napoleon, even though we concede the latter to have done much toward the break-up of the feudal system. The chief credit for this must in large measure be laid to the circumstance that in his youth he had for tutor, a great conqueror in the world of thought—Aristotle. His great teacher inspired him with a love of natural history, and the funds which enabled Aristotle to publish his great work on that subject, were furnished by Alexander. It is quite probable that the desire to discover and collect new plants and animals, figured in the ambitions of the Macedonian campaign, but as the campaign proceeded this noble impulse was rapidly swallowed in an insatiable thirst for rapine and conquest. It was destined however, that soon after his death, one of the purest aims of his youth was to be brought to a magnificent realization.

During his campaign, he founded several Alexandrias to perpetuate his name. The only

one which really served that purpose was the one he set up on the Mediterranean coast of Egypt. When he lay dying in Babylon, following a drunken orgy, and he was asked by the generals who were gathered at his bedside, to whom he bequeathed his empire, he answered, "To the strongest." As none proved strong enough, it fell to pieces, and his generals fought each other for the parts. Following a decisive battle at Ipsus in Phrygia, Syria and the East went to Seleucus—another king destined for assassination—Thrace to Lysimachus, Macedonia to Cassander, and—most important for our story and for later European civilization—Egypt to Ptolemy.

Ptolemy was the most far-sighted of all Alexander's generals. The dynasty of which he was the first king, ruled Egypt 293 years, closing with the death of the famous Cleopatra, the last of her line, in 30 B. C. when Egypt became a Roman province. The rule of the Ptolemies is the brightest chapter in the long history of Egypt, and is marked by the absence of discontent and revolt. Ptolemy I was known as Ptolemy Soter—the saviour—a surname given to him by the Rhodians for his preservation of them from their enemies. He maintained his

palace at Alexandria, and made that city the capital of Egypt.

Alexandria was in many respects, the most remarkable city of the ancient world. It was designed by the celebrated Greek architect Dinocrates, engaged by Alexander because of the great reputation he had acquired by the rebuilding of the temple of Diana at Ephesus. The reading of a description of the city reminds one of some of the plans submitted to the various modern municipalities for the making of a city beautiful, except that no modern city would possess the artistic skill or the civic enterprise necessary to even approach the magnificence of the Ptolemaic capital. The city was built on a neck of land washed by the Mediterranean on the north and Lake Maroetis on the south. Its streets were laid out in straight parallel lines, the principal street being about three miles long and two hundred feet broad. This was intersected at right angles by a shorter street of the same breadth, making the figure of a cross. Along both these streets were houses, temples, and public buildings of almost indescribable magnificence. In a two years' funeral journey the body of Alexander was brought from Babylon and buried in a splendid mausoleum at the intersection of the two main streets. The city was

divided into three sections: (1) the Jewish quarter on the northeast; (2) the Egyptian quarter on the west, which had been the site of the Egyptian village Rhacotis, and, (3) the Brucheum, which was the royal or Greek quarter and was the most magnificent part of the city.

Alexander had a very high opinion of Jews as citizens and went to great trouble to bring large numbers of them from Palestine to Alexandria. This policy was continued by Ptolemy Soter, who brought a hundred thousand more after the siege of Jerusalem. The second Ptolemy, Ptolemy Philadelphus, redeemed from slavery a hundred and ninety-eight thousand, paying their Egyptian owners a just money equivalent for each. The Jews were treated in all respects as the equals of the Macedonians, which attracted thousands of Jews from Syria. Never before, or since probably, have the Jews been so considerately treated and they laid aside many of their national distinctions, and were proud to be known as Hellenistic Jews.

The same wise and liberal policy was followed with the Egyptians. They were made to forget that they were a conquered race and that the Ptolemies were foreign kings. They were encouraged in the holding of high civil offices and especial deference was shown to the ancient

Egyptian religion. They were allowed to build their temples in their own quarters, and the Temple of Serapis, known as the Serapion, was one of the most palatial structures in the city. On great religious days the reigning Ptolemy would make a spectacular visit to show homage to the Egyptian gods. Throughout the rest of Egypt the Egyptians were allowed all the form and pomp of royalty, while the real power was retained by the Macedonian king. The Greek quarter became the intellectual center of attraction for all Greeks. Its unrestrained freedom of thought caused an immigration of Athenian philosophers and scientists which worked the ruin of Athens.

The most remarkable single institution in Athens was its world-famous Museum. This institution performed functions approximately similar to those of the modern university and is said to have housed at one time as many as fourteen thousand students. As a seat of learning it was without parallel in the ancient world. The most important element in its equipment was its enormous library. While much of the material for the library was collected by Ptolemy Soter, its establishment was made by his successor, Ptolemy Philadelphus, who was perhaps the most marked example of the love of learning

which seems to have run hereditarily through the entire dynasty. Demetrius Phalareus, considered the most learned man of the age, brought specially from Athens where he had been governor for many years, for the task, was instructed to collect all the writings in the world, and carried out his orders with great diligence and without regard to cost. A large body of transcribers was constantly maintained in the Museum to make correct copies of such works as their owners refused to sell. Any book brought into Egypt by foreigners was at once taken to the Museum and a correct copy made, which was given to the owner while the original was placed in the library. In most cases considerable sums of money were paid as indemnity. Draper says that Ptolemy Euergetes, having obtained from Athens the works of Euripides, Sophocles, and Aeschylus, sent their transcripts together with about $15,000 as payment for the originals. When works were translated as well as transcribed, enormous sums were involved. On the recommendation of Demetrius the famous translation of the bible, known as the Septuagint, was made. This was done at an almost inconceivable expense, and the translation had no rival until centuries later, when Jerome completed his Latin translation known as the Vulgate. The library

in the Museum increased rapidly until it is said to have contained four hundred thousand volumes.

The Museum was built in the Brucheum where it bordered on the Egyptian quarter. Close to it across the border was the Serapion and it was decided, probably for lack of space and other reasons, to form a second library, known as the daughter library, in the Serapion. The daughter library increased until it contained three hundred thousand volumes. The two libraries had on their shelves practically all the books then known. These libraries were to serve one of the three principal objects of the Museum—the perpetuation of knowedge. Another object was the increase of knowledge, and for this there was connected with the Museum, botanical and zoological gardens, containing plants and animals gathered from all parts of the world. There was also an astronomical observatory, containing spheres, globes, armils, astrolabes, and all instruments then known. For the measuring of time, they had the water-clock of Ctesibius. A very important department was the medical and anatomical, which carried on dissection for the increase of knowledge of the human body.

The third aim of the Museum was the diffusion of knowledge. This was accomplished

chiefly by lectures, discussions, and conversations carried on for the instruction of the immense body of students which had flocked there from all the leading countries of the world. It is not surprising that such an institution produced the greatest scientists and scholars recorded in the history of the times. Mathematicians, physicists, and astronomers, whose genius has never been surpassed, and whose names will never be forgotten, created what is known as the Alexandrian school. These men and their labors constitute the real birth of science. It was the first great attempt of the organization of human knowledge.

Before the labors of the Alexandrian astronomers, all that was known of the science was to be found in the writings of Aristotle, who had collected the current ideas of his time on this, as on many other subjects. As we shall see presently, it was the curse of the latter middle ages that the fragmentary knowledge of Aristotle was regarded by the Christian Church as the final revelation of all that should or could be known about the universe. This was entirely contrary to the spirit of the peripatetic philosopher, who fully realized and explained the tentative character of his own conclusions. Aristotle was called the peripatetic philosopher from his

habit of walking while addressing his pupils. He especially warned his readers not to accept his explanation of planatary motion but to compare that with their own ideas and what they had learned from others.

Aristotle was especially to be received with caution on astronomical subjects, as he himself was not an astronomer. He believed, in common with all Greek writers on this science, that the world was round, and this sound opinion was based probably not so much on observation and evidence as upon the Aristotelian idea that the circle was the perfect form. The Pythagoreans had accomplished a little in astronomy and the Greeks had inherited something from the Babylonian and Chaldean astronomers as a result of the Macedonian campaign. The scientific men who accompanied Alexander obtained from the Babylonian astronomers a series of observations of the eclipses of the moon covering a period of 1903 years. While the Babylonians were diligent observers, they accomplished next to nothing in astronomical theory and it was left for Alexandria to produce the first really great astronomers.

The first of these was Aristarchus who must be accounted one of the great astronomers of all time. Contrary to the established opinion of his

period, he believed that the earth moved in an orbit around the sun, a clear anticipation of Copernican astronomy. At the first glance it seems to be a great misfortune that Aristarchus failed to convince contemporary or later Greek astronomers. If this conception of the solar system could have been embodied a few hundred years later in the Almagest of Ptolemy, it might have prevented the great war between science and the church, waged around Galileo over the Copernican theory. On second thought, however, the mistake of the church in accepting the earth as the center of the universe has probably done more to emancipate the modern world from church authority than any single fact in its entire career. One of the books written by Aristarchus, which is still extent, is entitled "On the Magnitudes and Distances of the Sun and Moon." In this work he uses an ingenious method for ascertaining the comparative distances of the sun and the moon from the earth. His method was based on observing the moon at quadrature. Aristarchus knew the moon to be illumined by the light of the sun and that, therefore, when the moon was half full, it must be at right angles with the earth and the sun. The triangle formed by the three bodies would therefore be a right angled triangle. A calculation

well known in geometry would then yield the distance from the earth to the sun expressed in terms of the distance from the earth to the moon. By this method he arrived at the conclusion that the sun was from eighteen to twenty times the distance of the moon from the earth. The error is enormous, as we know now, and the actual distance of the sun from the earth is four hundred times that of the moon. It is amazing, however, that Aristarchus at his period should have even conceived such a method of measurement. The source of his error is easily understood. Even in our day, with our wonderful astronomical instruments, it is quite impossible to determine by the method of Aristarchus, when the moon is at quadrature, because it is impossible to tell by direct observation of the moon when it is half full. The moon being covered with elevations and depressions, the boundary line between the light and dark part of it, known as the terminator, is a very irregular line, and it is almost as difficult for us as it was for Aristarchus to know when this line is across the center of the moon. This determination being impossible to us, with our instruments, must have presented tremendous difficuties to Aristarchus, working with the crude apparatus of his time.

Belonging to the same period was Apollonius of Perga, who labored in Alexandria and came to be known as the great geometer. He developed the theory of conic sections and introduced the idea of epicycles to explain the apparent motion of the planets. The greatest of all the Alexandrian geometers, however, was Euclid, who opened a geometrical school in Alexandria about 300 B. C. His famous propositions in geometry have given him a reputation as durable as the science itself, and notwithstanding some criticism which has been passed upon them by recent geometers, they still maintain their ground as models of accuracy and perspicuity, and standards of exact demonstration. They were employed universally by the Greeks and were subsequently translated and preserved by the Arabs, and are still taught in our schools.

Perhaps even greater in mathematics than Euclid was Archimedes, the most inventive genius of antiquity. He was a native of Syracuse and spent almost all of his life there. He is included in the Alexandrian school of scientists because he want to Alexandria in his youth and completed his education in the museum under the Alexandrian mathematician and geometer Conon. This was about half a century after Euclid. He then returned to his native city and

immediately proceeded to make practical application of his knowledge and succeeded in establishing the science of engineering upon a mathematical basis. He was the devoted friend, and some say a relative of Hiero, the King of Syracuse. The famous Archimedian screw was invented to raise water from the hold of one of Hiero's ships. When Syracuse was besieged by the Romans, Hiero depended chiefly upon the ingenuity of Archimedes to hold them at bay. This he succeeded in doing by various contrivances, which prolonged the siege for three years. Some of the stories told of these devices are probably false or greatly exaggerated. Among these is the story of the burning mirror with which he is said to have thrown the heat of the sun upon the Roman ships, setting them on fire when they were within a bow shot of the city wall. This story is not now accepted because it is not mentioned by either Polybius, Livy or Plutarch. The French scientist Buffon, however, demonstrated that something of this kind could be accomplished. Probably the truth is that Archimedes did invent a burning mirror but that he did not set fire to the Roman ships. He invented a number of engines of war, one of which is said to have reached over the city wall, seized the Roman ships, lifted them high in the air and

then suddenly dropped them back into the sea. While he probably had devices which greatly damaged the Roman fleet, this enormous claw may be regarded as a myth. It may be said to the credit of the Roman general Marcellus, who conquered the city, that he gave strict orders to his soldiers that no harm should come to Archimedes. This disposition of the Roman general to honor brave and effective foes, which still persists in our day in the custom of allowing conspicuously brave enemies to keep their swords, was a departure from the policy of Alexander, who usually visited especial punishment on those who had succeeded in frustrating his plans. It is recorded, however, that when the soldiers entered Syracuse, one of them found Archimedes absorbed, to complete forgetfulness of the battle, in drawing a geometrical figure on the sand. The soldier, not having the least idea who he was, killed him. Marcellus lamented his death, gave him honorable burial and befriended his surviving relatives. In fulfillment of his own request, his tombstone was marked with the figure of a sphere inscribed in a cylinder. When Cicero was in Sicily, more than a hundred years later, he discovered the tomb of Archimedes overgrown with thorns and briars

and considered himself extremely fortunate in being able to rescue it from oblivion.

We return to the Alexandrian astronomers with the name of Hipparchus, who earned the reputation of being the greatest observing astronomer of the ancients. Competent critics have agreed that, notwithstanding the remarkable insight of Aristarchus, Hipparchus must be reckoned the greatest of the ancient astronomers. Unfortunately only one of his many books has been preserved. There is no proof that he belonged to Alexandria, though it is quite probable that he visited it and made observations there and his work is so associated with that of the Alexandrian astronomers that there is some justice in his inclusion in that school. He made more extensive observations than any other astronomer of his time, and made systematic use of old observations comparing them with later ones to discover astronomical changes which could not be detected within a single lifetime.

By comparing one of his own observations of the summer solstice with a similar one made by Aristarchus fourteen years before, he found that the anciently received value of 365¼ days was too great by seven minutes. This calculation by Hipparchus is within twelve seconds of the

truth. By very careful observation of the solstices and equinoxes, he discovered that the year is not divided by these into four equal parts. The sun required 94½ days to pass from the vernal equinox to the summer solstice while it took only 92½ to make the journey from the summer solstice to the autumnal equinox. This observation led Hipparchus to the great discovery of the eccentricity of the solar orbit; as we know now, of course, it really indicated the eccentricity of the earth's orbit around the sun. He was the first to construct astronomical tables, which have played so important a part in the history of astronomy. These were his tables of the sun. His observations of the moon led him to one of the finest theoretical deductions of lunar astronomy, known as the acceleration of the mean lunar motion. This discovery furnished Newton with one of the most delicate tests of his gravitation theory. Hipparchus also discovered the eccentricity of the lunar orbit and its inclination to the plane of the ecliptic.

The appearance of a new star induced him to direct his attention for the present from the sun and moon to the stars. By very arduous and protracted labor he made a star catalogue of the principal stars visible above his horizon, fixing the relative positions and configurations of 1080

stars. This led him to one of the greatest of all his discoveries, the shifting of the vernal equinox, indicating the precession of the equinoxes. By comparing his observations with those of Aristillus and Timocharis, of fifteen years before, he discovered that the vernal equinox had advanced two degrees, which he calculated to be a rate of forty-eight seconds a year. This is astonishingly near the truth, as a rate of fifty seconds and a fraction is now established. Most people who buy a planisphere at the stationers for the purpose of star gazing, would be surprised to learn that this method was invented by Hipparchus over two thousand years ago. Geography is also indebted to him for the happy method of fixing the places on the earth by latitude and longitude.

Before passing to the last of the great Greek astronomers, we will return to the period of Euclid and note the labors of the Alexandrian geographer, Eratosthenes. The most celebrated of his important labors was an effort to determine the size of the earth. It was known that Syene, the most southern city of ancient Egypt, was situated exactly on the equator, and at the summer solstice the gnomon cast no shadow, and the rays of the sun illumined the bottom of a deep well in that city. On the same day, Eratos-

thenes calculated that the meridional distance of the sun from the zenith at Alexandria was about seven degrees, or a one-fiftieth part of the circumference of the meridional circle. The distance from Syene to Alexandria was measured to be 5000 stadia. Eratosthenes multiplied this by fifty, calculating the circumference to be 250,000 stadia. Unfortunately we have no means of knowing the length of the Greek stadia, so that we cannot tell the correctness or incorrectness of this rough but ingenious calculation.

