

a superfluity of occupation, we may be certain that the care of a library of half a million books would transcend even his well-tryed powers; and the cost of preserving and supporting it, that had demanded the ample resources of the Ptolemies and the Cæsars, was beyond the means of a grammarian. Nor is the time required for its combustion or destruction any indication of the extent of the collection. Of all articles of fuel, parchment is, perhaps, the most wretched. Paper and papyrus do excellently well as kindling-materials, but we may be sure that the bath-men of Alexandria did not resort to parchment so long as they could find any thing else, and of parchment a very large portion of these books was composed.

There can, then, be no more doubt that Omar did order the destruction of this library, under an impression of its uselessness or its irreligious tendency, than that the Crusaders burnt the library of Tripoli, fancifully said to have consisted of three million volumes. The first apartment entered being found to contain nothing but the Koran, all the other books were supposed to be the works of the Arabian impostor, and were consequently committed to the flames. In both cases the story contains some truth and much exaggeration. Bigotry, however, has often distinguished itself by such exploits. The Spaniards burnt in Mexico vast piles of American picture-writings, an irretrievable loss; and Cardinal Ximenes delivered to the flames, in the squares of Granada, eighty thousand Arabic manuscripts, many of them translations of classical authors.

We have seen how engineering talent, stimulated by Alexander's Persian campaign, led to a wonderful development of pure science under the Ptolemies; a simi-

lar effect may be noted as the result of the Saracenic military operations.

The friendship contracted by Amrou, the conqueror of Egypt, with John the Grammarian, indicates how much the Arabian mind was predisposed to liberal ideas. Its step from the idolatry of the Caaba to the monotheism of Mohammed prepared it to expatiate in the wide and pleasing fields of literature and philosophy. There were two influences to which it was continually exposed. They conspired in determining its path. These were—1. That of the Nestorians in Syria; 2. That of the Jews in Egypt.

In the last chapter I have briefly related the persecution of Nestor and his disciples. They bore testimony to the oneness of God, through many sufferings and martyrdoms. They utterly repudiated an Olympus filled with gods and goddesses. "Away from us a queen of heaven!"

Such being their special views, the Nestorians found no difficulty in affiliating with their Saracen conquerors, by whom they were treated not only with the highest respect, but intrusted with some of the most important offices of the state. Mohammed, in the strongest manner, prohibited his followers from committing any injuries against them. Jesuiabbas, their pontiff, concluded treaties both with the Prophet and with Omar, and subsequently the Khalif Haroun-al-Raschid placed all his public schools under the superintendence of John Masue, a Nestorian.

To the influence of the Nestorians that of the Jews was added. When Christianity displayed a tendency to unite itself with paganism, the conversion of the Jews was arrested; it totally ceased when Trinitarian ideas were introduced. The cities of Syria and Egypt were

full of Jews. In Alexandria alone, at the time of its capture by Amrou, there were forty thousand who paid tribute. Centuries of misfortune and persecution had served only to confirm them in their monotheism, and to strengthen that implacable hatred of idolatry which they had cherished ever since the Babylonian captivity. Associated with the Nestorians, they translated into Syriac many Greek and Latin philosophical works, which were retranslated into Arabic. While the Nestorian was occupied with the education of the children of the great Mohammedan families, the Jew found his way into them in the character of a physician.

Under these influences the ferocious fanaticism of the Saracens abated, their manners were polished, their thoughts elevated. They overran the realms of Philosophy and Science as quickly as they had overrun the provinces of the Roman Empire. They abandoned the fallacies of vulgar Mohammedanism, accepting in their stead scientific truth.

In a world devoted to idolatry, the sword of the Saracen had vindicated the majesty of God. The doctrine of fatalism, inculcated by the Koran, had powerfully contributed to that result. "No man can anticipate or postpone his predetermined end. Death will overtake us even in lofty towers. From the beginning God hath settled the place in which each man shall die." In his figurative language the Arab said: "No man can by flight escape his fate. The Destinies ride their horses by night. . . . Whether asleep in bed or in the storm of battle, the angel of death will find thee." "I am convinced," said Ali, to whose wisdom we have already referred—"I am convinced that the affairs of men go by divine decree, and not by our administration." The Mussulmen are those who submissively resign them-

selves to the will of God. They reconciled fate and free-will by saying, "The outline is given us, we color the picture of life as we will." They said that, if we would overcome the laws of Nature, we must not resist, we must balance them against each other.

