

3. Jews—a fact that has left an impress on the religious faith of modern Europe.

Greek architects and Greek engineers had made Alexandria the most beautiful city of the ancient world. They had filled it with magnificent palaces, temples, theatres. In its centre, at the intersection of its two grand avenues, which crossed each other at right angles, and in the midst of gardens, fountains, obelisks, stood the mausoleum, in which, embalmed after the manner of the Egyptians, rested the body of Alexander. In a funereal journey of two years it had been brought with great pomp from Babylon. At first the coffin was of pure gold, but this having led to a violation of the tomb, it was replaced by one of alabaster. But not these, not even the great light-house, Pharos, built of blocks of white marble and so high that the fire continually burning on its top could be seen many miles off at sea—the Pharos counted as one of the seven wonders of the world—it is not these magnificent achievements of architecture that arrest our attention; the true, the most glorious monument of the Macedonian kings of Egypt is the Museum. Its influences will last when even the Pyramids have passed away.

The Alexandrian Museum was commenced by Ptolemy Soter, and was completed by his son Ptolemy Philadelphus. It was situated in the Bruchion, the aristocratic quarter of the city, adjoining the king's palace. Built of marble, it was surrounded with a piazza, in which the residents might walk and converse together. Its sculptured apartments contained the Philadelphian library, and were crowded with the choicest statues and pictures. This library eventually comprised four hundred thousand volumes. In the course of time, probably on account of inadequate accommodation for so many

books, an additional library was established in the adjacent quarter Rhacotis, and placed in the Serapion or temple of Serapis. The number of volumes in this library, which was called the Daughter of that in the Museum, was eventually three hundred thousand. There were, therefore, seven hundred thousand volumes in these royal collections.

Alexandria was not merely the capital of Egypt, it was the intellectual metropolis of the world. Here it was truly said the Genius of the East met the Genius of the West, and this Paris of antiquity became a focus of fashionable dissipation and universal skepticism. In the allurements of its bewitching society even the Jews forgot their patriotism. They abandoned the language of their forefathers, and adopted Greek.

In the establishment of the Museum, Ptolemy Soter and his son Philadelphus had three objects in view: 1. The perpetuation of such knowledge as was then in the world; 2. Its increase; 3. Its diffusion.

1. For the perpetuation of knowledge. Orders were given to the chief librarian to buy at the king's expense whatever books he could. A body of transcribers was maintained in the Museum, whose duty it was to make correct copies of such works as their owners were not disposed to sell. Any books brought by foreigners into Egypt were taken at once to the Museum, and, when correct copies had been made, the transcript was given to the owner, and the original placed in the library. Often a very large pecuniary indemnity was paid. Thus it is said of Ptolemy Euergetes that, having obtained from Athens the works of Euripides, Sophocles, and Æschylus, he sent to their owners transcripts, together with about fifteen thousand dollars, as an indemnity. On his return from the Syrian expedition he carried

back in triumph all the Egyptian monuments from Ecbatana and Susa, which Cambyses and other invaders had removed from Egypt. These he replaced in their original seats, or added as adornments to his museums. When works were translated as well as transcribed, sums which we should consider as almost incredible were paid, as was the case with the Septuagint translation of the Bible, ordered by Ptolemy Philadelphus.

2. For the increase of knowledge. One of the chief objects of the Museum was that of serving as the home of a body of men who devoted themselves to study, and were lodged and maintained at the king's expense. Occasionally he himself sat at their table. Anecdotes connected with those festive occasions have descended to our times. In the original organization of the Museum the residents were divided into four faculties—literature, mathematics, astronomy, medicine. Minor branches were appropriately classified under one of these general heads; thus natural history was considered to be a branch of medicine. An officer of very great distinction presided over the establishment, and had general charge of its interests. Demetrius Phalareus, perhaps the most learned man of his age, who had been governor of Athens for many years, was the first so appointed. Under him was the librarian, an office sometimes held by men whose names have descended to our times, as Eratosthenes, and Apollonius Rhodius.