After the death of Hipparchus, Greek astronomy and Greek science suffered a relapse. Many writers have attempted to discover the reasons, and various explanations have been offered. Probably the most acceptable is one which ascribes the intellectual decline of Alexandria to the successful rivalry of Rome, which gradually became the intellectual center of the then known world. Freedom of opinion, however, was preserved in the capital of Egypt and some scattering observations of the stars and an occasional work on mathematics showed that the scientific spirit had not disappeared and about 130 A. D. the last and one of the most illustrious of the Greek astronomers appeared in Alexandria. This was the famous Ptolemy. He was not related to the kings of the Ptolemy dynasty, al-

though some writers have so asserted. The name Ptolemy was quite common in Egypt. His greatest service to the science of astronomy was the collection of the knowledge of his time into his great work of thirteen books, known as the Almagest. This work was the Bible of astronomy down to the days of Copernicus and for many centuries Ptolemy was described as the "Prince of the Astronomers." Recent investigation however, proves that as an astronomer Ptolemy was considerably inferior to Hipparchus. The work of Hipparchus is really the basis of the Almagest. Delambre, the French historian of astronomy writes of Hipparchus, as follows:

"When we consider all that Hipparchus invented or perfected, and reflect upon the number of his works and the mass of calculations which they imply, we must regard him as one of the most astonishing men of antiquity, and as the greatest of all in the sciences which are not purely speculative and which require a combination of geometrical knowledge with a knowledge of phenomena, to be observed only by diligent attention and refined instruments."

The same authority says of Ptolemy that after a laborious and minute examination of the Almagest, he doubts whether anything is con-

tained in the great work, beyond the author's own statement, from which it can be decisively inferred that Ptolemy ever observed at all. His own catalogue of stars contained only 1022, being 58 below the catalogue of Hipparchus. His determination of the positions of the stars gives every evidence of being obtained, not by his own observations, but by calculation of changes from the time of Hipparchus.

Delambre justly remarks that if any modern astronomer were to adopt a similar course, he would immediately forfeit all claims to confidence. But Ptolemy stands alone having no contemporary astronomers or writers to judge his methods. His principal astronomical discovery was that of the evection of the moon, but the socalled Ptolemaic system of the universe is in reality the system of Hipparchus.

Even after its decline, the scientific reputation of Alexandria was so great in the days of Julius Caesar that when the Roman calendar of the period had caused confusion by its errors, Caesar brought from Alexandria the astronomer Sosigenes. By his advice the lunar year was abolished and the civil year was regulated entirely by the sun and the Julian calendar introduced.

Alexandria and its science have been dealt with at some length here to give the basis for

a just estimate of the merits of the struggle between Alexandrian science and the Christian religion which led to pitched battles on the streets of the city. Before that story can be related in its proper setting, we shall be obliged to observe the rise of Christianity in the Roman Empire.

CHAPTER IV

CHRISTIANS AND EMPERORS

AS all students of the period have observed, the triumph of the Roman legions over the armies of Greece, was followed by the victory of Greek learning in the minds of Roman scholars. From this pupilary relation Roman thought never emerged, for by the time it was essaying to stand upon its own feet, the Christian religion supervened and arrested the intellectual development of Europe for more than a thousand years.

There was one conspicuous element in Roman public policy which can hardly be said to be copied from the Greeks, as it was quite common among the ancient nations. This was the practical unanimity of the educated classes in the opinion that, while the miracles and vagaries of religion were incredible to them, they must be accorded a pretended reverence to avoid the intellectual awakening, and the consequent discontent of the subject masses. Many earnestly religious students have emerged from their studies with the clear conviction that this always has been, and will always remain, the chief function of religion, this is why the study of history ranks

with the cultivation of science, as a force making for social progress.

We have here also, the real explanation of the insecurity of ancient knowledge and freedom of opinion. In the carefully preserved ignorance of the masses, the educated rulers found, in times of crises, they had raised a specter they could not lay—they had nursed a beast which turned to devour them. In our own time hope of escape from a recrudescence of decadent Christian dogmas, or the disastrous triumph of such superstitious and reactionary cults as the half mis-named Christian science, lies in the thorough democratization of scientific knowledge.

There is no lack of evidence of the general emancipation from the superstitions in the Empire, enjoyed by the rulers and scholars of Rome. Cicero tells the story of a consul of the Claudian gens, who when about to engage in the first Punic war, openly flouted the sacred auspices. When the sacred poultry were let out of the coop, to indicate, if they should drop a grain from the bill, the success of his undertaking, they refused to eat. Claudius, disgusted with the mummery of a performance he did not believe in, caused them to be thrown in the water, saying that they might drink if they would not eat. For this irreverence, although

this form of diviniation was then falling into disuse, he was condemned by the people. His colleague Junius also ignored the auspices, and there-by fell into such deep disfavor that he committed suicide. Cato, a rigid observer of all Roman ceremonies, said that the haruspices—the Etruscan name for the auspices—might well laugh in each others faces. Julius Caesar, in whom, says Robertson, "we see the Roman brain at its strongest," expressed repeatedly his contempt for the auspices and avowed his disbelief in the popular doctrine of immortality. He came off better than Claudius and Junius because of his greater power, and also probably because he won his battles while they lost theirs. Even Dean Merivale admits that Caesar "professed without reserve the principles of the unbelievers." And Julius Caesar was thoroughly typical of the men of action of the Roman world.

The hypocritical program of ruling the people by clouding their minds with discredited superstitions met with great difficulties in Rome. The Roman generals brought home from their warlike expeditions, hordes of prisoners of war, and each new horde brought with it a new religion. The Roman policy required that each new religion be placed on an equal footing with the old ones. This involved the necessity of the widest

possible toleration between the adherents of the various faiths. It was precisely at this point that Christianity impinged upon the religious serenity of the Roman Empire.

Lucretius, the most brilliant of all the Roman poets and scholars, wrote his world masterpiece, "On the Nature of the World" in which he gives the highest achievements of ancient science, to the utter rout of religion; Juvenal wrote his keen satires; Lucian devoted a genius of the first magnitude to lampooning the gods; but whatever objections the Roman government might have to such proceedings were purely political. They were not impious blasphemies, but a menace to the stability of society, because they disturbed its religious foundations. The so-called crime of heresy was unknown in pre-christian Rome. Renan says: "We may search in vain the whole Roman law before Constantine for a single passage against freedom of thought, and the history of imperial government furnishes no instance of a prosecution for entertaining an abstract doctrine." It did not occur to the Romans that the gods needed human defenders; their attitude was expressed in the saying of the Emperor Tiberius: "If the gods are insulted, let them see to it themselves."

In their first acquaintance with the Christians, the Romans regarded them as a sect of the Jews. The Jews were in disfavor with the Romans because they refused to concur in the Roman policy of friendly tolerance of every religion for every other religion. With the Jew, as later with the Christian, his own religion was true, and every other religion was an abominable idolatry. While the Romans made some unjustifiable attacks on the Jews, Robertson says: "It was the constant policy of the Emperors to let them alone and to protect them against the hatred which their own fanaticism aroused." This policy worked well, but presently the Romans observed, to their dismay, that certain of the Jews were proselitizing, a practice which flew in the face of all Roman precedent. Rome expected every worshipper to keep to his own religion, and leave every other worshipper to the undisturbed enjoyment of the same privilege. When they discovered that the Jews who were seeking to make converts among the Romans were not judaists, but Christians, their anger was turned on the Christian faith. When the Romans who became Christians, began to follow the same evil example of vilifying every other faith in the interest of their own, the governing Romans saw the whole social fabric threatened with disintegration. Then it

was that the persecution of the Christians was begun. The persecution of the Christians by the Romans was, beyond all question due, not to Roman intolerance of Christianity, but to Christian intolerance of the religions which had been guaranteed protection by the tolerant Romans. Any one who reaches any other conclusion is guilty of a strange mis-reading of Roman history. Notwithstanding this provocation, the Emperor Trajan issued an edict decreeing that Christians were not to be sought out, that anonymous charges were not to be noticed, and that an informer who failed to establish his charge should be liable to be punished under the laws against calumny. All of which was in striking contrast to the later procedure of the Christian inquisition. The Christians themselves recognized that the edict of Trajan protected them, and that their persecution proceeded from the populace rather than the authorities. While there was great laxity of application, the law was severe; the Christian religion was outlawed, and to be found to be a Christian was punishable with death.

The Romans could not understand the refusal of the Roman Christians to join all other Romans in the worship of the Emperors, as this was more of an act of patriotism than religion. They felt

much as would a modern nation at a refusal to show respect to its flag, and as the Romans were almost constantly at war, it seemed to them like treason to the Empire. Moreover, this worship of the emperors was not required of all the inhabitants, but only of soldiers and civil officers. Although the Christians, in their written Apologies for Christianity, only thinly disguised their hatred of Roman civilization, and barely veiled their intention of exterminating all other cults should they get the upper hand, and at the same time openly sought the glory of martyrdom, the actual number of martyred Christians was far below those claimed by later Christian writers.

Professor Bury, a thoroughly reliable Roman scholar, says: "There were some executions in the second century—not many that are well attested." Of the third century he says: "Throughout this century, there were not many victims, though afterwards the Christians invented a whole mythology of martyrdoms. Many cruelties were imputed to Emperors under whom we know that the Church enjoyed perfect peace." Later, the Emperor Diocletian made a long and bloody attempt to suppress Christianity. When this was found impossible, because of their increased numbers, the Emperors who followed him discontinued the persecution, and

issued edicts of toleration, in the years 311 and 313 A. D. These documents clearly present the Roman attitude, as will be seen from Gibbon's translation of the first one to appear in the eastern provinces:

"We were particularly desirous of reclaiming into the way of reason and nature the deluded Christians, who had renounced the religion and ceremonies instituted by their fathers and presumptuously despising the practice of antiquity, had invented extravagent laws and opinions according to the dictates of their fancy, and had collected a various society from the different provinces of our Empire. The edicts which we have published to enforce the worship of the gods, having exposed many of the Christians to danger and distress, many having suffered death and many more, who still persist in their impious folly, being left destitute of any public exercise of religion, we are disposed to extend to those unhappy men the effects of our wonted clemency. We permit them, therefore, freely to profess their private opinions, and to assemble in their conventicles without fear or molestation, provided always that they preserve a due respect to the established laws and government."

The second edict, known as the Edict of Milan, brings us to the period of Constantine, who was

its author, and whose chief claim to fame is, that he was the first Christian Emperor. In the confusion of opinion as to the merits of his conversion, it is quite clear that political interest played a greater part than individual conviction, in his declaration for the new religion. The Emperor Diocletian adopted the idea of leaving his rulership of the vast Roman Empire to a number of Emperors who should divide the Empire among them, and rule as colleagues. Instead of which they became bitter rivals, plotting and counter-plotting for supremacy. This struggle was at its zenith when Constantine succeeded his father Constantius, as Emperor of the West. At York, in Britain, where he was present at his father's death, he accepted the nomination to his father's place, tendered him by the army, and shrewdly laid his plans to overthrow his rivals, and make himself supreme ruler. By this time the Christians had become so numerous, that the announcement of his conversion to that faith secured him supporters in every town, and soldiers in every army. It was while marching to the battle of Milvain Bridge, near Rome, where he conquered Maxentius, one of his rival Emperors, that he is said to have seen at noonday, a flaming cross in the sky, with the motto "By this conquer." This story has met with a variety

of reception, from the complete belief of the Christian historian Eusebius, who claims to have had it from the Emperor's own lips, to the scepticism of Gibbon, who treats it as a fable. Gibbon has probably anticipated the final judgment of posterity.

Constantine was never more than half Christian, half pagan. He attempted to combine the worship of Christ and Apollo, and upon his coins was the inscription of one and the image of the other. In this he was typical of Christianity itself, which, as the least research reveals, copied the great body of its ceremonies from the religious customs of pre-Christian Rome. Constantine also held for a time to the Roman policy of toleration. When the Christian church divided over the teachings of Arius, the Church Presbyter of Alexandria, who dissented from the doctrine of the co-eternity of the Trinity, insisting that it was impossible for the son to be as old as the father, Constantine desired a creed which would be broad enough to accept both parties to the controversy. He saw that his administration would be more effectively supported by a united Church. When he observed the Christian controversialists long enough to see that they had not the slightest notions of tolerance, he took sides with the most powerful sect and

issued the following edict against Arius: "This also I enjoin, that if any one shall be found to have concealed any writing composed by Arius, and shall not immediately bring it and consume it in the fire, death shall be his punishment; for as soon as ever he is taken in this crime, he shall suffer capital punishment. God preserve you."

It was Constantine who summoned the celebrated Council of Nicea, A. D. 325. His idea was that a council of the church rulers should draw up a written creed so that the Christians of the Empire might know what they should believe. Thus originated the Nicene creed. After the Nicean Council had decided against Arius, Constantine ordered his banishment. The supposed deliberation about the case of Arius in the Council was a pretense maintained for the sake of appearances; the fate of the Alexandrian had been determined before the Council gathered. The historian Draper says: "No contemporary for a moment supposed that this was an assembly of simple-hearted men, anxious by a mutual comparison of thought, to ascertain the truth. Its aim was not to compose such a creed as would give unity to the Church, but one so worded that the Arians would be compelled to refuse to sign it, and so ruin themselves."

Constantine's sister, Constantia, was a member of the Arian party and she eventually succeeded in converting him to the side of the Presbyter. This led to Arius being restored to imperial favor. He was invited to Constantinople, which had been the city of Byzantium until the change was made to perpetuate the name of the Emperor, and Alexander the Bishop of that city, was ordered to receive him into communion the day following his arrival. Bishop Alexander was a fanatical supporter of the anti-Arians. On receiving the Emperor's orders he fled from the Church and falling prostrate he prayed to God that he would interpose and save his servant from being forced into this sin, even if it should be by death. The only possible interpretation of this prayer is that it was a supplication for the death of Arius, and strangely enough that very evening as Arius was walking along the streets, he was seized with a sudden and violent illness, hastened into a house and died. Those familiar with Asiatic crimes of the period have never doubted that he was poisoned, and one historian says "the difference is little between praying for the death of a man and compassing it."

Before and during the reign of Constantine, the Church gave a dramatic imitation of the

bloody struggle between co-reigning Emperors for supremacy, in the fierce encounters between the bishops of Alexandria, Rome, and Constantinople, each seeking to be supreme authority in the Church. It was the common custom for churchmen, seeking places of power in the church, to maintain bodies of supporters drawn chiefly from the rabble of the streets, and between these bloody battles were often fought. Macedonius, the Bishop of Alexandria, passed over the slaughtered bodies of three thousand people to take possession of his episcopal throne. The Bishopric of Rome was often bitterly fought for because the prodigal gifts of the rich Roman ladies made it a luxurious possession. At the election of Damasus, a hundred and thirty of the slain lay in the basilica of Cisinnius; the conspirators had called in the aid of a rabble of gladiators, charioteers, and other ruffians, and the riot had to be ended by the intervention of the Imperial troops. When the bishops met to discuss questions of Church doctrine, they often had crowds of bathmen outside armed with bludgeons to save a lost argument by the test of battle.

From the time Christianity assumed the purple in the time of Constantine, the Emperors began to feel that the Christian religion was not

content to be a servant of the state, but that its official heads sought to be rivals of the Emperors and would not hesitate to be their masters. Athanasius, the Bishop of Alexandria, who belonged to the orthodox party, when the Emperor Constantius, Constantine's son and successor, was on the side of the Arians, openly defied the Emperor and challenged his authority. Here was forged a weapon which was used by the Popes with terrible results in the succeeding centuries. This was the power of the Church to absolve the subjects of an imperial ruler from his claim to their allegiance, on the ground that first obedience must be rendered to the divine power, which was able to punish their souls and which took precedence of the imperial power, which was only able to punish with death and the seizure of goods.

During this rivalry, the bishops indicated to the civil rulers such heretics as they wished to have punished, and the rulers were made to feel that if the wishes of the ecclesiastics were not observed dire results might follow. Even Constantine was made to feel this pressure to the point of causing the death of his old friend, Sopater the philosopher. Sopater was accused by the superstitious Christians of binding the winds in an adverse quarter by the influence of

magic so that the corn ships could not reach Constantinople. The Emperor was obliged to give orders for his decapitation in order to satisfy the Christian mob in the theater.

The grand historic struggle between religion, as represented by Christianity, and science, where it had reached its highest expression in Alexandria, was connected with the reign of the Emperor Theodosius, the Spaniard, who wore the purple toward the close of the fourth century. Theodosius was one of the most ardent Christians who ever held the Roman scepter. He was determined upon the extirpation of all anti-Christian ideas and the supremacy of official religion. It was largely because of the services he rendered in this field that he came to be known as Theodosius, the great. Before noting the consequences of his policy in Alexandria, it will be necessary to resume the narrative of the preceding chapter.

CHAPTER V

THE ALEXANDRIA TRAGEDY

DURING a battle fought in Alexandria between Julius Caesar and the last of the Ptolemies, the great library in the Museum caught fire, but the daughter library in the Serapion escaped. When the Alexandrian libraries were being formed by the early Ptolemaic kings, the king of Pergamos had set about securing a rival collection. The Ptolemies replied to his rivalry by forbidding the exportation of papyrus, but the king of Pergamos succeeded in building a library of 200,000 volumes through the invention of parchment. Cleopatra, the last of the Ptolemaic line, was disconsolate over the burning of the library in the Museum and Marc Antony to make amends for the catastrophe, presented to Cleopatra the library of Pergamos. This probably made the Serapion library about half a million volumes and larger than had been the library of the Museum. It was now the greatest collection of learning in existence in the world.