This dark doctrine prepared its devotees for the accomplishment of great things—things such as the Saracens did accomplish. It converted despair into resignation, and taught men to disdain hope. There was a proverb among them that "Despair is a freeman, Hope is a slave."

But many of the incidents of war showed plainly that medicines may assuage pain, that skill may close wounds, that those who are incontestably dying may be snatched from the grave. The Jewish physician became a living, an accepted protest against the fatalism of the Koran. By degrees the sternness of predestination was mitigated, and it was admitted that in individual life there is an effect due to free-will; that by his voluntary acts man may within certain limits determine his own course. But, so far as nations are concerned, since they can yield no personal accountability to God, they are placed under the control of immutable law.

In this respect the contrast between the Christian and the Mohammedan nations was very striking: The Christian was convinced of incessant providential interventions; he believed that there was no such thing as law in the government of the world. By prayers and entreaties he might prevail with God to change the current of affairs, or, if that failed, he might succeed with Christ, or perhaps with the Virgin Mary, or through the intercession of the saints, or by the influence of their relics or bones. If his own supplications were unavailing, he might obtain his desire through the inter-

vention of his priest, or through that of the holy men of the Church, and especially if oblations or gifts of money were added. Christendom believed that she could change the course of affairs by influencing the conduct of superior beings. Islam rested in a pious resignation to the unchangeable will of God. The prayer of the Christian was mainly an earnest intercession for benefits hoped for, that of the Saracen a devout expression of gratitude for the past. Both substituted prayer for the ecstatic meditation of India. To the Christian the progress of the world was an exhibition of disconnected impulses, of sudden surprises. To the Mohammedan that progress presented a very different aspect. Every corporeal motion was due to some preceding motion; every thought to some preceding thought; every historical event was the offspring of some preceding event; every human action was the result of some foregone and accomplished action. In the long annals of our race, nothing has ever been abruptly introduced. There has been an orderly, an inevitable sequence from event to event. There is an iron chain of destiny, of which the links are facts; each stands in its preordained place—not one has ever been disturbed, not one has ever been removed. Every man came into the world without his own knowledge, he is to depart from it perhaps against his own wishes. Then let him calmly fold his hands, and expect the issues of fate.

Coincidentally with this change of opinion as to the government of individual life, there came a change as respects the mechanical construction of the world. According to the Koran, the earth is a square plane, edged with vast mountains, which serve the double purpose of balancing it in its seat, and of sustaining the dome of the sky. Our devout admiration of the power and

wisdom of God should be excited by the spectacle of this vast crystalline brittle expanse, which has been safely set in its position without so much as a crack or any other injury. Above the sky, and resting on it, is heaven, built in seven stories, the uppermost being the habitation of God, who, under the form of a gigantic man, sits on a throne, having on either side winged bulls, like those in the palaces of old Assyrian kings.

These ideas, which indeed are not peculiar to Mohammedanism, but are entertained by all men in a certain stage of their intellectual development as religious revelations, were very quickly exchanged by the more advanced Mohammedans for others scientifically correct. Yet, as has been the case in Christian countries, the advance was not made without resistance on the part of the defenders of revealed truth. Thus when Al-Mamun, having become acquainted with the globular form of the earth, gave orders to his mathematicians and astronomers to measure a degree of a great circle upon it, Takyuddin, one of the most celebrated doctors of divinity of that time, denounced the wicked khalif, declaring that God would assuredly punish him for presumptuously interrupting the devotions of the faithful by encouraging and diffusing a false and atheistical philosophy among them. Al-Mamun, however, persisted. On the shores of the Red Sea, in the plains of Shinar, by the aid of an astrolabe, the elevation of the pole above the horizon was determined at two stations on the same meridian, exactly one degree apart. The distance between the two stations was then measured, and found to be two hundred thousand Hashemite cubits; this gave for the entire circumference of the earth about twenty-four thousand of our miles, a determination not far from the truth. But, since the spheri-

cal form could not be positively asserted from one such measurement, the khalif caused another to be made near Cufa in Mesopotamia. His astronomers divided themselves into two parties, and, starting from a given point, each party measured an arc of one degree, the one northward, the other southward. Their result is given in cubits. If the cubit employed was that known as the royal cubit, the length of a degree was ascertained within one-third of a mile of its true value. From these measures the khalif concluded that the globular form was established.