In connection with the Museum were a botanical and a zoological garden. These gardens, as their names import, were for the purpose of facilitating the study of plants and animals. There was also an astronomical observatory containing armillary spheres, globes, solstitial and equatorial armils, astrolabes, parallactic rules, and other apparatus then in use, the graduation on the

divided instruments being into degrees and sixths. On the floor of this observatory a meridian line was drawn. The want of correct means of measuring time and temperature was severely felt; the clepsydra of Ctesibius answered very imperfectly for the former, the hydrometer floating in a cup of water for the latter; it measured variations of temperature by variations of density. Philadelphus, who toward the close of his life was haunted with an intolerable dread of death, devoted much of his time to the discovery of an elixir. For such pursuits the Museum was provided with a chemical laboratory. In spite of the prejudices of the age, and especially in spite of Egyptian prejudices, there was in connection with the medical department an anatomical room for the dissection, not only of the dead, but actually of the living, who for crimes had been condemned.

3. For the diffusion of knowledge. In the Museum was given, by lectures, conversation, or other appropriate methods, instruction in all the various departments of human knowledge. There flocked to this great intellectual centre, students from all countries. It is said that at one time not fewer than fourteen thousand were in attendance. Subsequently even the Christian church received from it some of the most eminent of its Fathers, as Clemens Alexandrinus, Origen, Athanasius.

The library in the Museum was burnt during the siege of Alexandria by Julius Cæsar. To make amends for this great loss, that collected by Eumenes, King of Pergamus, was presented by Mark Antony to Queen Cleopatra. Originally it was founded as a rival to that of the Ptolemies. It was added to the collection in the Serapion.

It remains now to describe briefly the philosophical

basis of the Museum, and some of its contributions to the stock of human knowledge.

In memory of the illustrious founder of this most noble institution—an institution which antiquity delighted to call “The divine school of Alexandria”—we must mention in the first rank his “History of the Campaigns of Alexander.” Great as a soldier and as a sovereign, Ptolemy Soter added to his glory by being an author. Time, which has not been able to destroy the memory of our obligations to him, has dealt unjustly by his work. It is not now extant.

As might be expected from the friendship that existed between Alexander, Ptolemy, and Aristotle, the Aristotelian philosophy was the intellectual corner-stone on which the Museum rested. King Philip had committed the education of Alexander to Aristotle, and during the Persian campaigns the conqueror contributed materially, not only in money, but otherwise, toward the “Natural History” then in preparation.

The essential principle of the Aristotelian philosophy was, to rise from the study of particulars to a knowledge of general principles or universals, advancing to them by induction. The induction is the more certain as the facts on which it is based are more numerous; its correctness is established if it should enable us to predict other facts until then unknown. This system implies endless toil in the collection of facts, both by experiment and observation; it implies also a close meditation on them. It is, therefore, essentially a method of labor and of reason, not a method of imagination. The failures that Aristotle himself so often exhibits are no proof of its unreliability, but rather of its trustworthiness. They are failures arising from want of a sufficiency of facts.

Some of the general results at which Aristotle arrived are very grand. Thus, he concluded that every thing is ready to burst into life, and that the various organic forms presented to us by Nature are those which existing conditions permit. Should the conditions change, the forms will also change. Hence there is an unbroken chain from the simple element through plants and animals up to man, the different groups merging by insensible shades into each other.

The inductive philosophy thus established by Aristotle is a method of great power. To it all the modern advances in science are due. In its most improved form it rises by inductions from phenomena to their causes, and then, imitating the method of the Academy, it descends by deductions from those causes to the detail of phenomena.

While thus the Scientific School of Alexandria was founded on the maxims of one great Athenian philosopher, the Ethical School was founded on the maxims of another, for Zeno, though a Cypriote or Phœnician, had for many years been established at Athens. His disciples took the name of Stoics. His doctrines long survived him, and, in times when there was no other consolation for man, offered a support in the hour of trial, and an unwavering guide in the vicissitudes of life, not only to illustrious Greeks, but also to many of the great philosophers, statesmen, generals, and emperors of Rome.