The Serapion, however, gave constant offense to the Christian Archbishop of Alexandria, the notorius and infamous Theophilus. He hated the Serapion because it was associated with the

worship of the Egyptian gods. This attitude of Theophilus was typical of the attitude of the Alexandrian Christians in general. Everything in the Serapion came under their suspicion. They despised the brazen circles by which Eratosthenes had measured the size of the earth and Timocharis had determined the motions of Venus. The astronomical instruments which had been used for forty years on the terrace of the Serapion by Claudius Ptolemy "The Prince of Astronomers" meant nothing to the ignorant Theophilus, all he awaited was an opportunity to vent his wrath on this magnificent temple and all it contained. This opportunity came through a bequest formally made by the Emperor Constantius, son of Constantine, of the site of an ancient temple of Osiris for the erection of a Christian church. While digging the foundations they discovered the obscene symbols of phallic worship, and with more zeal than modesty or discretion, Theophilus had them exhibited to the derision of the ignorant rabble in the market place. The shocked and astounded Egyptians rose to avenge the insult to their ancient faith. A riot ensued, the Egyptian party being led by the philosopher Olympus. The Egyptians took up their headquarters in the Serapion, from which they sallied forth from

time to time to do battle with the Christians. The dispute was finally referred for settlement to the Emperor. On the arrival of the decision of Theodosius the Egyptians laid down their arms, little expecting what that decision would be. Theodosius, who was notoriously ignorant, enjoined that the building should be destroyed and entrusted the task to the willing Theophilus. He began his labors with the destruction of the library, one of the most sinister deeds ever performed deliberately in all the history of learning. He did not rest until the magnificent temple was in hopeless ruins.

A few years later the Archbishop Theophilus had died and his position had been taken by his nephew Cyril, who had lived for five years among the monks of Nitria. Cyril was the fashionable preacher of Alexandria and had a large congregation. His pagan critics asserted that the clapping of hands at the most eloquent passages of his sermons were performed by persons arranged in the congregation and paid for their approval. From which it appears that the "claque" is not an entirely modern institution. Cyril's activities were not confined to the preaching of eloquent and fashionable sermons. The division of the population of the city into Pagans, Jews, and Christians,

now that Greek toleration had disappeared, resulted in constant bloody brawls between the rabble of the various sections. In these street feuds Cyril had more than once been the instigator of the Christians. He also set them on to mob and sack the synagogues and pillage the houses of the Jews, and sought to drive them from the city. The Prefect Orestes was obliged to interfere to stop the riots, but Cyril was not disposed to recognize the authority of the Prefect. His old associates, the half wild Nitrian monks, swarmed in from the desert five hundred strong. One of their leaders, Ammonius, wounded the Prefect in the head with a stone. The non-Christian citizens, dismayed by this lawless performance, seized Ammonius and had him executed by the lictor. Cyril however, caused his body to be taken to the Caesareum, laid in state, buried with unusual honors, and cannonized as a holy martyr.

There was something else in Alexandria which disturbed the complacency of the Archbishop Cyril more than the Pagans and Jews. This was a beautiful young woman, the now celebrated Hypatia. She was the daughter of Theon, the mathematician, and was distinguished as a brilliant lecturer on the Neoplatonic and Aristotelian philosophies. She was also the author of works

in exposition of the geometry of Apollonius and others. Her lecture room was crowded with an audience more fashionable and wealthy even than that of Cyril. This was a source of constant bitterness to the Archbishop, who not only loathed her doctrines but resented her greater success.

Cyril decided to rid himself of his rival, and the "bare-legged, black-cowled fiends" of the Nitrian desert were again brought in. By Cyril's instructions they were ambushed outside the lecture room. What followed is described by Robertson as "one of the vilest episodes in the whole history of religion." As it is one of the most important events in the long struggle between science and superstition, it is presented here as narrated by the celebrated Roman scholar and historian, Gibbon, in the forty-seventh chapter of his "Decline and Fall of the Roman Empire."

"Hypatia, the daughter of Theon the mathematician, was initiated in her father's studies: Her learned comments have elucidated the geometry of Apollonius and Diophantus: and she publicly taught, both at Athens and Alexandria, the philosophy of Plato and Aristotle. In the bloom of beauty and in the maturity of wisdom, the modest maid refused her lovers and instruct-

ed her disciples; the persons most illustrious for their rank or merit were impatient to visit the female philosopher; and Cyril beheld, with jealous eye the gorgeous train of horses and slaves who crowded the door of her academy.

"A rumor was spread among the Christians that the daughter of Theon was the only obstacle to the reconciliation of the Prefect and the Archbishop; and that obstacle was speedily removed. On a fatal day, in the holy season of Lent, Hypatia was torn from her chariot, stripped naked, dragged to the church and inhumanly butchered by the hands of Peter the Reader and a troop of merciless fanatics; her flesh was scraped from her bones with sharp oyster shells, and her quivering limbs were delivered to the flames. The just progress of inquiry and punishment was stopped by seasonable gifts; but the murder of Hypatia has imprinted an indelible stain on the character and religion of Cyril of Alexandria."

After the cowardly murder of Hypatia, Greek learning lingered in scattered places for another century. In the third century, Porphyry, the celebrated pupil of Plotinus, had opened a school in Rome which had attained a great reputation in the teaching of astronomy and geography and other sciences. He was the author of a book

which contradicted the Christian religion and was replied to by Eusebius and St. Jerome. The most effective reply, however, was that of the Emperor Theodosius in the fourth century, who ordered all copies to be burned. The burning of the books containing Greek science and the persecution of any one found owning such books became a steady Christian policy, which burst forth into special action every time a very ardent Christian rose to power. The result was that men everywhere burnt the most precious volumes in their private libraries as a measure of self-protection against the Christians.

A hundred years after Theodosius came a still more earnest and fanatical Christian Emperor in Justinian. Justinian's anxiety to promote the faith among unwilling heathen resulted in seventy thousand forced baptisms in Asia Minor alone, and his determination to stamp out heresy brought on a bloody war with the Phrygians. His most notorious act was to give Greek philosophy and science the final death wound, by ordering the closing of the schools in Athens A. D. 529. When this order was enforced, the last representatives of Greek learning, Damasius, Simplisius, and Isadorus, who had been professors in the schools now closed, went as exiles to Persia. They returned when Chosroes, the Em-

peror of Persia, made his treaty of peace with the Romans, in which he stipulated safety and toleration for the exiled Greek philosophers. They returned to find however that Greek learning had been martyred and the Christian faith had been crowned in its place. Then came to a close a thousand years of Greek intellectual development which will illuminate the pages of history to the end of time. Thanks to Christianity, it was followed by a thousand years of intellectual darkness, which will be known as the Dark Ages as long as history continues to be written.

It is impossible to read the history of the struggle between science and superstition from the days of Thales to the deeds of Justinian without arriving at the conclusion reached by one of America's first scholars, the dean of American sociologists, Lester F. Ward, that "Christianity proscribed philosophy, abolished the schools, and plunged the world into an abyss of darkness from which it only emerged after twelve hundred years. Ignorant of what would have happened if this had not happened, nothing is left but to regard the advent of Christianity as a calamity."

As it will be impossible in this small volume to consider at length the developments of the

Dark Ages, which were dark largely because of the triumphs of Christianity in Europe, we will briefly trace the chief outlines. Until quite recently, it was the fashion to quote the Christian Fathers, but modern examination of their writings has put this out of vogue by showing that no enlightenment, human or divine, raised them above the dense ignorance of their time; an ignorance for which they themselves were in no slight degree responsible. Their attitude toward science is depicted by St. Augustine, the Bishop of Hippo, who contended that it was useless to study the structure of the universe, as the scriptures said there was soon to be a new heaven and a new earth.

With the capture of Alexandria by Omar in the seventh century, the Arabians came in contact with such Greek books as had escaped destruction by the Christians, and throughout the succeeding centuries the torch of science was kept burning by the Saracens. It was the renewal of contact between Arabia and Europe, as in the case of the Moors in Spain, which revived the sacred flame in Europe. The works of the Alexandrian astronomers and mathematicians, which had been translated into Arabic, were toward the close of the Middle Ages translated from the Arabic into the European languages.

The great work of Copernicus "De Revolutionibus," which is the foundation of modern astronomy shows the germination of modern knowledge from seeds originally planted by the Greeks.

Copernicus had great difficulty in securing the publication of his book and did not dare attempt it in Catholic countries. Even in Protestant countries the opposition to the new ideas was bitter. In order to escape as far as possible the notice and opposition of Protestant leaders at Wittenberg, a natural center of publication, it was intrusted to the publisher Osiander at Nuremberg, but Osiander knew the danger and his courage failed him. Copernicus died without seeing his book completed and never knew of the treachery of Osiander in the insertion of a crawling preface by himself, but supposed for some time to be by the author, in which it was declared that the teachings of the book were merely intended as indulgences of the imagination. For many years this historic work of the Canon of Frauenberg passed almost unnoticed, except for a small group of scholars who perceived its importance, only to become a standard of battle raised by the noted Bruno and the no less illustrious Galileo.

CHAPTER VI

BRUNO THE WANDERER

BRUNO was born at the middle of the sixteenth century—1548—in the township of Nola, near Naples. His father, Giovanni, was a soldier and, probably as a compliment to King Philip of Spain, who then ruled the Kingdom of Naples, Bruno was named Filippo. The name which he made famous in history, Giordano, was assumed according to custom when he entered the religious order of the Dominicans. An example of the impressions which religion made on Bruno's mind in his boyhood may be found in the story he told in later life which has its scene in a neighboring village. Bruno tells how Scipio Savolino used to confess his sins once a year on Holy Friday to the Cure, Don Paulino, who in addition to being his father confessor on one day of the year, was his boon companion on every other day. Although Scipio acknowledged that his sins "were many and great" his old companion, the Cure, had no difficulty in absolving him. One performance of the ceremony was enough and in succeeding years Scipio would say to Don Paulino, "Father Mine, the sins of a year ago today, you know them;" and Don Paulino would reply, "Son, thou knowest the ab-

solution of a year ago today—go in peace and sin no more!'' This story reflects the temper of the Church, which was rigid in the matter of belief and notoriously lax on the question of morals. This laxity of the Church was one of the important contributory factors to the Lutheran Reformation.

In his early youth Bruno had a striking lesson in that deceptiveness of appearances which was responsible for so many mistakes about the origin and structure of the universe. From his home he could see Mount Vesuvius; it looked dark, barren, rugged, and repellant, and he had this idea of it for many years. When he grew old enough to visit it, he found its slopes to be a perfect garden, rich in forms and colors, while now it was the slopes of his own garden-decked hill which looked barren and gloomy in the distance. This incident greatly impressed Bruno and probably helped him to discard current theories about the universe based on what is seen, and to accept the Copernican explanation, which contradicts all appearances.

To criticise Bruno for entering the Church would be to display a lack of historical sense. In the sixteenth century in Italy, the Church presented almost the only opportunity for a career, especially to one who was studious but

not rich. He had an opportunity to see the Church at its worst, as he joined the Dominican Order, which was the narrowest and most bigoted and had control of the Inquisition. At this time the doings of the Inquisition had become unbearable, resulting in riots, two of whose ringleaders were beheaded. The Waldenses were being subjected to a persecution by the Church, which was then at the zenith of its brutality. This was a sect which had risen in the south of France, as disciples of Peter Waldo. Their preacher explained the scriptures and urged men to holy lives, which was regarded by the mother Church as an important usurpation of ecclesiastical functions. The Waldenses protested against indulgences, which they said had nearly abolished prayer, fasting, and alms. They also protested against prayers for the dead, asserting that their souls had already gone either to heaven or to hell. When Bruno was thirteen years old, in one single day the Church butchered eighty-eight Waldenses with the same knife, their bodies being quartered and scattered along the road to Calabria. This was the period when the Catholic Church was taking the steps which it considered necessary as a result of the Lutheran Reformation of half a century earlier. These measures consisted in the institution of

the Order of the Jesuits, the establishment of the Inquisition, and the censorship of the press by means of the Index of forbidden books. At the Council of Trent it was decided that the Order of Jesus, founded by Loyola in order to prevent further developments of the Lutheran type, was to set itself "to erase with fire and sword the least traces of heresy." Little did Bruno realize what this decision would mean for him.

The signs of the coming heretic were evident in Bruno even during his novitiate. Written charges were drawn up against him for giving away some images of the saints which should have been carefully kept. As the monks were forbidden to study serious works, which might lead to heretical opinions, their minds were distracted and amused by foolish books which were highly recommended by the ecclesiastical authorities. One of these was called the "Seven Delights of the Madonna." This book Bruno advised the monks to throw aside and to devote their attention to the best of the books they were allowed to read, especially recommending the "Lives of the Fathers." The first charges were torn up by the Prior, but later more serious accusations of having spoken favorably of the Arian heresy in a private conversation convinced him that he was in danger, and while the process

was pending, he fled from Naples and went to Rome.

While Bruno was in Rome staying in the cloister of Minerva, news reached him that steps were being taken to begin a third action against him at Rome itself. This action was to be composed of thirty articles, the principal evidence against him being the discovery of a certain heretical book which he supposed he had safely disposed of before leaving Naples. As this threatened to be serious, he decided to flee from Rome.

Bruno was now twenty-eight years of age and his flight from Rome marks the beginning of sixteen years of constant wandering through Europe. This method of living seems to have been greatly facilitated by the customs of the period. The wandering scholar seems to have been a usual figure in the sixteenth century. Bruno selected the cities he visited from two principal consideration: first, whether they contained universities at which he might lecture; and, second, whether they had printing establishments where he might produce his books. When Bruno entered a university town, he appears to have gone directly to the university and sought employment as a specialist in the art of training the memory. As the preaching of long sermons was one of the principal public func-

tions of the time and congregations objected, then as now, to reading from manuscript, ability to memorize had great value and was greatly sought in the universities. Bruno had obtained his system from a close study of the works of Raymond Lully, who had a great reputation as a writer on the memory. Whether Bruno's system had any special merit, we have no means of knowing, but it certainly did not deserve the name of science which he gave it. It is quite probable that Bruno himself valued it chiefly as a means of securing quick employment, much as Kepler published his astrological almanac in which he did not believe, and used the proceeds of its sale to devote his time to the study of astronomy. It appears that when Bruno found himself settled in a university and began to feel his position secure, he also began to express his real opinions, which were in violent contradiction to those of his colleagues.

The bitter conflicts which invariably arose between Bruno and the other teachers in the universities usually had their origin in the criticism of Aristotelian philosophy. All through this period Aristotle had an authority second only to the scriptures. It must be remembered, however, that Aristotle, as taught in the univer-

sities and sustained by the Church as being almost a part of the divine revelation, was not Aristotle as known to the Greeks or to the moderns. The uses which were made of the writings of Aristotle to sustain the dogmas of the medieval Church would have greatly amazed the peripatetic philosopher himself. The idea that his works contained the sum of all human knowledge and that his opinions should be binding on the human race to the end of time had never occurred to him, and had such a notion been expressed to him it would undoubtedly have provoked his fierce denunciation. The bogus Aristotle of the mediaeval Church was the creation of the astute, thirteenth century theologian, Thomas Aquinas, known as the "divine" Thomas. Aristotle had been considered the chief bulwark of infidelity; after the transformation, the contradiction of his opinions was fraught with danger of capital punishment. Although Bruno did much to shake the authority of the Stagirite, it remained long in vogue. In Paris in 1624, twenty-four years after Bruno's death, the theologians induced parliament to issue a decree against all who publicly opposed Aristotle. Five years after the same parliament, urged by the theo-

logical department of the University of Paris —the Sorbonne—decreed that an attack on Aristotle should be considered and dealt with as an attack on the Church.

The strength of Aristotle as an authority in the universities is well illustrated in the story told by George Henry Lewes, who considers Bruno a figure in the history of philosophy. "A young student thought he observed spots on the sun and related the incident to a priest, by whom he was counseled as follows: 'My son, I have read Aristotle many times and I assure you there is nothing of the kind mentioned by him. Go rest in peace, and be certain that the spots you have seen are in your eyes and not in the sun.' "

In the intervals in which Bruno was not engaged in writing or in teaching in the universities, he managed to make a scant livelihood as private tutor. He sometimes worked as journeyman printer, being a skilful typesetter. He visited so many towns and cities during his wanderings that a mere catalogue of them would be confusing. In this narrative only the principal places will be given. The first town he visited was Noli, on the Gulf of Genoa, which also served as a refuge for Dante when in exile. He taught grammar to boys and astronomy and

cosmography to a group of gentlemen. After a stay of four or five months, he went to Savona, to Turin, and finally to Venice. Here he spent six weeks trying to find employment, but the principal offices and schools were closed on account of the plague which was destroying the inhabitants of the town. He managed, however, to get out his first book, which has not been preserved, entitled "Signs of the Times." This book was probably—to borrow a simile from the artists—a pot boiler, intended to enable its author to make a small sum for immediate necessities. It was followed by another work, "The Ark of Noah."