It is remarkable how quickly the ferocious fanaticism of the Saracens was transformed into a passion for intellectual pursuits. At first the Koran was an obstacle to literature and science. Mohammed had extolled it as the grandest of all compositions, and had adduced its unapproachable excellence as a proof of his divine mission. But, in little more than twenty years after his death, the experience that had been acquired in Syria, Persia, Asia Minor, Egypt, had produced a striking effect, and Ali, the khalif reigning at that time, avowedly encouraged all kinds of literary pursuits. Moawyah, the founder of the Ommiade dynasty, who followed in 661, revolutionized the government. It had been elective, he made it hereditary. He removed its seat from Medina to a more central position at Damascus, and entered on a career of luxury and magnificence. He broke the bonds of a stern fanaticism, and put himself forth as a cultivator and patron of letters. Thirty years had wrought a wonderful change. A Persian satrap who had occasion to pay homage to Omar, the second khalif, found him asleep among the beggars on the steps of the Mosque of Medina; but foreign envoys who had occasion to seek Moawyah, the sixth khalif, were presented to him

in a magnificent palace, decorated with exquisite arabesques, and adorned with flower-gardens and fountains.

In less than a century after the death of Mohammed, translations of the chief Greek philosophical authors had been made into Arabic; poems such as the "Iliad" and the "Odyssey," being considered to have an irreligious tendency from their mythological allusions, were rendered into Syriac, to gratify the curiosity of the learned. Almanson, during his khalifate (A. D. 753-775), transferred the seat of government to Bagdad, which he converted into a splendid metropolis; he gave much of his time to the study and promotion of astronomy, and established schools of medicine and law. His grandson, Haroun-al-Raschid (A. D. 786), followed his example, and ordered that to every mosque in his dominions a school should be attached. But the Augustan age of Asiatic learning was during the khalifate of Al-Mamun (A. D. 813-832). He made Bagdad the centre of science, collected great libraries, and surrounded himself with learned men.

The elevated taste thus cultivated continued after the division of the Saracen Empire by internal dissensions into three parts. The Abasside dynasty in Asia, the Fatimite in Egypt, and the Ommiade in Spain, became rivals not merely in politics, but also in letters and science.

In letters the Saracens embraced every topic that can amuse or edify the mind. In later times, it was their boast that they had produced more poets than all other nations combined. In science their great merit consists in this, that they cultivated it after the manner of the Alexandrian Greeks, not after the manner of the European Greeks. They perceived that it can never be advanced by mere speculation; its only sure progress

is by the practical interrogation of Nature. The essential characteristics of their method are experiment and observation. Geometry and the mathematical sciences they looked upon as instruments of reasoning. In their numerous writings on mechanics, hydrostatics, optics, it is interesting to remark that the solution of a problem is always obtained by performing an experiment, or by an instrumental observation. It was this that made them the originators of chemistry, that led them to the invention of all kinds of apparatus for distillation, sublimation, fusion, filtration, etc.; that in astronomy caused them to appeal to divided instruments, as quadrants and astrolabes; in chemistry, to employ the balance, the theory of which they were perfectly familiar with; to construct tables of specific gravities and astronomical tables, as those of Bagdad, Spain, Samarcand; that produced their great improvements in geometry, trigonometry, the invention of algebra, and the adoption of the Indian numeration in arithmetic. Such were the results of their preference of the inductive method of Aristotle, their declining the reveries of Plato.

For the establishment and extension of the public libraries, books were sedulously collected. Thus the Khalif Al-Mamun is reported to have brought into Bagdad hundreds of camel-loads of manuscripts. In a treaty he made with the Greek emperor, Michael III., he stipulated that one of the Constantinople libraries should be given up to him. Among the treasures he thus acquired was the treatise of Ptolemy on the mathematical construction of the heavens. He had it forthwith translated into Arabic, under the title of "Almagest." The collections thus acquired sometimes became very large; thus the Fatimite Library at Cairo contained one hundred thousand volumes, elegantly tran-

scribed and bound. Among these, there were six thousand five hundred manuscripts on astronomy and medicine alone. The rules of this library permitted the lending out of books to students resident at Cairo. It also contained two globes, one of massive silver and one of brass; the latter was said to have been constructed by Ptolemy, the former cost three thousand golden crowns. The great library of the Spanish khalifs eventually numbered six hundred thousand volumes; its catalogue alone occupied forty-four. Besides this, there were seventy public libraries in Andalusia. The collections in the possession of individuals were sometimes very extensive. A private doctor refused the invitation of a Sultan of Bokhara because the carriage of his books would have required four hundred camels.