The aim of Zeno was, to furnish a guide for the daily practice of life, to make men virtuous. He insisted that education is the true foundation of virtue, for, if we know what is good, we shall incline to do it. We must trust to sense, to furnish the data of knowledge, and reason will suitably combine them. In this the affinity of Zeno to Aristotle is plainly seen. Every ap-

petite, lust, desire, springs from imperfect knowledge. Our nature is imposed upon us by Fate, but we must learn to control our passions, and live free, intelligent, virtuous, in all things in accordance with reason. Our existence should be intellectual, we should survey with equanimity all pleasures and all pains. We should never forget that we are freemen, not the slaves of society. "I possess," said the Stoic, "a treasure which not all the world can rob me of—no one can deprive me of death." We should remember that Nature in her operations aims at the universal, and never spares individuals, but uses them as means for the accomplishment of her ends. It is, therefore, for us to submit to Destiny, cultivating, as the things necessary to virtue, knowledge, temperance, fortitude, justice. We must remember that every thing around us is in mutation; decay follows reproduction, and reproduction decay, and that it is useless to repine at death in a world where every thing is dying. As a cataract shows from year to year an invariable shape, though the water composing it is perpetually changing, so the aspect of Nature is nothing more than a flow of matter presenting an impermanent form. The universe, considered as a whole, is unchangeable. Nothing is eternal but space, atoms, force. The forms of Nature that we see are essentially transitory, they must all pass away.

We must bear in mind that the majority of men are imperfectly educated, and hence we must not needlessly offend the religious ideas of our age. It is enough for us ourselves to know that, though there is a Supreme Power, there is no Supreme Being. There is an invisible principle, but not a personal God, to whom it would be not so much blasphemy as absurdity to impute the form, the sentiments, the passions of man. All

revelation is, necessarily, a mere fiction. That which men call chance is only the effect of an unknown cause. Even of chances there is a law. There is no such thing as Providence, for Nature proceeds under irresistible laws, and in this respect the universe is only a vast automatic engine. The vital force which pervades the world is what the illiterate call God. The modifications through which all things are running take place in an irresistible way, and hence it may be said that the progress of the world is, under Destiny, like a seed, it can evolve only in a predetermined mode.

The soul of man is a spark of the vital flame, the general vital principle. Like heat, it passes from one to another, and is finally reabsorbed or reunited in the universal principle from which it came. Hence we must not expect annihilation, but reunion; and, as the tired man looks forward to the insensibility of sleep, so the philosopher, weary of the world, should look forward to the tranquillity of extinction. Of these things, however, we should think doubtingly, since the mind can produce no certain knowledge from its internal resources alone. It is unphilosophical to inquire into first causes; we must deal only with phenomena. Above all, we must never forget that man cannot ascertain absolute truth, and that the final result of human inquiry into the matter is, that we are incapable of perfect knowledge; that, even if the truth be in our possession, we cannot be sure of it.

What, then, remains for us? Is it not this—the acquisition of knowledge, the cultivation of virtue and of friendship, the observance of faith and truth, an unrepinning submission to whatever befalls us, a life led in accordance with reason?

But, though the Alexandrian Museum was especially intended for the cultivation of the Aristotelian philosophy, it must not be supposed that other systems were excluded. Platonism was not only carried to its full development, but in the end it supplanted Peripateticism, and through the New Academy left a permanent impress on Christianity. The philosophical method of Plato was the inverse of that of Aristotle. Its starting-point was universals, the very existence of which was a matter of faith, and from these it descended to particulars, or details. Aristotle, on the contrary, rose from particulars to universals, advancing to them by inductions.

Plato, therefore, trusted to the imagination, Aristotle to reason. The former descended from the decomposition of a primitive idea into particulars, the latter united particulars into a general conception. Hence the method of Plato was capable of quickly producing what seemed to be splendid, though in reality unsubstantial results; that of Aristotle was more tardy in its operation, but much more solid. It implied endless labor in the collection of facts, a tedious resort to experiment and observation, the application of demonstration. The philosophy of Plato is a gorgeous castle in the air; that of Aristotle a solid structure, laboriously, and with many failures, founded on the solid rock.

An appeal to the imagination is much more alluring than the employment of reason. In the intellectual decline of Alexandria, indolent methods were preferred to laborious observation and severe mental exercise. The schools of Neo-Platonism were crowded with speculative mystics, such as Ammonius Saccas and Plotinus. These took the place of the severe geometers of the old Museum.