"The Ark of Noah" was one of several satires which Bruno wrote and published from time to time, with a daring which amazed his more timid contemporaries. The book represented the animals assembled to settle a dispute about rank. The ass was in great danger of losing his pre-eminent position in the poop of the ark because his power was in his hoofs rather than in his head. It is quite probable that the readers of the book interpreted the ass to be the representative of the monks, and it is said that one of the popes considered the sarcasm as aimed at himself. Asininity was Bruno's favorite epithet for the expression of

his contempt for the ignorance and stupidity of the monks.

"From Venice," Bruno tells us, "I went to Padua, where I found some fathers of the order of St. Dominic, whom I knew; they persuaded me to resume the habit, even though I should not wish to return to the order, as it was more convenient for travel: with this idea I went to Bergamo, and had a robe made of cheap white cloth, placing it over the scapular which I had kept when I left Rome." As he was traveling from Bergamo to Lyons, he was warned that he would meet scant sympathy at the latter place and turned his face in the direction of Geneva, which at that time was the home of exiles of all nations, and especially of Italians. In the book of the Rector of the Academy at Geneva for the year 1579, under the date of May 22, is the name Philippus Brunus, written in his own hand. As there has been considerable discussion as to whether or not Bruno accepted the religion of Calvin during his stay in Geneva, the following statement, made by himself before the Court of Venice when he was on trial in that city and found in Document 9, seems to be decisive. When he arrived in Geneva, he was called upon by a distinguished exile and reformer, the

Marquis of Vico, a Neapolitan. The statement to the Court relates to his conversation with the Marquis:

"He asked me who I was, and whether I had come to stay there and to profess the religion of the city, to which, after I had given an account of myself and of my reasons for abandoning the Order, I said that I had no intention of professing the religion of the city, not knowing what it was, and that therefore I wished rather to remain living in freedom and security, than in any other manner. I was persuaded, in any case, to lay aside the habit I wore; so I had made for myself from the cloth a pair of trews and other things, while the Marquis himself, with other Italians, gave me a sword, hat, cape, and other necessaries of clothing, and enabled me to support myself so far by correcting proofs. I stayed about two months, and attended at times the preachings and discussions, both of Italians and Frenchmen who lectured and preached in the city; among others, I heard several times Nicolo Balbani of Lucca, who read on the epistles of St. Paul, and preached the Gospels; but having been told that I could not remain there long if I did not make up my mind to adopt the re-

ligion of the city, for if not I should receive no assistance, I resolved to leave."

Documents published by Dufour in 1884, dealing with Bruno's stay in Geneva, prove conclusively that he had additional reasons for leaving Geneva. The chief of these was a controversy which arose between himself and De La Faye, who was then professor of philosophy in the Academy. Bruno caused to be printed a reply to De La Faye in which he enumerated twenty errors made by the professor in one of his lectures. As the professor was almost all powerful with the authorities of the city, life in Geneva was made extremely unpleasant for Bruno, though he probably had the best of the controversy so far as merits were concerned. The power of the Church was invoked against him and he left Geneva with an impression, which he never changed, that narrow and bigoted as were the Lutheran Protestants, they were less so than the Calvinists. On the whole, Bruno escaped rather easily from the city in which Calvin only twenty-six years before had burned its ablest scientific man, Michael Servetus, because of his disagreement with the doctrine of the trinity.

From Geneva, he went to Lyons, where he found it impossible to make a living, and

passed on to Toulouse, which boasted one of the most flourishing universities of the period. While Bruno was conducting private classes, a chair of the university fell vacant and he was allowed to compete for it. He took a doctor's degree in theology and secured the chair by the free election of students. Here he remained for two years, lecturing on the teachings of Aristotle and here, as almost everywhere, his departure was brought about by opinions which he expressed in conversations and discussions. Toulouse was a bad city for heretics, as was demonstrated thirty-five years later by the burning of Vanini.

In the latter part of 1581, Bruno set foot in the streets of Paris, still slippery with the blood of the Eve of St. Bartholomew. Here he delivered a course of thirty lectures on the "thirty divine attributes," which brought him an offer of a professorship. This, however, he could not accept, as it required that he attend mass, which he refused to do. His fame had reached the ears of Henry III, who was then very much interested in philosophy and who desired to satisfy himself as to whether Bruno's art of memory was a natural process or based on magic. Bruno proved to him that a powerful memory was a purely natural product.

While in Paris on this first visit, he published many books, one on the "Art of Memory," being dedicated to the King. Brunnhofer speaking of the art of memory taught by Bruno, says, "The art was a convenient means of introducing Bruno to strange universities, gaining him favor with the great, or helping him out of pressing money troubles. It was his exoteric philosophy, with which he could carefully drape his philosophy of religion hostile to the Church, and ride as hobby horse in his unfruitful humours." His Parisian writings reveal him as an ardent disciple of Copernicus, which also brought him into conflict with the accepted authorities. His lectures in Paris were highly successful and Nostitz, who was one of his pupils, wrote thirty-three years later: "He was able to discourse impromptu on any subject suggested, to speak without preparation extensively and eloquently, and he attracted many pupils and admirers in Paris." By 1583, however, he had come into conflict with conventional opinion and found it desirable to seek the wider tolerance of London.

England in the days of Elizabeth was a refuge to the religious exiles of many nations, and Italians were especially welcome. Elizabeth had two Italian physicians and conversed

with them in their own language. The Elizabethan court attracted and encouraged masters of literature, who have made the period famous. These were the days of Shakespeare, Spenser, and Jonson. In the early months of 1583, Bruno was in Oxford, which was the English stronghold of Aristotelian philosophy. One of its statutes said that: "Bachelors and Masters who did not follow Aristotle faithfully were liable to a fine of five shillings for every point of divergence," and the records of the university show that teachers had been expelled for dissenting from the teachings of the Greek. Oxford was cold and conservative, a reputation which it has never since lost. It had none of the enthusiasm of French and Italian institutions and one can well imagine the chill reception accorded Bruno's letter asking permission to lecture there, which read as follows:

"To the most excellent, the Vice-Chancellor of the University of Oxford, its most famous Doctors and celebrated Masters—Salutation from Philotheus Jordanus Brunus of Nola, Doctor of a more scientific theology, professor of a purer and less harmful learning, known in the chief universities of Europe, a philosopher approved and honourably received, a stranger

with none but the uncivilised and ignoble, a wakener of sleeping minds, tamer of presumptious and obstinate ignorance, who in all respects professes a general love of man, and cares not for the Italian more than for the Briton, male more than female, the mitre more than the crown, the toga more than the coat of mail, the cowled more than the uncowled; but loves him who in intercourse is the more peaceable, friendly and useful, whom only propagators of folly and hypocrites detest, whom the honourable and studious love, whom noble minds applaud. If this writing appears to conflict with the common and approved faith, understand that it is put forward by me not as absolutely true, but as more consonant with our senses and our reason, or at least less dissonant than the other side of the antithesis. And remember, that we are not so much eager to show our own knowledge, as moved by the desire of showing the weakness of the common philosophy, which thrusts forward what is mere opinion as if demonstrably proved, and of making it clear by our discussion (if the gods grant it) how much in harmony with regulated sense, in consonance with the truth of the substance of things, is

that which the garrulous multitude of plebeian philosophers ridicule as foreign to sense."

Nevertheless Bruno lectured in Oxford and when the Polish prince, Alasco, was entertained by the faculty at a tournament of disputations, Bruno was one of the disputants. The Prince declares that "these learned opponents, respondents, and moderators, acquitted themselves like themselves, sharplie and soundlie." Bruno was evidently well pleased with his part in the proceedings, declaring that the representative put forward by the University could not meet his arguments and was left fifteen times "like a hen in the stubble" and resorted to incivility and abuse. It is evident that Bruno cited Copernicus in the debate, for he says: "The dispute grew envenomed. My antagonists took refuge in sarcasms and insults. One, seizing pen and paper, cried: 'Look, be silent and learn; I will teach you Ptolemy and Copernicus!' But as soon as he began to sketch the spheres, it was clear he had never opened Copernicus." This discussion seems to have had the usual result of getting Bruno into trouble and he departed in the same month for London. His most stinging blow at Oxford was his characterization of it as "the widow of true learning."

During his stay in London, he found a quiet haven in the French Embassy. The French Ambassador, Mauvissiere, befriended him against all attacks, and Bruno's gratitude appears in his dedication of one of the most important of the many books he produced during his London sojourn: "I, for the great favors enjoyed from you, food and shelter, freedom, safety, harbourage, who through you have escaped so terrible and fierce a storm, to you consecrate this anchor, these shrouds and slackened sails, this so dear to me, more precious still to the future world, to the end that through your favour they may not fall a prey to the ocean of injustice, turbulence, and hostility."

To the Venetian court inquiry he explained that he was the Ambassador's "gentleman," but it seems he was also his secretary, and as such accompanied him to Elizabeth's court, where he was graciously received by the English Queen. One of the many counts against him at Venice, was the admiration for England's heretical Ruler, which he had, with the customary fulsomeness, expressed: "That most singular and rare of ladies, who from this cold clime, near to the Arctic parallel, sheds a bright light upon all the terrestial globe. Eliza-

beth, a Queen in title and in dignity, inferior to no King in all the world. For her judgment, counsel, and government, not easily second to any other that bears a sceptre in the earth. In her familiarity with the arts, knowledge of the sciences, understanding and practice of all languages spoken in Europe by the people or the learned, I leave the whole world to judge what rank she should hold among princes." That Bruno was willing to modify this when on trial, appears from his answer to the charge of having called Elizabeth "divine." "In my book on 'The Cause, Principle, and One,' I praise the Queen of England and call her 'divine,' not as a term of worship, but as an epithet such as the ancients used to apply to their princes, and in England, where I then was, and where I composed this book, the title 'divine' is usually given to the Queen. I was the more inclined to call her so, that she knew me, as I went continually with the Ambassador to court; but I know I erred in praising this lady, she being a heretic, and in calling her 'divine.'"

The poetic Italian found a kindred soul in the elegant man of letters, Sir Phillip Sidney, whom he describes as "the most illustrious and excellent cavalier, one of the rarest and

brightest spirits in the world." Of the seven works which came from Bruno's pen while in England, the two chief ethical works were dedicated to Sidney. It would be pleasant to believe that the greatest Italian met the most illustrious Englishman—Shakespeare—as some have asserted, but the facts are that Bruno left London in 1585, while Shakespeare did not come there until 1586.

Among the books he published while in England was another satire in the vein of "The Ark of Noah." It was entitled "The Expulsion of the Triumphant Beast." It was an allegorical prose poem, in which the repentant Jupiter resolved to drive out the beasts who occupied his heavenly firmament. At a council of the gods there is an illuminating discussion of the history of religions. Such "beast" constellations as the Bear and the Scorpion, which represented vices, were to be expelled to make room for virtues. The "Triumphant Beast" was generally understood to mean the Pope, or the Church. Even more mercilessly satirical was "The Cabala," dedicated to an imaginary Bishop of Casamarciano, who is put forward as the representative of backwardness, ignorance, and simplicity. It has his favorite theme—the Asininity of the

Monks or the Church. Referring probably to the last part of it, he says: "The image and figure of the animal are well known, many have written on it, we among the rest, in a particular fashion; but as it displeased the vulgar, and failed to please the wise, for its sinister meaning, the work was suppressed."

Departing from London, probably in the company of the returning French Ambassador, Mauvissiere, Bruno arrived in Paris in the October of 1585. He immediately sought to ameliorate the difficulties of his situation by having his excommunication lifted, and being admitted to the Church without being compelled to return to the priesthood. The Papal Nuncio, to whom he appealed, told him nothing could be even attempted unless he promised to return to his order. As Bruno considered this an impossible condition, the negotiations were abandoned.

He found his heretical opinions were in great disfavor in Paris, and had no intention of staying there, but wished to do something in keeping with his doings on his former visit. He entered a public disputation to be held in the Royal Hall of the university. He drew up one hundred and twenty theses against the Aristotelian philosophy, which was the sub-

stance of the teaching of the Sorbonne. On his side he had the more progressive college of Cambray, which later became the College of France. Bruno's chief attack in the debate, was published as "The Awakener," and indicates how great must have been the contrast between his modern ideas and the medieval notions of his opponents. He showed them how their whole attitude towards Aristotle stood condemned by the writings of Aristotle himself, and held he had the same right to criticize the Greek philosopher that he had to criticize his predecessors. The following are examples of his command of brilliant epigram in debate. Denouncing authority, he said, "If we are really sick, it helps us nought that public opinion thinks we are really making for health." Again he said, "It is a poor mind that will think with the multitude because it is a multitude; truth is not altered by the opinions of the vulgar, or the confirmation of the many." And to the same effect, "It is more blessed to be wise in truth in face of opinion than to be wise in opinion in face of truth."

Turning from France to Protestant Germany, where he called at several cities, he had an interesting experience at Marburg. On the roll of the matriculated students of the university,

under the date of July 25, 1586, is Bruno's name, accompanied with the following note by the Rector: "When the right of publicly teaching philosophy was denied him by me, with the consent of the faculty of philosophy, for weighty reasons, he blazed out, grossly insulting me in my own house, protesting I was acting against the law of nations, the customs of all the universities of Germany, and all the schools of humanity. He refused then to become a member of the university,—his fee was readily returned, and his name accordingly erased from the album of the university by me." At a later period the name of Bruno could still be made out under the heavy line drawn across it by the rector. A subsequent rector, finding Bruno more famous, rewrote the name above the line, and crossed out, "with the consent of the faculty of philosophy" in the rector's note.

Bruno went to Wittenburg, where the Lutherans were in power, and obtained permission to lecture on the condition of not conflicting with their religion. For two years he expounded Aristotle's Organon and taught his own Art of Memory. Wittenburg gave him a period of peace equalled only by Paris and London. The grateful Italian responded in the

dedication of one of his books on memory: "Because I was a pupil in the temple of the Muses, you thought me worthy of the kindliest welcome, enrolled me in the album of your academy, and gave me a place in a body of men so noble and learned that I could not fail to see in you neither a private school nor an exclusive conventicle, but as becomes the Athens of Germany, a true university." Among other books published here was the one intended, "To enable one to dispute promptly and copiously on any subject proposed," in which art he was unequalled.

From Wittenburg, he was tempted to Prague, in Bohemia, by the reputation of Emperor Rudolf II, as a patron of learning. He found the Emperor almost entirely absorbed in astrology, which Tycho Brahe and Kepler turned to the advantage of astronomy. Rudolf recognized the Nolan's powers to the extent of giving three hundred dollars, and he resumed his travels, calling at Helmstadt, on his way to Frankfort. Frankfort was the last of the cities he visited which was able to keep him from the clutches of the Roman Inquisition.

CHAPTER VII

BRUNO THE MARTYR

AT FRANKFORT the incidents occurred which led to the tragic close of his eventful career. In those days Frankfort was the world-center for books, and every half year printers and booksellers came to Frankfort to see the world's new books and stock their houses. There came two booksellers from Venice, Ciotto and Bertano, who stayed at the monastery, where they met Bruno. After their return to Venice, Ciotto received a call at his book shop from a young Venetian nobleman, Mocenigo, who was destined to achieve a reputation paralleled only by Judas Iscariot. Mocenigo inquired for a book by Bruno, and asked Ciotto if he knew the author and where he might be found? On being told that Bruno was in Frankfort, he requested to know if Ciotto thought he could be persuaded to come to Venice, to teach him the secrets of memory, and secrets of magic, the possession of which were credited to Bruno by popular ignorance. Ciotto thought he might, and a few days later Mocenigo gave him a letter for Bruno, which was eventually delivered.

Bruno's dramatic career and the noble courage of his closing years has attracted several biographers and much sympathetic investigation, and all have been amazed at the readiness which Bruno seems to have accepted the perilous offer of Mocenigo. The same astonishment seems to have possessed his contemporaries. On his way to Venice he made a brief stay at Padua, and while there, one of his friends, Michael Forgacz, received a letter from Valens Havekenthal, which contained the following: "Tell me one thing more: Giordano Bruno, whom you knew at Wittenburg, the Nolan, is said to be living just now among you at Padua. Is it really so? What sort of a man is this that he entered Italy, which he left an exile, as he used himself to confess? I wonder, I wonder, I cannot yet believe the rumor, although I have it on good authority. You shall tell me whether it is true or false." A wandering life was probably losing its charm, and he was forty-three years old. In the sixteenth century it was less agreeable than now to be a foreigner, and one clew to his longing for home may be found in his own accounts of the kickings and beatings which were given to foreigners in the English streets on the slightest pretext. Again, he was constantly seeking, and apparently ex-

pecting to find, some basis of compromise with the church, by which he would be able to peacefully pass his last days on his native soil. He probably felt himself a part of the church, seeking reforms from within, rather than an enemy attacking it from without, for he surely did not realize how fierce had been some of his denunciations. Finally, he regarded Mocenigo as a powerful noble, able and willing to give him the protection he had fully pledged. Whatever may have been back of his decision, the event proved that he made a costly blunder when he placed himself within reach of the Holy Office.