There was in every great library a department for the copying or manufacture of translations. Such manufactures were also often an affair of private enterprise. Honian, a Nestorian physician, had an establishment of the kind at Bagdad (A. D. 850). He issued versions of Aristotle, Plato, Hippocrates, Galen, etc. As to original works, it was the custom of the authorities of colleges to require their professors to prepare treatises on prescribed topics. Every khalif had his own historian. Books of romances and tales, such as "The Thousand and One Arabian Nights' Entertainments," bear testimony to the creative fancy of the Saracens. Besides these, there were works on all kinds of subjects—history, jurisprudence, politics, philosophy, biographies not only of illustrious men, but also of celebrated horses and camels. These were issued without any censorship or restraint, though, in later times, works on theology required a license for publication. Books of reference abounded, geographical, statistical, medical, historical,

dictionaries, and even abridgments or condensations of them, as the "Encyclopedic Dictionary of all the Sciences," by Mohammed Abu Abdallah. Much pride was taken in the purity and whiteness of the paper, in the skillful intermixture of variously-colored inks, and in the illumination of titles by gilding and other adornments.

The Saracen Empire was dotted all over with colleges. They were established in Mongolia, Tartary, Persia, Mesopotamia, Syria, Egypt, North Africa, Morocco, Fez, Spain. At one extremity of this vast region, which far exceeded the Roman Empire in geographical extent, were the college and astronomical observatory of Samarcand, at the other the Giralda in Spain. Gibbon, referring to this patronage of learning, says: "The same royal prerogative was claimed by the independent emirs of the provinces, and their emulation diffused the taste and the rewards of science from Samarcand and Bokhara to Fez and Cordova. The vizier of a sultan consecrated a sum of two hundred thousand pieces of gold to the foundation of a college at Bagdad, which he endowed with an annual revenue of fifteen thousand dinars. The fruits of instruction were communicated, perhaps, at different times, to six thousand disciples of every degree, from the son of the noble to that of the mechanic; a sufficient allowance was provided for the indigent scholars, and the merit or industry of the professors was repaid with adequate stipends. In every city the productions of Arabic literature were copied and collected, by the curiosity of the studious and the vanity of the rich." The superintendence of these schools was committed with noble liberality sometimes to Nestorians, sometimes to Jews. It mattered not in what country a man was born, nor what

were his religious opinions; his attainment in learning was the only thing to be considered. The great Khalif Al-Mamun had declared that "they are the elect of God, his best and most useful servants, whose lives are devoted to the improvement of their rational faculties; that the teachers of wisdom are the true luminaries and legislators of this world, which, without their aid, would again sink into ignorance and barbarism."

After the example of the medical college of Cairo, other medical colleges required their students to pass a rigid examination. The candidate then received authority to enter on the practice of his profession. The first medical college established in Europe was that founded by the Saracens at Salerno, in Italy. The first astronomical observatory was that erected by them at Seville, in Spain.

It would far transcend the limits of this book to give an adequate statement of the results of this imposing scientific movement. The ancient sciences were greatly extended—new ones were brought into existence. The Indian method of arithmetic was introduced, a beautiful invention, which expresses all numbers by ten characters, giving them an absolute value, and a value by position, and furnishing simple rules for the easy performance of all kinds of calculations. Algebra, or universal arithmetic—the method of calculating indeterminate quantities, or investigating the relations that subsist among quantities of all kinds, whether arithmetical or geometrical—was developed from the germ that Diophantus had left. Mohammed Ben Musa furnished the solution of quadratic equations, Omar Ben Ibrahim that of cubic equations. The Saracens also gave to trigonometry its modern form, substituting sines for chords, which had been previously used; they elevated