The Alexandrian school offers the first example of that system which, in the hands of modern physicists, has led to such wonderful results. It rejected imagination, and made its theories the expression of facts obtained by experiment and observation, aided by mathematical discussion. It enforced the principle that the true method of studying Nature is by experimental interrogation. The researches of Archimedes in specific gravity, and the works of Ptolemy on optics, resemble our present investigations in experimental philosophy, and stand in striking contrast with the speculative vagaries of the older writers. Laplace says that the only observation which the history of astronomy offers us, made by the Greeks before the school of Alexandria, is that of the summer solstice of the year B. C. 432, by Meton and Euctemon. We have, for the first time, in that school, a combined system of observations made with instruments for the measurement of angles, and calculated by trigonometrical methods. Astronomy then took a form which subsequent ages could only perfect.

It does not accord with the compass or the intention of this work to give a detailed account of the contributions of the Alexandrian Museum to the stock of human knowledge. It is sufficient that the reader should obtain a general impression of their character. For particulars, I may refer him to the sixth chapter of my "History of the Intellectual Development of Europe."

It has just been remarked that the Stoical philosophy doubted whether the mind can ascertain absolute truth. While Zeno was indulging in such doubts, Euclid was preparing his great work, destined to challenge contradiction from the whole human race. After more than twenty-two centuries it still survives, a model

of accuracy, perspicuity, and a standard of exact demonstration. This great geometer not only wrote on other mathematical topics, such as Conic Sections and Porisms, but there are imputed to him treatises on Harmonics and Optics, the latter subject being discussed on the hypothesis of rays issuing from the eye to the object.

With the Alexandrian mathematicians and physicists must be classed Archimedes, though he eventually resided in Sicily. Among his mathematical works were two books on the Sphere and Cylinder, in which he gave the demonstration that the solid content of a sphere is two-thirds that of its circumscribing cylinder. So highly did he esteem this, that he directed the diagram to be engraved on his tombstone. He also treated of the quadrature of the circle and of the parabola; he wrote on Conoids and Spheroids, and on the spiral that bears his name, the genesis of which was suggested to him by his friend Conon the Alexandrian. As a mathematician, Europe produced no equal to him for nearly two thousand years. In physical science he laid the foundation of hydrostatics; invented a method for the determination of specific gravities; discussed the equilibrium of floating bodies; discovered the true theory of the lever, and invented a screw, which still bears his name, for raising the water of the Nile. To him also are to be attributed the endless screw, and a peculiar form of burning-mirror, by which, at the siege of Syracuse, it is said that he set the Roman fleet on fire.

Eratosthenes, who at one time had charge of the library, was the author of many important works. Among them may be mentioned his determination of the interval between the tropics, and an attempt to ascertain the size of the earth. He considered the articulation and expansion of continents, the position of moun-

tain-chains, the action of clouds, the geological submersion of lands, the elevation of ancient sea-beds, the opening of the Dardanelles and the straits of Gibraltar, and the relations of the Euxine Sea. He composed a complete system of the earth, in three books—physical, mathematical, historical—accompanied by a map of all the parts then known. It is only of late years that the fragments remaining of his "Chronicles of the Theban Kings" have been justly appreciated. For many centuries they were thrown into discredit by the authority of our existing absurd theological chronology.

It is unnecessary to adduce the arguments relied upon by the Alexandrians to prove the globular form of the earth. They had correct ideas respecting the doctrine of the sphere, its poles, axis, equator, arctic and antarctic circles, equinoctial points, solstices, the distribution of climates, etc. I cannot do more than merely allude to the treatises on Conic Sections and on Maxima and Minima by Apollonius, who is said to have been the first to introduce the words ellipse and hyperbola. In like manner I must pass the astronomical observations of Aristyllus and Timocharis. It was to those of the latter on Spica Virginis that Hipparchus was indebted for his great discovery of the precession of the equinoxes. Hipparchus also determined the first inequality of the moon, the equation of the centre. He adopted the theory of epicycles and eccentrics, a geometrical conception for the purpose of resolving the apparent motions of the heavenly bodies on the principle of circular movement. He also undertook to make a catalogue of the stars by the method of alineations—that is, by indicating those that are in the same apparent straight line. The number of stars so catalogued was 1,080. If he thus attempted to depict the aspect