Whether Mocenigo was merely a shallow-brained fool, or a designing scoundrel, cannot be definitely decided, but the evidence indicates that he was both. It was not long before he went whining to Ciotto about Bruno, "who promised to teach me much, and has had clothes and money in plenty from me, but I cannot bring him to a point, and fear he may not be quite honest." The pitiful patrician was greatly disappointed that his tutor had not furnished him those secrets of magic, which were to give him power over nature and man. He requested Ciotto, when he next visited the Frankfort book-market, to inquire about Bruno's reputation. Ciotto returned with the

unfavorable report that in Frankfort, the Italian was held to be a man of no religion. Trivial as this charge would be in our day, it was a very serious accusation in the sixteenth century. Mocenigo then informed Ciotto, "I, too, have my doubts of him, but I will see how much I can get of what he promised me, so as not lose entirely what I have paid him, and then I will give him up to the judgment of the Holy Office." Holy Office, was the official title of that monstrous institution, the inquisition.

Bruno seems to have been still unaware of his danger, for he walked still further into the trap,—he gave up his lodgings, from whence he might have fled the country unobserved, and went to live in Mocenigo's house. Ciotto, whose testimony before the inquisition was favorable to Bruno, introduced him to Andrea Morosini, an educated and liberal nobleman, whose house was a frequent meeting-place for a group of scholarly Venetians. Testifying before the inquisition, Morosini said: "Several gentlemen meet there, prelates among them, for entertainment, discoursing of literature, and principally of philosophy; thither Bruno came several times, and talked of several things, as is the custom; but there was never a sign that he held any opinions against the faith, and so far as I

am concerned, I have always thought him a Catholic, and had I had the least suspicion of the contrary I should not have permitted him to enter my house." McIntyre, to whom this narrative is greatly indebted, points out that the last sentence does not present Morosini's real views. It does, however, indicate his knowledge of the seriousness of being in the disfavor of the Holy Office. These meetings evidently misled Bruno as to the safety of free expression of opinion in the Venetian Republic, which was really liberal and powerful, and jealous in the protection of the rights of its citizens against the encroachments of Rome. Bruno, moreover, seems to have strangely overlooked the important fact that he was not a Venetian, but a native of Italy. He was still nursing his delusion that he might secure such a reconciliation with the church as would permit him to live quietly in Rome as a lecturer and man of letters. He was parleying to this end with several Venetian priests, especially Father Domenico, who seems to have been sympathetic, and who gave favorable testimony as to these discussions at the trial. In this project, he had the worthless promise of aid from Mocenigo.

At last, when too late, Bruno observed the

gathering cloud and formed a plan of escape. He pretended a desire to go to Frankfort to get some books printed, but made the mistake of bidding Mocenigo goodby. It is very doubtful, however, whether he would have been able to escape in any event. On the night set for his departure, Mocenigo, with five or six gondoliers, seized him, and locked him in an attic. He was then turned over to the Holy Office, with a mass of grotesque charges about magic, which were chiefly a reflection of Mocenigo's own superstitions. Of a second denunciation by Mocenigo, McIntyre says, "there is no more pitiful self-revelation of meanness and hypocrisy extant." The description of the prisoner was, "A man of ordinary stature, with chestnut brown beard, of the age and appearance of forty years."

At the request of the Father inquisitor, Mocenigo made a still further deposition in which he accused Bruno of saying that it was a mistake to allow the friars to remain so rich in Venice; they should do as in France, where the nobles enjoyed the revenues of the monasteries, the friars living on soup, as befitted such "asses." About the same time Bertano, the book-seller, gave evidence that he recalled having heard the prior of the Carmelite mon-

astery at Frankfort say of Bruno, that he spent most of his time in writing, and went about dreaming dreams and meditating new things, that he had a fine mind and knowledge of letters, and was a universal man, but that he had no religion so far as the prior knew. At these hearings Bruno gave the account of his travels which furnishes the information summarized in the preceeding pages.

The prisoner gave his judges a statement of his creed, one passage of which is enough to show its contrast to the puerile superstitions of the time: "I believe in an infinite universe, the effect of the infinite divine potency, because it has seemed to me unworthy of the divine goodness and power to create a finite world, when able to produce besides it another and infinite; so that I have declared that there are endless particular worlds similar to this of the Earth; with Pythagoras I regard it as a star, and similar to it are the moon, the planets, and other stars, which are infinite, and all these bodies are worlds, and without number, constituting the infinite all in an infinite space." This noble concept of the immensity of the universe not only sounded strangely to the people of his day, but it was bitterly offensive to the priestly ear. It was in violent

conflict with the priestly notion that this earth was so pre-eminently important, that the creator had died for the salvation of its inhabitants.

The next development in the drama was the struggle for the extradition of the prisoner to Rome. There "The Sacred Congregation of the Supreme Tribunal of the Holy Office," was waiting impatiently for the opportunity to wreak its vengeance on the helpless prophet of modern thought. The appeal was made to the Doge and Senators, and the Father Inquisitor urged a decision, informing them that a vessel was ready to set out. The reply of the Senate was that "the matter being of moment, and deserving consideration, and the occupations of the State being many and weighty, they could not at that time come to a decision, and his Reverence might for the present let the vessel sail." Three days before Christmas, the Papal Nuncio appeared before the Senate, and pleaded that Bruno was a Neapolitan, and not a subject of the Venetian Republic. On the seventh of January the plea was resumed by the procurator, Contarini, who said, "his faults were extremely grave in respect of heresies, although in other respects one of the most excellent and rarest natures, and of exquisite

learning and knowledge." The political situation of the moment was fatal to Bruno. It was considered desirable to conciliate the Pope, and on the same day it was decreed by the Senate that, "to gratify the Pope, the said Giordano Bruno be remitted to the Tribunal of the Inquisition at Rome, being consigned to Monsignor the Nuncio that he may be sent in what custody and by what means his Reverend Lordship thinks best; that the Nuncio be notified of this, and that our Ambassador at Rome be also advised thereof to represent it to his Holiness as a mark of the continued readiness of the Republic to do what is pleasing to him." Bruno, the ill-starred knight-errant of philosophy, entered the Roman prison of the Inquisition on the 27th of February, 1593, and from that moment his fate was sealed.

Though the Inquisition was notoriously quick to strike its victims, Bruno, for reasons which will probably never be known, remained in its dungeons for the next six years. The use of torture was the rule, and there is not the slightest reason for believing that Bruno escaped. In 1849 an opportunity was given to study the records in the Vatican; the student began at 1600, the year of Bruno's death and worked back to November, 1598, when the per-

mission was withdrawn, and the world had to be satisfied with the assertion that there were no more documents, though it is difficult to understand, if that were really the case, why the investigator was not allowed to convince himself.

One wonders if human society will ever again sink to the point of treating a man as worse than a murderer because he disagrees with a church on such points as (1) the distinctions of the persons in God; (2) the incarnation of the Word; (3) the nature of the Holy Spirit; (4) the Divinity of Christ, which were the first and most important half of the subjects on which Bruno was charged with heresy. There is also something utterly disgusting in the urging of the prisoner to long discussions of these crack-brained questions, when all the parties to the pitiful proceedings knew that, no matter what he said, he was to be burned alive at the end of the mock-debate.

It has been held that Bruno twisted and turned before the Venetian Tribunal, in his efforts to escape the hungry maw of the Holy Office, but he can hardly be blamed when it is remembered that he knew of the fiendish devices for producing unendurable agony, ruthlessly applied until men swooned from pain,

by inhuman monsters whose souls were seared by the love of God. All writers are agreed that from the moment he was thrown into the Roman prison, and realized his inevitable fate, his courage was unwavering and magnificent. He defied his Roman inquisitors, and they reported him as saying, that he neither ought nor will recant, that he has nothing to recant, no matter for recantation, does not know what he ought to recant."

Prominent among his inquisitors was the fanatical San Severin, who stands forth in history as the man who declared the drenching of Parisian streets with Protestant blood on St. Bartholomew's Eve, as "a glorious day, a day of joy for Catholics." The Tribunal appointed Hippolyte Maria, general of the Dominican order, and Paul of Mirandula, the vicar, "to deal with Bruno, show him what had to be abjured, that he might confess his errors, amend his ways, and agree to abjure; and should try to bring him to the point as soon as possible." They reported their efforts fruitless, as Bruno stood firm.

At the meeting of January 20th, 1600, the Pope being present, and refusing to read a memorial from Bruno, it was decreed, "that sentence be passed, and that the said Friar

Giordano be handed over to the secular authority." The decree was carried out on the eighth of February, when he was placed in the hands of the Governor of Rome, with the usual recommendation that he be punished "with as great clemency as possible, and without effusion of blood," which was the euphemistic and hypocritical formula for burning at the stake.

For a long time the only evidence of the burning of Bruno was a letter by Gaspar Schopp, and Catholic writers were confident in their assertions that it never occurred. Later discoveries of documents not then known to be in existence, have abolished this line of defense, except for a few irresponsible scribes, who rely upon the dense ignorance of their readers. Schopp's letter, then denounced as a forgery, but now admitted to be genuine, was written from Rome to Conrad Rittershausen. Schopp had renounced Protestantism, embraced Catholicism, and journeyed to Rome in search of his reward. He was not disappointed, as he was quickly admitted to the Pope's favor, made a knight of St. Peter, and a count of the Sacred Palace. His letter relates how Bruno's sentence charged him with the damnatory crime of "early doubts concerning and ultimate denial of the Transubstantiation, and of

the virgin conception, and cited as among the 'horrible absurdities' of his Latin writings, his doctrine of the infinite number of worlds. The one redeeming feature of the letter is its record of Bruno's reply to his judges: 'Greater perhaps is your fear in pronouncing my sentence than mine in hearing it.' " Schopp was present at the burning, and tells how Bruno turned his eyes angrily away from the crucifix held before him, and adds, "he was burned and perished miserably, and is gone to tell, I suppose, in those other worlds of his fancy, how the blasphemous and impious are dealt with by the Romans." "It is pleasant to know," says McIntyre, "that when Lord Digby was English Ambassador to Spain he caused Gaspard Schopp to be horse-whipped." The Count of Ventimiglia, one of Bruno's pupils, was also present at the burning. The "Avvisi" and the "Ritorni" which served as the Roman newspapers of the time, have been unearthed, and both contain accounts of the execution, one describing him as a Friar of St. Dominic, of Nola, burnt alive in the Campo di Fiori, an obstinate heretic, with his tongue tied. This latter detail was a common feature of the burnings of heretics, as it prevented the

crowd from hearing the victims heap their curses on the Church.

The last possible doubt as to the burning of Bruno was dispelled by the discovery of the report of the Company of St. John, the Beheaded. This organization had for its function, the attendance upon heretics in their last hours and death. By a fine piece of sarcasm, they were sometimes called the Company of Mercy, for about all they did was to annoy the victims with urgent requests to repent of their sins, the priests thrusting images and crucifixes in their faces while the fire was being started. It is recorded that they were not above co-operating with the executioner in the use of cruel devices to compel the victim to appear to be kissing the cross when they were really trying to avoid it. Their Official Report of the burning of Europe's noblest thinker gives a realistic and vivid picture of the event:

"At the second hour of the night it was intimated to the Company that an impenitent was to be executed in the morning; so at the sixth hour the comforters and the chaplain met at St. Ursula, and went to the prison of the Tower of Nona. After the customary prayers in the chapel there was consigned to them the under mentioned condemned to death, viz.:

Giordana, son of the late Giovanni Bruno, an Apostate Friar of Nola in the kingdom, an impenitent heretic . With all charity our brethren exhorted him to repent, and there were called two Fathers of St. Dominic, two of the Society of Jesus, two of the new Church, and one of St. Jerome, who, with all affection and much learning, showed him his error, but he remained to the end in his accursed obstinacy, his brain and intellect seething with a thousand errors and vanities. So, persevering in his obstinacy, he was led by the servants of justice to the Campo dei Fiori, there stripped, bound to a stake, and burned alive, attended always by our Company chanting the litanies, the comforters exhorting him up to the last point to abandon his obstinacy, but in it finally he ended his miserable, unhappy life."

Thus, on the seventeenth day of February, of the year 1600, in the flower market of Rome, amid the dismal chanting of monks, the greatest of the Italians passed from the earth, his ashes scattered by the winds, as his sublime doctrine of the infinite number of worlds, spread among the minds of men. In the historic struggle between science and superstition, for the moment, the cowled army was triumphant, but posterity has reversed the ver-

dict, and today the Church is suppliant at the bar of civilization, begging men to forget her medieval murders.

On the ninth day of June, in the year 1889, in the same flower market, with the conspicuous absence of priests, there gathered a vast concourse of thirty thousand men and women, representing every civilized country. With bared heads they witnessed the unveiling of a magnificent statue of the martyred Bruno, contributed as a monument of his final triumph by the freemen of the world.

CHAPTER VIII

GALILEO TO 1616

THIRTY-SIX years before the prophet of modern science was burned, the man who was destined to be the greatest of its early exponents was born. On the 18th of February, 1564, there was a very important addition to the family of Vincenzo Galileo, which, at the time, was visiting at Pisa, famous for its leaning tower. Presently the family returned to Florence, and there the boy grew up and received the beginnings of his education. He was instructed in the classics, as became the son of a nobleman, but as the father had no property and but a small income, he was to be denied a professional career, and devote himself to the honorable and lucrative occupation of a cloth dealer.

The pupil learned his early lessons so rapidly that his father changed his plan from the distribution of fabrics to the practice of medicine, considered to be the most remunerative of the sciences. At seventeen he was entered at the University of Pisa, and it was here that he gave the first indication of a genius that was to leave its impress on the world to the end of time. When he was kneeling in the Ca-

thedral, and supposed to be deep in prayer, he really had his eye fixed on Maestro Possenti's beautiful lamp swinging in the archway to better distribute the light. He discovered by feeling his pulse, that while the length of the lamp's swing became shorter, the time consumed by each swing remained the same. The pendulum being thus discovered, it was a short step to clocks, and the young observer's fame began to spread through Europe.

Then something happened to turn his attention away from medicine. The Court of Tuscany came to Pisa, and every morning while Ricci, the governor of the pages, was giving them their morning lesson in mathematics, young Galileo listened eagerly from a hiding place in the door-way. Finally, in his eagerness, he revealed himself to the astonished teacher, and asked the privilege of further instruction, which was quickly granted. He secured his father's permission to turn from medicine to physics, of which science he is the universally recognized founder. He failed to secure one of the forty free places for poor students, because of his opposition to the paralyzing authority of Aristotle, and had to go home without his degree. His talents having

already attracted the notice of learned men, through the influence of Riccoboni, Marquis and mathematician, he secured the vacant position of professor of mathematics at the University of Pisa. The economic unwisdom of his last change of calling appears in his salary of sixty scudi a year, whereas the professor of medicine in the same institution received two thousand.

He found it impossible to repress his opposition to the uncritical worship of Aristotle, which had caused so many of the misfortunes of Bruno. Varchi in 1544, and Benedetti in 1563, had denied Aristotle's proposition that the rate at which a body falls depends on its weight, and had supported their denials by clever reasoning, but Galileo was the first to anticipate the methods of modern science, by putting it to the test of experiment. One morning, before the assembled university, he ascended the famous tower of Pisa, which leaned over as if for the purpose of the experiment, which was the most important event in its history. Aristotle had said that a ten pound ball would fall ten times faster than a one pound ball. To put the demonstration beyond dispute, Galileo dropped a one pound ball, and a one hundred pound ball, at the same instant,

and the great assemblage saw them start and strike the ground together. Some were convinced, others preferred the authority of the Aristotelian text to the evidence of their own senses, and many did not dare to admit their conversion. While the creator of modern physics had given the almost divine authority of the misused Greek philosopher a mortal wound, the only immediate result to himself was to insure his being driven from the university. This was accomplished through his impolitic condemnation of an invention of a distant relative of the Grand Duke, for cleaning out the harbor of Leghorn. It did not help Galileo that he had been commissioned to examine the machine, or that experiment confirmed his verdict.

Fortunately, his dismissal turned to his advantage, for the learned Riccaboni came again to the rescue, and he was engaged for six years by the Republic of Venice, as professor of mathematics in the University of Padua. He arrived at Padua, to take up his new duties, a few months after Bruno had left on his fateful journey to Venice. Though only twenty-eight years old, he began, almost immediately, to reap the reward of his great ability. He attracted so many pupils, including a number

of distinguished persons, from all over Europe, that no lecture hall in Padua was large enough to hold them. The Senate of the Republic was quick to recognize the value of his services; they treated him generously and held him in high regard. He accompanied his lectures with many curious demonstrations, invented many machines of great value to the Republic, and invented a heat indicator—a thermoscope—which led to the thermometer, but was not itself a thermometer, as claimed by some of his over-zealous biographers. Near the close of his six years he wrote to Kepler, Germany's foremost astronomer: "I count myself happy, in the search after truth, to have so great an ally as yourself. . . . I have been for many years an adherent of the Copernican system, and it explains to me the causes of many of the appearances of nature which are quite unintelligible on the commonly accepted hypothesis. I have collected many arguments for the purpose of refuting the latter. . . . I should certainly venture to publish my speculations if there was more people like you. But this not being the case, I refrain from the undertaking."

At the close of his six years he was eagerly re-engaged for a similar term, his annual sal-

ary being steadily raised from 18 to 400 zecchini—$90 to $2,000. During his second term he made his epoch-creating telescope. Galileo himself contradicts those over-enthusiastic eulogists, who have claimed that his telescope was the first. He says that he had heard that a Dutchman had made an instrument, by means of which distant objects were brought nearer, and could be seen very plainly. The Dutchman was Lippershey. With no further information he quickly succeeded in making one of his own, and by further experiment, having "spared neither expense nor labor," he finally obtained an instrument which brought an object more than thirty times nearer. This astonishing achievement was destined to lead to serious trouble. The Church did not concern itself with the Copernican conception of the universe, so long as it could be regarded as an unproved and unprovable phantasm. The wide liberty allowed in the discussions of the scholastic philosophy was due to its conclusions being as vaporous as the processes by which they were reached. The achievements of the telescope were definite, and their implications unmistakable. The seven known stars of the Pleiades rose to thirty-six, and the seven of Orion were increased by five hundred. The

milky way ceased to be a luminous mist, and became a girdle composed of millions of individual stars. The planets appeared as disks, while the stars remained, as they still remain in the largest telescopes, and, because of their enormous distance, always must remain, mere points of light. There was a revelation which set all Europe by the ears when Galileo turned his crude telescope on the mighty Jupiter. Four specks of light, always in a straight line, because they circle the planet in the same plane, must for a certainty be Jupiter's moons.

And so the long cherished dogma of the earth's supremacy vanished before the astronomer's ardent gaze; the earth was not even monarch of the planets, for here was a king with four courtiers to the earth's one. In our day it is impossible to realize the storm which broke forth with this announcement. The ignorant champions of the Holy Faith donned their armor and came forth to battle, with a confidence born of their inability to understand. Even the learned Clavius at Rome, said that "he laughed at the pretended satellites of Jupiter; you must construct a telescope which would first make them and then show them." With such an illustrious example, the Aristotelians were not slow to assert that the tele-

scope was constructed to show things that did not exist, although Galileo offered 10,000 scudi to anyone who could construct such an instrument. Julius Libri violenty opposed, but refused to look through the telescope, and when he died, Galileo, in a letter he was writing at the time, said that as Libri was never willing to look at Jupiter's moons from the earth, he might perhaps see them on his way to heaven.

Not only did Jupiter overthrow the ancient and current doctrine that the earth was the only center of motion, but the Peripatetic fanatics were further discredited when the telescope was turned on the sun and moon. Galileo declared the moon to have an irregular surface, while the apparently even face of the sun was disfigured by dark spots which changed their form and position, all of which contradicted the Aristotelian idea that all the heavenly bodies were "perfect and immutable." The spots on the sun had been previously observed with the naked eye, but had been explained as the passing of Mercury before the sun. When Galileo presented a telescope to the Venetian Senate, he was made professor for life at a salary of one thousand florins.

We now reach a crisis in the astronomer's career. He gradually developed the fixed idea

of returning to Italy. This was an exact counterpart of the mistake made by Bruno when he left Frankfort for Venice. Under no circumstances would the Senate, which had sacrificed Bruno to diplomacy, have given up its famous professor, had he remained in their service. The relations of the two governments had entirely changed. Six years after the burning of Bruno Pope Paul V. had issued an interdict against the Republic, which had replied by driving the Jesuit Fathers from the soil of Venice "for ever," and Rome had again countered by the excommunication of the Doge and Senate. Had all this happened before 1593, the Pope would have begged in vain for Bruno, though for him the Venetians had felt no such obligations as for Galileo. Galileo began to feel a great desire to give his mass of accumulating knowledge the permanence of books, but was hindered by having his time absorbed in the delivery of lectures. His letters of this period express his desire for a salaried position, free from academic duties, thus giving the leisure for the production of his contemplated books. He felt this salaried leisure could only be found in the employ of some wealthy patron of science. One of his letters says: "It would not be suitable to receive a salary from a free

state, without serving the public for it; because if you derive benefit from the public, you have the public to please, and not a mere private person." In this dilemma, he turned to the Grand Duke of his native kingdom, Tuscany. As this looked like ingratitude to the Republic, he kept the negotiations wth the Grand Duke a secret from Venice until they were completed and irrevocable. The Grand Duke Cosmo II. gave him the position of first philosopher to the University of Pisa, at a salary of one thousand Florentine scudi, with no obligation to live at Pisa or to deliver lectures. In the September of 1610, Galileo departed from Padua. His friend Sagredo was in the East, on business of the Republic, at the time, and did not return to Padua until the following spring. Immediately on his return, he wrote to Galileo, expressing his amazement and regret at finding Galileo gone, and his fears for his safety away from the protection of the free Republic, adding that as he was "convinced that as Galileo could not regain what he had lost, he would take good care to hold fast what he had gained." From which it appears that the disappointment of the Venetians over Galileo's leaving, was sufficiently bitter to make his return impossible.

For a time Galileo was greatly honored in Italy, but the priests were powerful there, and the troubles feared for him by his friends soon appeared. Destiny had chosen him as the great protagonist of the new system of the universe, and the black robed defenders of the ancient faith were mustering their forces for the struggle. It was to be Ptolemy against Copernicus, and the intellect of Europe was, if possible, to be kept in bondage to the blunders of ancient science, petrified forever in the name of religion. Only a month after his arrival in Florence, he dealt the geo-centric—earth-center—theory a heavy blow. It had been pointed out to Copernicus that if Ptolemy was wrong, and he right, Venus should show phases like the moon. The founder of modern astronomy had replied: "You are right; I know not what to say; but God is good, and will in time find an answer to this objection." It was for Galileo's telescope to furnish the answer; the only difficulty had been that the phases of Venus were beyond the reach of the naked eye, for they were plainly visible even in Galileo's crude instrument.

Soon after this Galileo discovered the spots on the sun, and from their regular motion across its surface, announced that the sun

turned on its axis. As this was in conflict with the accepted system, it was received "frowningly." Professor Andrew Dickson White says: "Monsignor Elci, head of the University or Pisa, forbade the astronomer Castelli to mention these spots to his students. Father Busaeus, at the University of Innspruck, forbade the astronomer Scheiner, who had also discovered the spots and proposed a safe explanation of them, to allow the new discovery to be known there. At the college of Douay and the University of Louvain this discovery was expressly placed under the ban, and this became the general rule among the Catholic universities and colleges of Europe."

In all the scientific controversies Galileo was easily victorious, and his enemies shrewdly perceived that the theological armory would furnish their most effective weapons against him. A week before Christmas, 1611, he received a letter from his friend Cigoli, the painter, which convinced him he was living in a fool's paradise of fancied security. Cigoli gave him the details of the conferences of high ecclesiastics, held in the palace of the Archbishop of Tuscany at Florence, where means to accomplish his ruin were the sole topics of discussion. Professor White says: "Pope Paul V. while petting

Galileo and inviting him as the greatest astronomer of the world to visit Rome, was secretly moving the Archbishop of Pisa to pick up evidence against the astronomer." A fanatical young monk, Sizy, opened the theological battery by asserting, in his book published at Venice, 1611, that the existence of the moons of Jupiter was incompatible with the doctrines of Holy Scripture. Father Caccini, the Dominican monk, turned punster, and preached a sermon from the text, "Ye men of Galilee, why stand ye gazing up into heaven." Father Lorini, professor of ecclesiastical history at Florence, described by the German scholar Gebler, as "a ringleader of the base intrigues against Galileo," declared that the view of "this Ipernic, or whatever his name might be," appeared to be contrary to Holy Scripture. Of him Galileo wrote to Prince Cesi, "The good man is so well acquainted with the author of these doctrines that he calls him Ipernic. You see how and by whom poor philosophy suffers." The Archbishop of Florence solemnly denounced Galileo's doctrines as unscriptural. Father Lecazre declared they "cast suspicion on the doctrine of the incarnation."

The struggle grew fiercer and Professor White says: "There were intrigues and coun-

ter-intrigues, plots and counter-plots, lying and spying; and in the thickest of this seething mass of priests, bishops, archbishops, and cardinals, appear two popes, Paul V. and Urban VIII." While Galileo took the course which seemed most natural under the circumstances, he really did the most dangerous thing possible. He undertook to show that the new astronomy did not necessarily contradict the Scriptures. This had the unexpected effect of increasing the seriousness of his offence, as it was bitterly received by the priests, as an invasion of their functions as the sole interpreters of Holy Writ. Galileo made this ill-starred defence in a long letter to his friend and pupil Castelli. Castelli had been present at a brilliant gathering at the Grand Duke's apartments. Boscaglia, one of Galileo's enemies, had maliciously interjected the Bible into a discussion of Galileo's theories, and Castelli had felt obliged to champion the cause of his absent friend. He reported to Galileo that he had silenced all objectors except the dowager Grand Duchess Christine. It was to provide his colleague with the arguments with which to satisfy even the aged Duchess, that Galileo wrote the now historic letter to Castelli. The Church has been glad to avail itself of the very defence

which Galileo offered for it in the 17th century, but they held it as one of his most serious crimes at the time.

The following passage will given an idea of the reasoning of the famous letter: "Since two truths can obviously never contradict each other, it is the part of wise interpreters of Holy Scripture to take the pains to find out the real meaning of its statements, in accordance with the conclusions regarding nature which are quite certain, either from the clear evidence of sense or from necessary demonstration. As therefore the Bible, although dictated by the Holy Spirit, admits, from the reasons given above, in many passages of an interpretation other than the literal one; and as, moreover, we cannot maintain with certainty that all interpreters are inspired by God, I think it would be the part of wisdom not to allow any one to apply passages of Scripture in such a way as to force them to support, as true, conclusions concerning nature the contrary of which may afterwards be revealed by the evidence of our senses or by necessary demonstration."

Castelli saw no harm in the sage advice of this letter, and spread it about by means of numerous copies. Father Lorini obtained a

copy and presented it as a part of the evidence, when he acquired the doubtful honor of being the first to accuse Galileo to the inquisition. The inquisiton required the original letter, and ordered the Archbishop of Pisa to obtain it "in a skillful manner." When Castelli visited Pisa a few days later, the Archbishop suggested that he thought he could show where Galileo was mistaken if only he could see the original letter. Fortunately Castelli had already returned the original to the author. When Castelli explained to Galileo, and asked for the letter again to show to the Archbishop the author's suspicions were aroused and the Archbishop's subsequent intrigues were of no avail. Galileo then increased the letter into a long and careful statement of his whole position, to protect himself against the many misrepresentations of his enemies. These, he observed, were rapidly increasing, but he knew nothing of the cause—the secret proceedings of the inquisition against him. It was in the enlarged edition of the letter that he quoted the saying of Cardinal Baronius, that in inspiring the Bible: "The Holy Spirit intended to teach us how to go to heaven, and not how the heavens go."

It was now clear that trouble was brewing in Rome and Galileo concluded his wisest

course would be to meet it there. He arrived in Rome to promote his cause, in December, 1615. He seems to have been entirely successful so far as his personal affairs were concerned; his many and powerful friends in Rome greatly aided him to escape the snares laid for him by his enemies. This accomplished, he was determined to secure a triumph for the theories of Copernicus. He was laboring under the delusion that the Roman Curia was open to be convinced by scientific evidence. He lectured at the houses of prominent Romans, enthusiastically expounding the Copernican system, until the inquisition was aroused and determined to take action. This was done in the historically important proceedings of February 25th and 26th, 1616. What was really done at this meeting of the Holy Office has been the subject of a controversy much too long for reproduction here. The most reliable conclusions seem to be those of Cantor, Wohlwill, Gherardi, and especially of Karl von Gebler, who was permitted to make a German translation of all the documents of the trial now in the archives of the Vatican. According to these authorities, Galileo was ordered to abandon his belief in the Copernican system, as that system was undoubtedly contradictory to the Holy

Scriptures. The custom of the Church at this period shows that this did not prohibit Galileo, or anyone else, from explaining that system as a supposition or hypothesis, so long as it was not advanced as actually true. It is certain that Galileo acted at the time, and for the next sixteen years, on the assumption that this was the extent of their condemnation, and it may be safely assumed that the inquisition fully informed him as to its desires. Realizing that any other course was hopeless, he agreed to cease teaching the Copernican system "as true."

Meanwhile Grand Duke Cosmo II., who was anxious about the welfare of his great philosopher, was receiving disquiting letters from his Ambassador Guiccardini, who was urging that it was unwise for Galileo to remain longer in Rome, "especially at a time when the ruler of the eternal city hates science and polite scholars, and cannot endure these innovations and subtleties." This portrait did no injustice to Pope Paul V. On March 5th the Congregation of the Index issued its decree placing the writings of Copernicus on the Index of prohibited books. The Grand Duke, alarmed by these developments, issued the order for Galileo's return. Accordingly, on May 23rd the

Secretary of State Picchena, wrote Galileo as follows:

"You have had enough of monkish persecutions, and know now what the flavor of them is. His Highness fears that your longer tarriance at Rome might involve you in difficulties, and would therefore be glad if, as you have so far come honorably out of the affair, you would not tease the sleeping dog any more, and would return here as soon as possible. For there are rumors flying about which we do not like, and the monks are all powerful." Galileo complied at once with the wishes of the Grand Duke and on the 4th of June departed from Rome.

CHAPTER IX

TRIAL AND SENTENCE

THE SEVEN years following 1616 were passed quietly by Galileo in the Villa Segni, near Florence. The inquisition had ordered changes to be made in the prohibited book of Copernicus, and Galileo waited for these changes as indications of the intentions of the Church. During this period he wrote no new books. He was hoping he might be allowed to freely express his real convictions and was unwilling to express them by subterfuge until that hope perished. His attitude of mind is revealed in a letter to the Archduke Leopold, which he sent with a copy of his treatise on the causes of the tides:

"With this I send a treatise on the causes of the tides, which I wrote rather more than two years ago at the suggestion of his Eminence Cardinal Orsini at Rome, at the time when the theologians were thinking of prohibiting Copernicus' book and the doctrine announced therein of the motion of the earth, which I then held to be true, until it pleased those gentlemen to prohibit the work, and to declare that opinion to be false and contrary to Scripture. Now, knowing as I do, that it behooves

us to obey the decisions of the authorities, and to believe them, since they are guided by a higher insight than any to which my humble mind can of itself attain, I consider this treatise which I send you merely to be a poetical conceit or dream, and desire that your Highness may take it as such, inasmuch as it is based on a double motion of the earth, and indeed contains one of the arguments which I have adduced in confirmation of it."

In 1616 an attack on Copernicus' system had been especially addressed to him by the lawyer Ingoli of Ravenna. To this Galileo did not dare to reply. In 1618 it was effectively answered in a book by Kepler, which was promptly placed on the Index of prohibited books. During this period, Galileo conducted a controversy with Father Grassi in which he greatly humiliated the Jesuit by the superiority of his wit and arguments. Father Grassi finally condescended to a reply of so scurrilous and contemptible a nature that it had to be published in Paris, as he was afraid to publish it in Rome, where Galileo was well known and much admired. When this discreditable work finally reached Rome it destroyed the influence of Father Grassi, who had been considered above such behavior.

Galileo finally realized that it would be impossible within the jurisdiction of the Roman Curia to publish any book which undisguisedly advocated the theories of Copernicus. Nevertheless he was bent upon the production of a great book which would contain the result of his researches of fifty years. It is clear that he intended this from the beginning, no matter what subterfuges might have to be employed, to secure permission for its publication. The book was to deliver a great blow against Ptolemy and for Copernicus. As a method of disguise he fell back upon the Greek device of dialogues. This work is now known as one of the few epochmaking books of the world and had for its title "Dialogues on the Two Principal Systems of the World, the Ptolemaic and Copernican." The subject matter of the book is communicated through the mouths of three characters, Salviati, Sagredo, and Simplicius. Salviati had been a pupil in Florence, and Sagredo a pupil at Padua and a Venetian senator. Neither of these men were then living. Simplicius was the name of one of the well known commentators on Aristotle and for this reason was well fitted to his role of defending the Aristotelian antagonists of Copernicus.

In the dialogues it was the role of Salviati to advocate the Copernican system; Simplicius was to reply and to defend the Ptolemaic system, while Sagredo was to be a third and impartial person anxious to learn. It is impossible to read the book without seeing the overwhelming victory of the Copernican theory. This victory was all the greater because Galileo placed in the mouth of Simplicius a more eloquent and capable defense of his case than could have been offered by any of the protagonists of that school. The arguments of Salviati are clear, forcible, and convincing and it is obvious that they represent the real convictions of Galileo. Salviati, however, always felt himself in the shadow of the inquisition and followed each powerful argument by urging that this was not presented as an actual truth, but as a chimera or a paradox.

The book was finished at the close of 1629, and then began the long struggle to secure permission for its publication. Everything appeared favorable for this and Galileo apparently expected little difficulty. He had many and influential friends, although he had lost his powerful protector, the Grand Duke Cosmo II., who had been succeeded by Ferdinand II. Eight years before in 1621, the year of the

Grand Duke's death, Pope Paul V. died. He was succeeded by a feeble old man who lived and ruled as pontiff for two years. Upon his death the papacy fell to Cardinal Maffeo Barberini, who ruled as Urban VIII. This was the pope who ignored precedents, declaring that "the sentence of a living pope is worth more than the decrees of a hundred dead ones." He refused to take counsel with the Sacred College, saying that he "knew better than all the cardinals put together." He revoked the resolution of the Romans never again to erect a monument to a pope during his lifetime, asserting that "such a resolution could not apply to a Pope like himself." He made some considerable display of an interest in poetry and science and had for years shown the warmest friendship for Galileo. It was therefore expected that the Pope would present no obstacles to the new publication.

The chief censor of the press was Father Riccardi at Rome, and the faithful Castelli, assured Galileo that Riccardi was favorable to the plan. Castelli further informed him of a conversation between the Pope and Thomas Campanella who had been brought from Spain to Rome by the Pope himself and had told the Pope at an audience that he had been trying

to convert some German nobles to the Catholic faith, and had found them favorably disposed, but when they heard of the prohibition of the Copernican system, they became deaf to all further arguments. To this Urban had replied "It never was our intention; and if it had depended upon us, that decree would not have been passed." It should be noticed, however, that in the struggle of 1616 the Pope, then a cardinal, did nothing for the cause of Copernicus.

Galileo was convinced that his best policy was to proceed to Rome, and he arrived there on the third of May, 1630, with the manuscript of the dialogues ready for submission. Of a long audience which he had immediately with the Pope, he writes: "His Holiness has begun to regard my affairs in a way that permits me to hope for a favorable result." Riccardi, the chief censor, justified the hope raised by Castelli's report, but did not fail to perceive after looking through the manuscript, that Galileo had not kept strictly within the limits of the merely hypothetical treatment of Copernicus prescribed by the inquisition. He set himself, therefore, in the dscharge of his official duty and in the interest of Galileo, to have these parts altered to the hypothetical standpoint.

This task he intrusted to Father Visconti, professor of mathematics, who made what were considered the necessary alterations and finally approved the revised work. In June Galileo persuaded Riccardi to forego his wish to read the book again himself and issue immediately the permission of its printing in Rome. Riccardi had imposed only one condition—after the index and dedication were prepared it should be again submitted to him before being sent to the press.

It was expected that the book would be published in Rome in the autumn in the name of the liberal society, Accademia dei Lincei, and was to be seen through the press by its president, Prince Cesi, an enthusiastic patron of all scientific enterprises. It was a great disaster for Galileo that Prince Cesi was seized with a fever in August and died after a few days illness. The society, which had been held together by him immediately began to dissolve. Robbed of his most powerful protector Galileo's enemies renewed their activities and in less than a month after the Prince's death, Castelli urged Galileo "for many most weighty reasons which he did not just then wish to commit to paper, to have the work printed in Florence, and as soon as possible." Castelli also

informed him that Father Visconti wished the book to see the light and has assured him that there would be no objection to the printing at Florence. Galileo immediately applied to the Inquisitor-General of the city, to the Inspector-General, and to the political authorities for permission, which was granted without hesitation.

The only thing remaining was to secure the final permission of the Roman censor, Riccardi. This was promptly refused on the ground that the manuscript had not been submitted for final revision. Riccardi demanded that it be sent to Rome to undergo this final censorship, after which it could be printed at Florence or anywhere else. Carrier service between Florence and Rome had been rendered so unreliable by the plague, that Galileo was afraid to intrust his entire manuscript and finally persuaded Riccardi to be satisfied with the final revison of the preface and conclusion, and to appoint, for the revision of the rest of the manuscript, some representative in Florence. This appointment fell to Father Stephani, Counsel to the Inquisition at Florence. This ecclesiastic diligently performed his task and it is reported that he was moved to tears at some passages by the humility and reverent obe-

dience to the Church displayed by the author. After making a few changes, he declared that the author should be begged to publish rather than have obstacles placed in his way.

Riccardi thought otherwise. He had kept the preface and conclusion for months, persistently failing to fulfil his promise to return them. Galileo, convinced that no further difficulty could be raised, had already begun the printing at Florence, when Riccardi suddenly raised the point that in the original agreement the book was to be published in Rome. With this new objection, Galileo began to lose both hope and patience. In a letter to Cioli, he complained that Riccardi is apparently determined "to delay and spin out everything with empty words, which it is not easy to put up with." The influence of the Grand Duke Ferdinand II. was invoked, and Riccardi was induced to leave the final examination of the work to the Inquisitor at Florence, who would then decide the question of publication. Riccardi wrote a letter of instructions which should govern the Inquisitor in his examination of the manuscript, the chief item of which was that the truth of the Copernican system was never to be conceded, but always made to appear as a mere hypothesis.

After a further tiresome wait Riccardi finally returned the preface and conclusion and the great book appeared in February of 1632. It was enthusiastically applauded by all independent scholars. They properly appraised the thin hypothetical disguise and Professor White says "The pious preface was laughed at from one end of Europe to the other." The main argument of this preface was to the effect that the book itself would show to the non-Italian world that the condemnation of Copernicus in 1616 was not in any way due to Roman ignorance of Copernican ideas. This argument being received by scholars throughout Europe as a hugh joke caused the Church to suspect that it had been outwitted by the author. The Jesuits were especially bitter because it appeared to them that Galileo was usurping their claim to be the educators of Europe. A diligent search was prosecuted in every direction for some means of attacking the author.

The first attack was made because of three dolphins which adorned the title-page of the book, and were charged to have some heretical significance. It turned out, however, that this was a sort of trademark of the publisher, Landini, and appeared in all his books. A really formidable weapon was used when Ga-

lileo's foes succeeded in persuading Pope Urban that he himself was meant by Simplicius and that this was one way of calling him a simpleton. If the Pope had been less of an egotist, he would probably have laughed at this ridiculous idea instead of believing it. Although this personal motive of the Pope figured in his antagonism to Galileo, it was overshadowed by the feeling that the Dialogues was a work that menaced the foundations of the Church.

The first blow was struck when the publisher, Landini at Florence, was forbidden the further sale of the book. This was followed by a special commission appointed by the Pope to investigate the whole affair. Landini was then further ordered to send all the copies in stock to Rome, but replied that all the copies had been delivered to the purchasers. Galileo was clearly in danger. When the Grand Duke's ambassador, Nicolini, following his instructions from the Duke, went into the Vatican to intercede for Galileo, the Pope bluntly told him: "Your Galileo has ventured to meddle with things that he ought not, and with the most important and dangerous subject that can be stirred up in these days."

Fruitless efforts were made by the friends of Galileo to check the general movement for an inquisition trial for Galileo and it was equally in vain that the always faithful Castelli insisted "Nothing can be done now to hinder the earth from revolving." The chief difficulty that confronted Galileo's enemies was that the book had been submitted to all the proper authorities and had received all the necessary permissions, so that responsibility for its publication seemed to lie with the authorities and the censors, and Riccardi and Visconti at Rome were dismissed with disgrace, and Castelli was banished for three years from the papal presence.

The appointed commission, however, succeeded, evidently to its own great surprise, in finding an effective weapon ready to its hand. In investigating the proceedings of February 26, 1616, it discovered an unsigned note which no one appears to have known to have been any part of the legal documents of that occasion. Von Gebler and many other eminent authorities seem to have the best of the case when they argue that this note had been interpolated into the proceedings by Galileo's opponents of that period. Galileo, himself, strenuously insisted and evidently quite sincerely that he had

never been informed of the existence of such an order, and it is reasonably evident that the order was not adopted or communicated to him. The commission, however, insisted that both these contentions were wrong, that the inquisition of 1616 had adopted and communicated to Galileo the order, which reads as follows:

"To relinquish altogether the said opinion that the sun is the center of the world and immovable, and that the earth moves; nor henceforth to hold, teach, or defend it in any way whatsoever, verbally or in writing, otherwise proceedings would be taken against him by the Holy Office, which injunction the said Galileo acquiesced in and promised to obey."

This order, were it genuine, would mean that Galileo was not allowed to present Copernican ideas even as suppositions. It is flatly in conflict with the letter given to Galileo at the time by Cardinal Bellarmine and is contradicted by the fact that Galileo always assumed himself to be at perfect liberty to adopt the hypothetical method and certainly the censor could have known nothing of this remarkable note. Whoever managed to interpolate it into the proceedings of 1616 worked against Galileo more effectively than they could have dreamed,

for it was the grand cause of or at least the excuse for Galileo's undoing in 1633.

Galileo was ordered to appear in Rome by a papal mandate of November 11. On the eighteenth of December the Father Inquisitor at Florence, reported to Rome that Galileo was seriously ill in bed and sent with the information a signed statement of three reliable physicians that the least aggravation, such as would be caused by traveling, might be dangerous to life. At this time Galileo was within a few months of seventy years. The Roman reply to this came two days later and was a threat that if Galileo did not immediately appear the Holy Congregation would send its own physician upon whose consent he would be brought to Rome in irons. It was added that the papal commissioner and the physician would travel at Galileo's expense. The helplessness of the Italian rulers before the power of the hierarchy is seen in the utter inability of the Grand Duke to protect his philosopher from these extreme measures. Therefore, on the twentieth of January, 1633, with the plague everywhere raging, the feeble old man was carried in a litter to Rome.

The long and dreary trial, reaching into the summer, found the aged astronomer so com-

pletely exhausted that he begged his judges to have pity on his physical condition. Pity, however, had little place in their scheme of things. At this time Galileo was a prisoner, but it will probably never be possible definitely to decide whether he was kept in some apartment of the Vatican or consigned to the dungeons of the inquisition. Von Gebler cautiously says that "it may perhaps be concluded that he was never thrown into the dungeons of the inquisition." The charge that he was submitted to torture must be dismissed, unless we take our definition of torture from Julius Clarius: "Know then there are five degrees of torture; first, the threat of the rack; second, being taken into the torture chamber; third, being undressed and bound; fourth, being laid upon the rack; fifth, turning the rack." In the sense of this definition it might be argued that Galileo was submitted to torture in the first degree. What really happened was that he was threatened with torture, and had he failed to comply with all the demands of his judges, would have been actually tortured. On Wednesday, June 22, 1633, in the large hall of the Dominican Convent of St. Maria sopra la Minerva, in the presence of his judges and a large gathering of cardinals and prelates of

the Holy Congregation, Galileo had read to him the following sentence, which will be an important historical document to the end of time:

"We, Gasparo del titolo di S. Croce in Gierusalemme Borgia;

Fra Felice Centino del titolo di S. Anastasia, detto d'Ascoli;

Guido del titolo di S. Maria del Popolo Bentivogilo;

Fra Desiderio Scaglia del titolo di S. Carlo detto di Cremona;

Fra Antonio Barberino detto di S. Onofrio;

Laudivio Zacchia del titolo di S. Pietro in Vincola detto di S. Sisto;

Berlingero del titolo di S. Agostino, Gessi;

Fabricio del titolo di S. Lorenzo in pane e perna, Verospi, chiamato Prete;

Francesco di S. Lorenzo in Damaso Barberino, e;

Martio di S. Maria Nuova Ginetti Diaconi;

by the grace of God, cardinals of the Holy Roman Church, Inquisitors General, by the Holy Apostolic see specially deputed, against heretical depravity throughout the whole Christian Republic.

"Whereas you, Galileo, son of the late Vincenzo Galileo, Florentine, aged seventy years,

were in the year 1615 denounced to this Holy Office for holding as true the false doctrine taught by many, that the sun is the centre of the world and immovable, and that the earth moves, and also with a diurnal motion; for having disciples to whom you taught the same doctrine; for holding correspondence with certain mathematicians of Germany concerning the same for having printed certain letters, entitled 'On the Solar Spots,' wherein you developed the same doctrine as true; and for replying to the objections from the Holy Scriptures, which from time to time were urged against it, by glossing the said Scriptures according to your own meaning: and whereas there was thereupon produced the copy of a document in the form of a letter, purporting to be written by you to one formerly your disciple, and in this divers propositions are set forth, following the hypothesis of Copernicus, which are contrary to the true sense and authority of Holy Scripture:

"This Holy Tribunal being therefore desirous of proceeding against the disorder and mischief thence resulting, which went on increasing to the prejudice of the Holy Faith, by command of his Holiness and of the most eminent Lord Cardinals of this supreme and uni-

versal inquisition, the two propositions of the stability of the sun and the motion of the earth were by the theological 'Qualifiers' qualified as follows:

"The proposition that the sun is the centre of the world and does not move from its place is absurd and false philosophically and formally heretical, because it is expressly contrary to the Holy Scripture.

"The proposition that the earth is not the centre of the world and immovable, but that it moves, and also with a diurnal motion, is equally absurd and false philosophically, and theologically considered, at least erroneous in faith.

"But whereas it was desired at that time to deal leniently with you, it was decreed at the Holy Congregation held before his Holiness on the twenty-fifth of February, 1616, that his Eminence the Lord Cardinal Bellarmine should order you to abandon altogether the said false doctrine, and, in the event of your refusal, that an injunction should be imposed upon you by the Commissary of the Holy Office, to give up the said doctrine, and not to teach it to others, nor to defend it, nor even discuss it; and failing your acquiescense in this injunction, that you should be imprisoned. And

in execution of this decree, on the following day, at the Palace, and in the presence of his Eminence, the said Lord Cardinal Bellarmine, after being gently admonished by the said Lord Cardinal, the command was intimated to you by the Father Commissary of the Holy Office for the time before a notary and witnesses, that you were altogether to abandon the said false opinion, and not in future to defend or teach it in any way whatsoever, neither verbally nor in writing; and upon your promising to obey you were dismissed.

"And in order that a doctrine so pernicious might be wholly rooted out and not insinuate itself further to the grave prejudice of Catholic truth, a decree was issued by the Holy Congregation of the Index, prohibiting the books which treat of this doctrine, and declaring the doctrine itself to be false and wholly contrary to sacred and Divine Scripture.

"And whereas a book appeared here recently, printed last year at Florence, the title of which shows that you were the author, this title being: 'Dialogue of Galileo Galilei on the Two Principal Systems of the World, the Ptolemanic and the Copernican'; and whereas the Holy Congregation was afterwards informed that through the publication of the

said book, the false opinion of the motion of the earth and the stability of the sun was daily gaining ground; the said book was taken into careful consideration, and in it there was discovered a patent violation of the aforesaid injunction that had been imposed upon you, for in this book you have defended the said opinion previously condemned and to your face declared to be so, although in the said book you strive by various devices to produce the impression that you leave it undecided, and in express terms as probable; which, however, is a most grievous error, as an opinion can in no wise be probable which has been declared and defined to be contrary to Divine Scripture:

"Therefore by our order you were cited before this Holy Office, where, being examined upon your oath, you acknowledged the book to be written and published by you. You confessed that you began to write the said book about ten or twelve years ago, after the command had been imposed upon you as above; that you requested license to print it without, however, intimating to those who granted you this license that you had been commanded not to hold, defend, or teach in any way whatever the doctrine in question.

"You likewise confessed that the writing of the said book is in various places drawn up in such a form that the readers might fancy that the arguments brought forward on the false side are rather calculated by their cogency to compel conviction than to be easy of refutation; excusing yourself for having fallen into an error, as you alleged, so foreign to your intention, by the fact that you had written in dialogue, and by the natural complacency that every man feels in regard to his own subtleties, and in showing himself more clever than the generality of men, in devising, even on behalf of false propositions, ingenious and plausible arguments.

"And a suitable term having been assigned to you to prepare your defense, you produced a certificate in the handwriting of his Eminence the Lord Cardinal Bellarmine, procured by you, as you asserted, in order to defend yourself against the calumnies of your enemies, who gave out that you had abjured and had been punished by the Holy Office; in which certificate it is declared that you had not abjured and had not been punished, but merely that the declaration made by his Holiness and published by the Holy Congregation of the Index, had been announced to you, wherein it

is declared that the doctrine of the motion of the earth and the stability of the sun is contrary to the Holy Scriptures, and therefore cannot be defended or held. And as in this certificate there is no mention of the two articles of the injunction, namely, the order not 'to teach' and 'in any way,' you represented that we ought to believe that in the course of fourteen or sixteen years you had lost all memory of them; and that this was why you said nothing of the injunction when you requested permission to print your book. And all this you urged not by way of excuse for your error, but that it might be set down to a vainglorious ambition rather than to malice. But this certificate produced by you in your defense has only aggravated your delinquency, since although it is there stated that the said opinion is contrary to Holy Scripture, you have nevertheless dared to discuss and defend it and to argue its probability; nor does the license artfully and cunningly extorted by you avail you anything, since you did not notify the command imposed upon you.

"And whereas it appeared to us that you had not stated the full truth with regard to your intention, we thought it necessary to subject you to a rigorous examination, at which

(without prejudice, however, to the matters confessed by you, and set forth as above, with regard to your said intention) you answered like a good Catholic. Therefore, having seen and maturely considered the merits of this, your cause, together with your confessions and excuses above mentioned, and all that ought justly to be seen and considered, we have arrived at the underwritten final sentence against you:

"Invoking, therefore, the most holy name of our Lord Jesus Christ and of His most glorious Mother, and ever Virgin Mary, by this our final sentence, which sitting in judgment, with the counsel and advice of the Reverend Masters of sacred theology and Doctors of both Laws, our assessors, we deliver in these writings, in the cause and causes presently before us between the magnificent Carlo Sinceri, Doctor of both Laws, Proctor Fiscal of this Holy Office, of the one part, and you Galileo Galilei, the defendant, here present, tried and confessed as above, of the other part—we say, pronounce, sentence, declare, that you, the said Galileo, by reason of the matters adduced in process, and by you confessed as above, have rendered yourself in the judgment of this Holy Office vehemently suspected of heresy, namely,

of having believed and held the doctrine—which is false and contrary to the sacred and divine Scriptures—that the sun is the centre of the world and does not move from east to west, and that the earth moves and is not the centre of the world; and that an opinion may be held and defended as probable after it has been declared and defined to be contrary to Holy Scripture; and that consequently you have incurred all the censures and penalties imposed and promulgated in the sacred canons and other constitutions, general and particular, against such delinquents. From which we are content that you be absolved, provided that first, with a sincere heart, and unfeigned faith, you abjure, curse, and detest the aforesaid errors and heresies, and every other error and heresy contrary to the Catholic and Apostolic Roman Church in the form to be prescribed by us.

"And in order that this your grave and pernicious error and transgression may not remain altogether unpunished, and that you may be more cautious for the future, and an example to others, that they may abstain from similar delinquencies—we ordain that the book of the 'Dialogues of Galileo Galilei' be prohibited by public edict.

"We condemn you to the formal prison of this Holy Office during our pleasure, and by way of salutory penance, we enjoin that for three years to come you repeat once a week the seven penitential psalms.

"Reserving to ourselves full liberty to moderate, commute, or take off, in whole or in part, the aforesaid penalities and penance.

"And so we say, pronounce, sentence, declare, ordain, condemn and reserve, in this and any other better way and form which we can and may lawfully employ.

"So we, the undersigned cardinals pronounce.

"F. Cardinalis de Asculo,
G. Cardinalis Bentiuolus,
Fr. Cardinalis de Cremona,
Fr. Antonius Cardinalis S. Honuphrij,
B. Cardinalis Gypsius,
Fr. Cardinalis Verospius,
M. Cardinalis Ginettus."

CHAPTER X

RECANTATION AND AFTER

IT WILL be observed that three of the names preceding the sentence are missing from the signatures at its close. The opinion of scholars who have devoted themselves to the remarkable career of the Florentine astronomer is divided as to whether or not this signified their disagreement with its imposition. However that may be, the document will stand forever as the irrefutable evidence of one of the darkest blots on the annals of mankind. Immediately after the sentence was pronounced, the great astronomer, now thoroughly cowed and broken, was compelled to kneel humbly before the whole assembly and make the following degrading recantation:

"I, Galileo Galilei, son of the late Vincenzo Galilei, Florentine, aged seventy years, arraigned personally before this tribunal, and kneeling before you, most Eminent and Reverend Lord Cardinals, inquisitors general against heretical depravity throughout the whole Christian Republic, having before my eyes and touching with my hands, the Holy Gospels—swear that I have always believed,

do now believe, and by God's help will for the future believe, all that is held, preached, and taught by the Holy Catholic and Apostolic Roman Church. But whereas—after an injunction had been judicially intimated to me by this Holy Office, to the effect that I must altogether abandon the false opinion that the sun is the centre of the world and immovable, and that the earth is not the centre of the world, and moves, and that I must not hold, defend, or teach in any way whatsoever, verbally or in writing, the said doctrine, and after it had been notified to me that the said doctrine was contrary to Holy Scripture—I wrote and printed a book in which I discuss this doctrine already condemned, and adduce arguments of great cogency in its favor, without presenting any solution of these; and for this cause I have been pronounced by the Holy Office to be vehemently suspected of heresy, that is to say, of having held and believed that the sun is the centre of the world and immovable, and that the earth is not the centre and moves:

"Therefore, desiring to remove from the minds of your Eminences, and of all faithful Christians, this strong suspicion reasonably conceived against me, with sincere heart and unfeigned faith I abjure, curse and detest the

aforesaid errors and heresies, and generally every other error and sect whatsoever contrary to the said Holy Church; and I swear that in future I will never again say or assert, verbally or in writing, any thing that might furnish occasion for a similar suspicion regarding me; but that should I know any heretic, or person suspected of heresy, I will denounce him to this Holy Office, or to the inquisitor and ordinary of the place where I may be. Further, I swear and promise to fulfill and observe in their integrity all penances that have been, or that shall be, imposed upon me by this Holy Office. And, in the event of my contravening (which God forbid!) any of these my promises, protestations, and oaths, I submit myself to all the pains and penalities imposed and promulgated in the sacred canons and other constitutions, general and particular, against such delinquents. So help me God, and these His Holy Gospels, which I touch with my hands.

"I, Galileo Galilei, have adjured, sworn, promised and bound myself as above; and in witness of the truth thereof I have with my own hand subscribed the present document of my abjuration, and recited it word for word at Rome, in the Convent of Minerva, this twenty-second day of June, 1633.

"I, Galileo Galilei, have abjured as above with my own hand."

It may be held that Galileo would be a still greater hero had he displayed the martyr courage of Bruno. It must be considered, however, that his torture and death were in no way necessary to the ultimate triumph of science, and that it was in the following years of imprisonment that he was able to give to the world vast researches in another monumental scientific book, "The Dialogues of the Two New Sciences."

Now that Galileo was effectually silenced, a host of priestly writers arose and undertook to show the world the absurdity of the new astronomy. Two of the most famous of these will serve as examples of the rest. Scipio Chiaramonti produced the following luminous arguments:

"Animals, which move, have limbs and muscles; the earth has no limbs or muscles, therefore it does not move. It is angels who make Saturn, Jupiter, the sun, etc., turn around. If the earth revolves, it must also have an angel in the centre to set it in motion; but only devils live there; it would therefore be a devil who would impart motion to the earth.

"The planets, the sun, the fixed stars, all belong to one species—namely, that of stars. It seems, therefore, to be a grievious wrong to place the earth, which is a sink of impurity, among these heavenly bodies, which are pure and divine things."

Chiaramonti was ably seconded by Polacco, who produced a book entitled Anticopernicus Catholicus, which contained the following gems:

"If we concede the motion of the earth, why is it that an arrow shot into the air falls back to the same spot, while the earth and all the things on it have in the meantime moved very rapidly toward the east? Who does not see that great confusion would result from this motion?

"The Copernican theory of the earth's motion is against the nature of the earth itself, because the earth is not only cold but contains in itself the principle of cold; but cold is opposed to motion and even destroys it—as is evident in animals, which become motionless when they become cold.

"Since it can certainly be gathered from Scripture that the heavens move above the earth, and since a circular motion requires something immovable around which to move,

. . . . the earth is at the centre of the universe."

To the above collection of forensic jewels might be added an argument of the great theologian Fromundus, of the Cathedral of Antwerp, in his book "Ant-Aristarchus," produced before the trial. Fromundus argues that if the earth be revolving, as says Copernicus, "buildings on the earth itself would fly off with such a rapid motion that men would have to be provided with claws like cats to enable them to hold fast to the earth's surface."

While Galileo was unable to reply, other champions spoke. Conspicuous among these was Campanella, who wrote his "Apology for Galileo," for which, along with other heresies, he seven times underwent torture. As yet the Church had not the slightest inkling that it had committed the most colossal blunder of all history and continued its harshness against the overwhelmed philosopher. During Galileo's lifetime the truths he had established were carefully weeded from all Catholic colleges and universities in Europe. When, in a scientific book which appeared, he happened to be referred to as renowned, the inquisition ordered the substitution of the word notorious. All efforts made by the friends of the astronomer for

the suspension of the sentence of imprisonment were useless, and he spent the last years of his life a prisoner in his own villa at Arcetri. He was allowed to receive one visit from the Grand Duke, but pleaded in vain for the extension of the same privilege to his many friends, until he was too blind to see them and too deaf to hear their voices. Says Gebler, "It was not until the old man was quite blind and hopelessly ill, with one foot in the grave, that any human feeling was awakened for him at the Vatican." One of his last wishes, to be buried in the vault of his ancestors, was denied, and although money was contributed by his admirers for a handsome monument, no monument of any kind was permitted. Even the funeral sermon had to pass the censorship of the inquisition to see that there were no reflections on the behavior of that organization.

The works of Galileo and Copernicus remained on the Index of prohibited books, and in 1765 the celebrated French astronomer, Lalande, tried in vain to have the ban removed. They were still on the Index published in 1819, but in 1820, a crisis developed as the result of the writing of a book by Canon Settele, Catholic professor of astronomy at Rome, in which the Copernican system was taken for granted,

as was the custom by this time throughout the world. The Master of the Sacred Palace, Anfossi, holder of the position held in Galileo's time by Riccardi, refused permission to print the book unless it was changed to treat the theories of Copernicus as mere hypotheses. The Canon refused to make himself the laughing stock of the nineteenth century and the cardinals were afraid to declare themselves as believing in a stationary earth, and so on the eleventh of September, 1822, the Church decreed that, "the printing and publication of works treating of the motion of the earth and the stability of the sun, in accordance with the general opinion of modern astronomers, is permitted at Rome." The Church had at last arrived at the position reached by Galileo more than two hundred years before.

Thirteen more years elapsed, however, before the Church had the courage to acknowledge its error, and issue in 1835 in an edition of the Index which did not condemn works dealing with the double motion of the earth. It is not necessary to dignify with a reply the shameful and unscrupulous arguments which appear in Catholic periodicals that Galileo was not persecuted for his scientific opinions, but because of his impertinence to the Church, etc. The

only reply necessary to the folly of such irresponsible writers is to be found in the recent works of prominent Catholic scholars, a fair example of whom is Professor Walsh of Fordham University, who in his book, "The Popes and Science," which bears the imprimatur of Archbishop Farley, says: "There is no doubt that Galileo was persecuted by the inquisition on account of his astronomical teachings. We would be the last to deny that this was a deplorable mistake made by persons in ecclesiastical authority, who endeavored to make a Church tribunal the judge of scientific truth, a function altogether alien to its character which it was not competent to exercise."

This position taken by Professor Walsh is paralleled by the modern historical scholars of the Church, and the reader may form his own opinion of the article which appeared in the February, 1915, issue of the Catholic magazine "Truth," which says, "The accusation that Galileo was persecuted on account of his scientific views, is now admitted by every writer as untrue and unjust."

The actual documents of the Galileo trial remained hidden from the world in the archives of the Vatican until Napoleon took possession of the papal city and, in 1811, ordered the

removal of the archives to Paris. The French State Librarian, Barbier, recognized the immense importance of the records of the trial, and with the approval of the Emperor ordered a French translation. This would undoubtedly have been accomplished had not Napoleon been banished to Elba. It is interesting to read of the many and strenuous efforts made by the Vatican to recover these documents. They were still in Paris when Louis XVIII sat on the throne of France. The papal representative, Marini, seeking to recover them at this date, was informed that the King was anxious to read them and had them in his cabinet. Two years later, in 1817, the influence of the powerful Richelieu was invoked in vain. Eleven years after this the effort was still fruitless and when Count Daru wished to use the documents in his work on astronomy, he was informed that they could not be found.

It is now agreed that they had been deliberately hidden and they remained in concealment seventeen years longer. The plea of the French government to the papacy that the documents were not returned because they had been lost was made to prevent an open breach on the subject. A representative of the Pope was sent from one library to another with per-

mission to search and the sure knowledge that he would not find. Louis Phillipe finally promised to return them to Rome if they could be found on the express condition that Rome would publish them complete. This condition being agreed to they were mysteriously found, and Pope Pius IX. was able to restore them to the prefect of the Sacred Archives, Marino Marini.

Then came a discreditable effort to escape the promise given to the French ruler. Marini made a publication entitled "Galileo and the Inquisition," supposed to meet the French condition. Von Gebler says it was really a collection of "disjointed extracts, arbitrary fragments, and in many instances nothing." The Galilean biographer, Alberi, and ten years later, Professor Cantor asked in vain to be allowed to consult the documents for work they had in hand. It was in 1877, nearly thirty years after their recovery from Paris, that Karl von Gebler was permitted free access to the documents in the Vatican and brought out a German translation at Stuttgart. About the same time, Epinois, who had been working for some time on the project, brought out another complete edition, and now the world possesses the actual facts of the greatest trial in his-

tory, and knows what it may expect if ever again priests and prelates are permitted to become masters of society and dictators of the human mind.

CHAPTER XI

THE FUTURE

THE chief value of the study of history is, that a knowledge of the past helps us to understand the present and, in a measure, to anticipate the future. There is considerable divergence of opinion as to the destinies of science and religion. There are many superficial thinkers who believe that the warfare belongs almost exclusively to the past. They are of the opinion that the differences between the historic antagonists are incidental, and accidental, but not fundamental. These accidental distinctions being removed, harmonious relations are expected to prevail.

These complacent apostles of reconciliation have utterly failed to grasp the nature and foundation of the antagonism. The Christian Church, Protestant and Catholic, holds and must hold that it is the guardian of certain unchangeable truths, committed to it by the creator of the universe. These revealed truths are sacred and the idea of an investigation of their verity with the possible result of rejection is intolerable.

The attitude of science is and must be the exact opposite. Science does not and never can

consent to the placing of any so-called truth beyond the reach of re-examination, and the very law of its being is that weight of evidence is the sole justification for positiveness of affirmation.

The science of astronomy has rendered magnificent service to the cause of progress by completely overthrowing what were alleged for centuries to be revealed truths about the universe. The Church has always maintained that its sacred colleges, and especially its popes, had the advantage of divine co-operation and enlightenment. The history of astronomy has completely destroyed this claim. It is no longer possible for an intelligent man to believe that an organization which for two hundred and nineteen years forbade the reading of books teaching the rotation of the earth on its axis and its revolution about the sun could have had, during that entire period, access to divine sources of knowledge. During that period, the double motion of the earth, now known to every schoolboy, was denounced in eleven bulls solemnly issued by eleven different infallible popes.

Great as have been the services of astronomy in shaking the foundations of ecclesiastical authority, they are likely to be eclipsed when the

real implications of the theory of evolution are thoroughly established in the general mind. Unfortunately for religion, science has not been satisfied with the investigation of stars, rocks, animals, and other visible and material phenomena. It has gradually assumed the right to turn its gaze in any direction, and has not hesitated to direct its searchlight upon, and apply its methods to, the phenomena of religion.

One of its most striking and reliable discoveries is that every religion represents the intellectual condition of a certain people of a certain period. What the modern religionist seeks to accomplish is to fasten upon the human mind forever the conclusions reached by the men of a certain age. When this is understood, as it will be when the evolutionary theory is generally assimilated, the death knell of theology will have sounded.

To seek to impose upon the modern mind the petrified blunders of primitive men, is as hopeless a task as would be the administration of a great modern city by the regulations which prevailed two thousand years ago in a Syrian village. The theological concept and the evolutionary concept are irreconcilable enemies, and

either can only live in peace by the extermination of the other.

In a fair field with no favor there would not be the slightest doubt as to the outcome of the struggle. Indeed in such a field, it would have terminated long ago. Religion has been and is protected, because it has proved the most effective of all instruments for the perpetuation of the subjection of the so-called lower classes. As George Burman Foster, Professor of Religion in the University of Chicago, has well said, "Rulers have ever availed themselves of religion as a mighty agency in keeping under their unruly subjects—an agency more effective than brute force, since it aroused a less violent reaction." In the same paragraph the Professor quotes a German who said, "How are the people to be saved from the Social Democrats if they stop going to church?"

It has become the custom of religious conventions to bewail the irreligion of the proletariat, which is largely due to the clear perception of thousands of the most intelligent of the working class that the ecclesiastical forces have always been mustered against them. There is a marked disposition on the part of an increasing number of working men and working women to revolt against all oppres-

sors, be they royal, or priestly, or economic. Kings have always been tenacious when their revenues were threatened; priests have hesitated at nothing when their tithes were in jeopardy, and the bourgeoisie presents an unbroken front when its profits are in danger, but all these forms of income represent the robbery of labor and are responsible for its tragic poverty.

Unless all signs fail, we or our immediate successors shall behold a generation of working men and working women who will scorn to be oppressed and refuse to be longer cajoled by enemies who pretend to be friends. Their attitude toward their social oppressors has been anticipated by Swinburne:

"We have done with the kisses that sting,
With the thief's mouth red from the feast,
With the blood on the hands of the king,
And the lie on the lips of the priest."